[Course Overview](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live" \t "psplayer)

[Course Overview](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live)

[Hello. My name is Erin Stellato, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=0) [welcome to my course, SQL Server:](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=6.461) [Analyzing Query Performance for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=11.131000000000002) [Developers. I'm a SQL Server consultant](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=13.087000000000005)[with SQL Skills, as well as a Microsoft](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=14.917923076923078) [data platform MVP, and many of the clients](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=17.065) [I work with don't have a database](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=19.377000000000013) [administrator, but they do have database](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=21.61675) [developers. These developers are sometimes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=24.651249999999994) [charged with fixing performance issues and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=27.04633333333334) [they have no idea where to start. They've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=29.65257142857143)[never seen a query plan or when they look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=31.609142857142867) [at one they're not sure what it really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=33.880615384615375) [means. The developers know how long it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=35.97784615384612) [takes for a query to execute, but they](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=37.98050000000001) [don't know how to see how much I/O, CPU,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=40.34926666666666) [or memory it uses, and sometimes they just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=43.176466666666634) [create an index and that seems to fix the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=45.42653846153846)[problem, even though they have no idea](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=47.662) [why. If any of these sound like you, then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=50.478624999999994) [this course is one you should watch. We](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=53.17913333333334) [will talk about all that data that SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=55.49613333333333) [Server generates when a query executes.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=57.945200000000014) [It's more than just the query plan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=59.782) [we'll cover where it exists and how to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=62.104461538461535) [find it. We will step through what the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=64.39323076923077) [data represents, how to read a query plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=66.6258461538462) [and we will review some of the operators](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=68.83614285714287) [you will see most often. We'll wrap up the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=71.039) [course discussing what information is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=73.7705) [included in the plan, which may not be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=75.25172727272728) [immediately obvious, but can be extremely](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=77.53463636363641) [valuable when troubleshooting. If you've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=80.511875) [been lost when looking at query plans, or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=82.58053846153847) [aren't sure what other metrics matter when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=84.39469230769235) [you're talking about query execution, then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=86.67055555555557) [join me as we create a foundation for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=88.9816153846154) [looking at query performance. If you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=91.5145384615385) [not a developer, but are new to SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=93.28918181818182) [Server, then you'll still benefit from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=95.32190909090906) [information in this course, SQL Server:](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=97.64359999999999) [Analyzing Query Performance for Developers.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=7fe907ac-5c44-462d-9557-738e24c92478&clip=0&mode=live&start=101.022)

[Introduction](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live)

[Introduction and Why We Need to Understand Query Execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live)

[Hi. This is Erin Stellato from sqlskills.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=0) [com, and I'm recording this course for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=3.2013333333333343) [Pluralsight. This course is analyzing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=6.2537777777777785) [query performance for developers in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=8.168222222222223) [Server, and this is the introduction. For](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=11.1108) [this first module I want to make sure we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=14.575624999999999) [are all on the same page and talk through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=16.372249999999994) [our plan for this course. So we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=18.535999999999998) [to start by discussing developer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=21.364333333333338) [responsibilities, and then we'll talk](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=23.3948888888889) [about why it's important to understand](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=24.775181818181817) [what happens when queries execute in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=26.236454545454546) [Server. We'll go through our course](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=29.25028571428572) [objectives in detail, and we'll wrap up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=31.27825) [with the structure of this course, so that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=33.471)[you'll know what to expect along the way,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=35.87715384615387) [so let's get started. If you're watching](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=38.989000000000004) [this course I'm thinking you're a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=41.856300000000005) [developer. Now it's quite possible that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=43.30290000000002) [you're not, but understand that for this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=44.95441666666666) [course I'm assuming that you are, and as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=46.929) [such I like to start with making sure I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=49.073571428571455) [understand what you do every day, as that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=51.54738461538462) [helps me explain what, with regard to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=53.85507692307694) [performance, is important and why, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=56.888999999999996) [just like to know what people do for a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=59.67525) [living, and I don't just mean their title,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=61.15687500000001) [I mean what do they really do during the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=62.789538461538456) [day? So I asked some friends and some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=65.21815384615387) [colleagues who are developers what they](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=67.19308333333333) [do, and they said that they write code.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=68.74633333333334) [Now I could have guessed that one, but I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=71.429) [didn't want to assume, so then I said,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=73.85969230769236) [okay, what else do you do, and most of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=75.85226666666665) [them said, fix code, and I said, so that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=77.90486666666662) [really means that you write more code? Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=81.06700000000001) [my developer friends gave me other answers](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=84.078)[too, such as meetings with business folks](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=86.21300000000005) [to look over or review a specification,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=88.67260000000002) [work on that specification, try to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=91.565) [understand it, try to understand someone](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=93.27827272727274) [else's code, and of course, tuning or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=95.12772727272727) [fixing their code, but the bulk of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=98.07981818181814) [work is writing code. Now it could be code](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=100.66699999999997) [that meets a specification that does what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=103.04659999999993) [the business wants and expects that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=105.20372727272726) [returns the right data or it could be code](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=107.08846153846154) [that addresses an issue that's been found.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=109.85561538461539) [Either way, it's about creating a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=112.24600000000002) [solution, but it really doesn't end there.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=114.44800000000005) [It's easy to think that it might. Once](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=117.902) [you've written the application to do what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=119.96133333333337) [you need it to do you're done. Hand it off](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=121.687) [to QA for testing and it's off your to-do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=124.14200000000001) [list, but truly it isn't because, as you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=126.63500000000002) [know, sometimes that code comes back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=129.02716666666666) [you, either because it doesn't do what's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=131.0645) [expected or because it doesn't perform](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=132.90725) [well, it doesn't meet some time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=134.8961)[requirement. The former is typically](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=137.29429999999996) [easier to fix than the latter.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=139.23079999999996) [Understanding why the lines of code you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=141.536) [wrote don't perform well can take time.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=143.61700000000005)[You often have to dig beyond just what you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=145.698) [have done and look at other things, like](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=147.6732000000001) [the data in the system, or the schema, or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=149.60257142857142) [what users are doing at the same time. As](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=152.35914285714279) [a developer you have to remember that when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=156.37808333333334) [you write T-SQL, which you may be directly](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=158.82675) [writing in your code or you may be writing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=161.11178571428576) [methods, which then generate T-SQL, that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=163.572) [that T-SQL is declarative. You tell SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=166.50299999999993) [Server what you want it to do, like return](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=169.2792307692308) [certain columns from a table that meet a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=171.7459230769232) [specific predicate, but you don't tell it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=174.52716666666674) [how to do that. Now there's always](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=176.88654545454548) [exceptions, right? You can use hints, you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=178.87645454545464) [can use plan guides, you can force a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=180.57821428571424) [specific plan with query store, and some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=182.39135714285703) [features, such as column store indexes are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=184.55600000000004) [more sensitive to query construction, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=186.8164) [in general SQL Server decides how to get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=188.75259999999997) [the information, and this is where query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=191.15700000000007) [plans and query metrics come in, and why](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=193.26775)[they're so important. If you want to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=196.08175000000008) [understand what SQL Server did, you have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=198.16659999999996) [to look at the plan, and the additional](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=199.9683999999999) [metrics that are captured. We use query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=203.06699999999995) [plans to find out how the results are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=205.8527692307692) [being retrieved, what did SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=207.7641538461538) [decide to do, and for every query that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=209.50685714285717) [execute a plan is generated, and you then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=212.35278571428583) [use that plan to triage what occurred. You](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=214.98699999999997) [look at the metrics, which help explain](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=217.53128571428573) [what you find in the plan, and then you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=219.1152857142858) [can address the areas that would benefit the most from improvement.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=0&mode=live&start=223.473)

[Course Objectives and Structure and Module Summary](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live)

[I've proposed that it's important for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=1.992) [developers to understand more than just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=3.8717999999999995) [whether their code or a specific query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=5.767166666666666) [returns the right data or does what it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=8.01475) [should, and so we'll use the rest of this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=10.161666666666667) [course to prove that. We'll start with a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=12.292266666666668) [high level review of the information you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=14.486666666666672) [can obtain about query execution from SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=16.5952) [Server, specifically the execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=19.0809) [metrics, such as duration, memory use,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=20.862333333333336) [I/O, and CPU, and then we'll talk about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=23.715) [how you can use those to get an idea of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=25.849933333333322) [whether a query is performing well,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=28.84075) [whether it's really optimal or not. Then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=31.08625) [we'll talk about capturing the plan for a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=34.159285714285716) [specific query. Once we understand those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=38.05985714285714) [basics, that is, the information we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=40.18066666666667) [get from SQL Server, we'll talk](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=42.18558333333334) [specifically about where to find it inside](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=43.96616666666667) [SQL Server, so we'll cover the different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=46.058) [options available for gathering query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=48.57309999999998) [execution data, and then we'll talk about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=50.25027272727274) [how to understand what those numbers are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=52.347727272727305) [really telling you about performance.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=55.541999999999994) [After discussing metrics we'll move on to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=58.137) [talk about execution plans, which means](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=59.988181818181836) [we'll dive into how you go about reading](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=61.72236363636363) [one, where to start, what the different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=64.42781818181817) [components tell you, and how to find the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=66.40349999999997) [metrics within the plan. Some of them are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=68.55023076923078) [easy to see, some are a little more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=70.58715384615391) [hidden, and some exist in multiple](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=72.92891666666668) [locations. We'll also highlight what is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=74.8224166666667) [not important in a plan, things that can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=76.56453846153849) [be detractors sometimes when you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=78.847) [diffing into an issue, and finally, we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=80.69977777777777) [dive into the plan in more detail and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=83.20384615384617)[discuss some of the operators that you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=85.92876923076929) [see most frequently in a plan, and how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=88.0577272727273) [those operators can change based on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=90.36776923076924) [changes you make to a query, but you might](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=92.08607692307696) [see what to expect. Finally, I'll show you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=94.7730769230769) [some additional information you can pull](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=97.2832307692307) [from a plan that you'll want to consider](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=98.95075000000003)[after that initial review and analysis of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=101.23472727272727) [what's going on. It's a lot to cover, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=103.95581818181813) [I've organized it into five different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=107.61476923076926) [modules. So here's our plan. First, we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=110.10753846153851) [going to talk about finding information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=111.88990909090907) [about queries, just a high level overview](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=113.43278571428571) [of what data we can capture. Then we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=116.25928571428574) [talk about understanding those query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=119.33575) [metrics, really diffing into that data and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=120.97012500000001) [understanding how it relates to the query.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=123.66746153846157) [Next, we're onto query plans, so that when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=126.433) [you look at them they make sense to you,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=128.14842857142858) [and you can understand what SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=130.6360909090909) [did. Within that plan we'll look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=133.43863636363636) [operators, and we'll cover just the ones](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=135.53946153846164) [that you see frequently, but it gives you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=137.25833333333335) [really a good foundation to build on, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=139.34900000000007) [lastly, that additional important](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=142.2096666666667)[information in a plan, those items beyond](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=143.871) [operators that you want to pay attention](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=146.01066666666668) [to when you're trying to understand a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=148.505) [query that's not really optimal. And](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=151.88600000000002) [that's just a quick module to talk about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=154.53392307692306) [the responsibilities of a developer, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=156.39730769230763) [my list may not have been comprehensive,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=158.07122222222222) [but I'm thinking we all agree that a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=160.669) [developer spends a majority of time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=163.14838461538457) [writing code, and then even though that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=165.02475) [what a developer does we've talked about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=167.31200000000004) [why it's important to understand query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=169.77609999999999) [execution. We also covered the objectives](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=172.0902999999999) [for this course and the structure for it,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=173.59433333333337) [and with all of that stuff out of the way let's get started.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=aa4eb9bf-15e8-4b13-8161-d681d34557b8&clip=1&mode=live&start=176.16)

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[Introduction and Information About Queries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live)

[Hi. This is Erin Stellato from sqlskills.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=0) [com, and I'm recording this course for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=3.35475) [Pluralsight. This course is analyzing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=6.553222222222222) [query performance for developers in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=8.558777777777777) [Server, and this module's topic is,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=10.8366) [Finding Information About Queries. I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=13.05) [to step through the data that is generated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=17.524076923076926) [when a query executes, and this is data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=18.952384615384624) [generated by SQL Server, and the majority](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=21.356750000000005) [of it is found there, but not all of it,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=23.973) [so we will cover where you can find it, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=26.36674999999999)[that it can be used for further analysis.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=29.566333333333336) [When we start to think about the data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=33.093) [relevant to query execution we start with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=35.10838461538462) [the query itself. Whether that query is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=36.90866666666667) [run from an application, from Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=38.801) [Studio, or from another query tool that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=40.980000000000004) [query text is something we can get from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=44.172) [dynamic management objects, which I'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=47.310909090909064) [also refer to as DMOs. We can also get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=49.07553846153846) [that information from extended events or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=51.719461538461516) [trace, from Query Store, and of course, we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=53.80009090909091) [see it in Management Studio when we run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=56.721999999999994) [the query. Interestingly enough, we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=59.193999999999974) [get query plan information from those same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=61.30040000000001) [sources, the DMOs, extended events and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=63.9251) [trace, Query Store, and Management Studio.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=66.2777) [The plan tells us what SQL Server did when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=68.40707692307693) [it executed our query, what tables or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=71.26630769230773) [indexes it accessed, what type of join it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=73.72700000000003) [did, if more than one table was involved,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=76.3263076923077) [and of course, a whole lot more. In](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=78.15153846153845) [addition to the query that executed in its](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=80.2494615384615) [plan, we want to see execution statistics.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=82.511) [What was the query duration? How much IO](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=85.837) [did it require? How much CPU did it use?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=88.21881818181818) [And those execution stats can be captured](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=90.82384615384618) [from the same sources I listed previously.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=92.821) [Now, at this point, you may start to think](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=95.795) [that since all these sources have the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=97.94530769230765) [query text, the plan, and execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=99.867) [statistics that you can just pick one and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=101.79900000000002) [use it, but that's not the case. There are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=103.94669230769232) [times where it's more appropriate to use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=106.60407692307692) [one source over another. When we talk](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=109.76484615384615) [about query execution data one of the main](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=112.2766923076923) [differences in the sources is whether you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=114.15853846153844) [have the ability to view information live](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=116.28858333333336) [or whether that data is stored somewhere,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=118.612) [either within SQL Server or external to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=121.66749999999996) [it. These different sources that I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=124.51733333333334) [mentioned, the DMOs, Query Store,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=126.51933333333338) [Management Studio, extended events, trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=128.54749999999999) [they only really do one or the other. They](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=130.60588888888887) [either display live data or they capture](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=133.88975) [it and retain it. SQL Server Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=136.49899999999997) [Studio is the only source for you to view](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=138.8454615384615) [live data, and to be clear, by live data I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=141.411846153846) [mean that you run the query, and you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=144.33099999999996) [capture how long it takes to run, and you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=146.7372) [can see what resource used, such as IO and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=148.68780000000004)[CPU looked like. In addition, Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=151.6553333333333) [Studio gives you the ability to capture](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=153.8106) [the actual execution plan for the query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=156.136) [that you run or you can capture the estimated plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=0&mode=live&start=158.293076923077)

[Demo: Viewing "Live" Query Execution Data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live)

[In this first demo we're going to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=2.427) [how you can view query execution data live](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=4.255285714285715) [via SQL Server Management Studio. The goal](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=6.959625) [of this demo is for you to simply see what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=10.215874999999999) [data we can get. Done worry yet about how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=12.425249999999997) [to interpret it. I just want you to be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=14.480071428571428) [clear on where to go for that information.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=16.588) [For all our demos I'm going to be working](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=20.702) [with the WideWorldImporters database, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=23.3555) [I am running the latest version of SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=24.982666666666663) [Server 2016 Service pack 1CU3. Again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=27.953333333333322) [WideWorldImporters database, which you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=30.953777777777777) [download from GitHub, and I think it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=33.776) [also still on CodePlex, and then I have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=36.68609090909092) [the latest Management Studio available for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=39.94754545454544) [production, which is a 17. 1 I believe. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=42.34536363636361) [we're going to assume that I've just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=44.966333333333345) [opened up Management Studio, which I have,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=46.91) [and I've opened up this query, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=48.323999999999984) [going to run it. So this is where you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=49.98020000000001) [would typically start. Now a lot of DBAs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=51.91880000000003) [that I know live in Management Studio,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=53.51266666666668) [spend a lot of their day there, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=54.83940000000004) [why understanding how you can run these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=56.9693846153846) [queries and get information is really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=58.791) [important. So we'll switch our context to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=60.98957142857142) [the WideWorldImporters database, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=63.45666666666667) [run our query, and we get our output, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=64.87246666666667) [from here we can see how many rows were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=66.51706666666665) [returned. We had 53 rows returned, and it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=68.95335714285713) [took less than 1 second, but we don't know](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=71.68192857142853) [exactly how long it took, we just know it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=73.9460769230769) [took less than 1 second, and this is where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=75.99333333333331) [we can start to use some commands to get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=77.89533333333327) [additional information. We're going to use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=81.11488888888886) [SET STATISTICS IO. We're going to enable](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=82.86066666666666) [that option to get IO information, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=84.51733333333331) [that's going to show up in our Messages](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=86.34960000000002) [tab. Right now it just tells us how many](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=88.47706666666672) [rows we have returned. When we enable this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=90.64433333333335) [we'll get to see IO information, and when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=92.66528571428572) [we run SET STATISTICS TIME ON we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=94.80585714285715) [to get time information in that same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=97.18900000000004) [Messages tab, so let's go ahead and run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=99.57607692307693) [all of this together, and now again, we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=103.88869230769228) [still get the same output here, and that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=106.74846666666666) [we get our result set, but if we look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=108.15539999999997) [Messages now we can see what we have for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=110.43256250000002) [parse and compile time, as well as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=112.682)[execution time, so this was no](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=115.18369230769233) [milliseconds at all. It returned](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=117.328) [immediately, and then here in the middle I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=118.64345454545453) [have my IO information, what tables were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=121.045)[accessed, what I had in terms of logical,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=123.92550000000003) [physical, read-ahead reads. What I really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=126.2459) [tend to pay attention to here is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=127.83592307692307) [logical reads. Physical reads are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=129.8943846153847) [interesting, but typically, unless I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=131.5475) [looking at really large result sets, I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=133.44500000000005) [just have logical reads here. Now I can do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=136.1515) [one additional step here with keeping the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=139.90792307692305) [STATISTICS IO and TIME enabled, and also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=143.07353846153842) [pull the Actual Execution Plan, and I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=145.5741538461538) [get the Actual Execution Plan a couple](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=148.128) [different ways. The first way is to use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=150.31200000000007) [SET STATISTICS XML ON, so remember I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=152.99676923076916) [already set IO and Time on, and now we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=155.401) [going to add the STATISTICS XML as well to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=158.59857142857143) [get the plan, and I'm going to turn that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=161.55975) [one off when I'm done here. So we run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=164.22543750000003) [this, and in our output we still have our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=166.88479999999996) [Results tab and our Messages tab, and if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=169.541) [we hop to our Messages tab there's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=171.34099999999995) [additional information that's showing up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=173.00266666666667) [because we've asked for that execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=174.561)[plan, but we still get our IO information,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=176.71181818181816) [and notice that the execution time now we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=179.954) [have 290 ms because I've asked for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=182.92507692307692) [plan, which does require a little bit of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=185.473) [additional time, so that's something to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=187.3156666666667) [pay attention to when you're pulling data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=189.23225000000005) [from Management Studio. It's great that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=191.593)[can run this live, but realize that if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=193.72418181818182) [grab the execution plan that does affect](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=196.77433333333335) [the execution time. So where is that plan?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=199.33960000000002) [Well, if we go to Results here's our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=201.94971428571426) [result set here, and down here in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=204.3668571428571) [bottom I've got a second result set, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=206.3615000000001) [is our plan, so when I click on this, XML,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=208.3979375) [now I get the plan, the graphical plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=211.8373125000001) [and from here I can dig into it, and if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=214.38462500000003) [look at, let's say the clustered index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=217.41925000000018) [scan, you can see that I have estimated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=219.50023076923074)[information, and I also have actual, like](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=221.947) [actual number of rows, actual number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=224.06609090909097) [batches because this is the actual plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=226.11007692307695) [so I get estimates and actuals in here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=228.05392307692318) [and I can save this plan if I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=230.3595) [interested. Just right-click, Save](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=232.7155) [Execution Plan As, and I will save it, if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=234.1401818181818) [I want to, if I'm interested, as a.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=237.4420909090909)[sqlplan file. I'm not going to do that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=239.74681818181807) [now, but if I wanted to share this with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=241.19220000000004) [anyone or retain it for any purposes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=242.496) [that's what I could do. That's one of my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=245.48150000000004) [options for getting a plan. The other one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=248.3015555555556) [is to enable the actual plan through the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=250.45525000000004) [UI. So we still have the SET STATISTICS IO](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=253.90658333333346) [and TIME enabled, but if I come up here to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=256.49586666666664) [Query I can do Include Actual Plan, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=259.195) [can also do Ctrl+M, but I like to show you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=261.62799999999993) [in the UI where you would go, so we'll say](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=263.8670000000001) [Include Actual Plan, and we'll highlight](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=266.33969230769236) [all of our text again, and run that, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=268.42907692307705) [this time we get a fourth tab. So we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=271.4886666666666) [got our result set here, our 53 rows,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=274.3925714285714) [we've got our messages, and again, extra](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=276.6748571428569) [information because I've asked for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=278.8156) [plan, and then I have my execution plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=280.8148000000002) [tab. So a graphical plan just as we saw](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=283.40500000000014) [before, but rather than having a link to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=286.2421428571428) [click on it displays the plan here, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=288.5627142857142) [again, right-click and save, and this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=291.205)[the actual plan. I've got my estimates and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=293.79849999999993) [my actuals as well. Now if I wanted to get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=296.83111111111106) [an estimated plan, so not actually run the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=300.3835714285713) [query, but SQL Server tell me what you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=303.071) [going to do is basically what you're doing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=305.02976923076915) [when you ask for the estimated plan, so we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=306.87200000000007) [highlight the query, and we come back up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=308.7260000000002) [to the Query menu, and we say, Display](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=311.1154999999999) [Estimated Execution Plan or we could do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=313.64341666666667) [Ctrl+L, and when this happens the query is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=316.0543333333335) [sent to SQL Server, it does parsing and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=318.6980000000001) [optimization, it creates a plan, it shows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=321.23) [us the plan, but it doesn't actually run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=323.55938461538443) [the query, it doesn't actually put the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=326.17783333333335) [plan into cache, and again, most of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=328.35425000000015) [time this plan is the same as what you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=330.8873333333333) [would see for the actual plan, but not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=333.76793333333325) [always, and here when we look at an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=335.86086666666665) [operator you'll notice that I only see the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=337.887) [estimates. I don't see any actuals because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=340.4790000000001) [again, it's the estimated plan. Hop back](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=343.4370000000001) [to the Editor here. Actually there's two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=346.0386153846154) [more things I want to show you. The first](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=347.46176923076933) [one is a client statistics option. So up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=349.70636363636356) [here in my toolbar I've got little icons](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=352.0129333333333) [that I can click on, and one of them is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=354.3686666666666) [this guy here, Include Client Statistics.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=357.381) [I could also do Shift+Alt+S. So if I click](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=359.229) [on this, and then I'm going to run this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=362.2002857142856)[query again, and in addition now to my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=365.56214285714293) [messages and my execution plan I also have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=368.9844285714288) [client statistics, and if we come here we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=372.0789230769231) [can see we get a different set of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=374.92379999999997) [information. Here I get an understanding](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=376.78619999999995) [of, do I have any inserts, updates, or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=378.3806666666667) [deletes, and how many rows were affected,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=380.60736363636363) [how many transactions, I get network](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=382.8499090909092) [stats, I get some time statistics as well,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=384.74018181818184) [and then what's really cool is that if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=387.218) [go and I run this query again, and it's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=389.80459999999994) [different query. Notice that I've changed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=392.57366666666667) [the predicate. Here I have WHERE](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=394.1406666666667) [CountryName is United States. Now I've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=396.06600000000003) [WHERE StateProvinceName LIKE O, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=398.46107692307686) [chose O because I like in Ohio, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=400.4452307692306) [anything, there's Ohio. There's the other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=403.37885714285716) [two, Oklahoma and Oregon. If I look at my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=405.5191428571429) [client stats tab now, in addition to my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=407.9452142857142) [first execution, I have my second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=409.8383571428569) [execution. So if you're making changes to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=411.8159090909092) [your query, and you want to look at those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=414.1805333333333) [over time, you could just run each query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=416.66033333333326) [using SET STATISTICS IO ON, and TIME ON,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=418.782) [and grab the plan and pull all that, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=420.7659999999999) [you have to save that information or copy](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=423.05242857142844) [it off somewhere. Client Statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=425.109) [basically tracks that for you in this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=427.08490909090904) [window, but one thing to note is if I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=429.74853333333334) [to capture this or retain it I've got to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=432.6738666666666) [save it off from here, and I only get 10](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=435.12370588235285) [different trials. I can run a query 10](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=437.68311764705857) [different times and that all shows up as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=439.4110000000001) [10 individual executions. Once I go beyond](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=441.0323333333336) [that then it starts to age the older one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=443.2595000000001) [out, but this is sometimes really useful](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=446.286) [to understand what's going on behind the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=448.624) [scenes. Now one other thing to point out](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=451.44853846153853) [is that streaming that result set back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=454.899) [Management Studio consumes resources. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=458.6963333333334) [takes time, and sometimes maybe you want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=460.91115384615387) [to exclude that in your tuning, and you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=463.12423076923073) [can enable this option within Tools,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=466.6247)[Options, actually hang on, there's two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=470.4641000000001) [different ways to get in this Options](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=472.1663076923076) [window. One is this one, Query Options,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=473.6535384615383) [which is what I want right here, so here's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=475.0826153846152) [my results, and here's my grid, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=477.15276923076925) [going to say, discard results after](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=479.7558461538462) [execution, which means get rid of them,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=481.818) [don't pull them back to me. So we say okay](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=484.352) [here, and when I run this, and I say](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=487.5395000000002) [Execute, notice I still get my execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=490.4068571428571) [plan, I still get my client statistics,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=492.6348571428571) [but I don't have any output window, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=495.15180000000004) [actually, in this case, didn't even get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=498.5113846153846) [STATISTICS IO or TIME information, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=500.1122307692308) [don't have my 53 rows, right, because it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=502.1298461538461)[discarded them. If I change this, if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=505.070769230769) [come back to Query Options, come back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=507.40040000000005) [my Results, say never mind, and I run it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=509.5262666666668) [again, now I get my result set. So it's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=513.2405333333332) [useful option to sometimes take that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=517.0559999999999) [result set out of the equation. Just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=518.6519999999997) [remember to change the option back, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=520.5345833333333) [that when you're running queries you do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=522.5406666666663) [get your results again. Otherwise, you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=524.553181818182) [might spend minutes or many, many minutes,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=526.285545454546) [which has happened to me, troubleshooting.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=528.5548181818182) [So just remember to turn that off when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=530.585) [you're done, so that you're not confused](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=532.4775714285715) [about why you're not seeing result set. Let's head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=1&mode=live&start=534.251875)

[Finding Query Execution Data and Extended Events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live)

[Management Studio is, as I said, the one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=2.382) [place to find live query information. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=5.518000000000001) [one of the best ways to capture an actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=8.130071428571428) [plan for a query. The query execution data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=10.470714285714289) [that we capture for Management Studio is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=13.098666666666663) [also valuable, but that collection is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=15.877083333333324) [manual, meaning you run a query, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=17.87718181818182) [you have to take note of the duration, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=20.276285714285713) [IO, the CPU. You have to copy it out or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=22.415071428571444) [write it down. If you're looking for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=25.1125) [additional query execution that is per](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=27.359363636363632) [query Extended Events or Trace is another](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=29.45390909090908) [option. We can get information from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=32.846714285714285) [Extended Events or Trace that includes the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=34.82025) [query text, that includes duration, IO,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=36.873) [and CPU for each individual query executed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=39.50100000000001) [that meets a specific criteria. When we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=42.965857142857146) [shift to the Dynamic Management Objects](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=46.87266666666667) [and to Query Store, then the execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=49.03166666666667) [data that we see is aggregated. Assuming a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=51.50266666666667) [query is executed more than one time, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=54.08) [data that gets captured and retained in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=56.13599999999998) [the DMOs and in Query Store is aggregated.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=58.44833333333334) [We don't have performance metrics for each](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=61.531) [individual query execution, and finally,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=64.72159999999998) [we can get information from Performance](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=66.7766) [Monitor about query execution, but this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=68.83940000000001) [data is really at the instance-level or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=71.06445454545452)[database-level, it's not at the individual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=73.755) [query level. This course will mostly focus](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=76.57199999999997) [on individual query metrics, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=79.4343333333333) [understanding the server and instance data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=81.262) [that you can capture about query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=82.99600000000001) [performance from Perf Mon can be extremely](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=84.8389090909091) [important when troubleshooting query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=87.24309090909094)[performance. Extended Events is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=90.35466666666667) [infrastructure within SQL Server that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=93.04779999999998) [handles events, and an event relates to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=94.89879999999997) [something of interest in SQL Server. There](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=98.12649999999996) [are over 300 events available in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=101.27884615384615) [Server 2016, and some of them are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=103.3427692307692) [obviously more commonly used than others.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=105.61375) [When we are talking about query execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=108.004) [there are some events that I definitely](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=110.09969230769228) [recommend that you use. They include](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=112.37514285714286) [sql\_statement\_completed,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=115.25)[sp\_statement\_completed, rpc\_completed, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=116.987) [sql\_batch\_completed. Now the two events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=120.8502) [that you will probably use the most are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=122.79620000000001)[sql\_statement\_completed and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=126.5267142857143) [sp\_statement\_completed, but the other two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=127.61357142857146) [definitely have their uses. All of these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=129.58299999999997) [events capture resource information, such](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=132.0326) [as duration, logical reads, writes, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=133.73860000000008) [CPU. Now there are a few events in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=136.10599999999994) [Extended Events that I don't recommend,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=139.476) [and I don't mean to have such an angry](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=141.0636923076923) [face here, it probably should be a sad](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=143.3945714285714) [face, but I don't recommend them because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=145.308857142857) [of the overhead that they introduce. It is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=147.18033333333335) [true that Extended Events is more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=149.65099999999998) [lightweight than trace, but you can still](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=151.57699999999997) [create a performance problem in your](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=153.69133333333335) [environment if if you don't properly](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=155.41833333333338) [configure your event session. If you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=157.46900000000002) [include expensive events you can have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=159.77259999999998) [problem. The expensive events related to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=162.67269999999996) [queries are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=164.90057142857137)[query\_post\_compilation\_showplan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=165.626) [query\_post\_execution\_showplan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=168.1095) [query\_pre\_execution\_showplan. As you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=171.142) [probably guess, these events produce an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=173.33800000000002) [execution plan, but capturing that plan is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=175.898) [not a trivial operation, which is why](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=178.45649999999998) [these events are not recommended unless](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=181.11072727272727) [you carefully consider the overhead, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=183.3957) [you have an understanding of the potential impact to performance.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=2&mode=live&start=185.66190000000003)

[Demo: Query Information from Extended Events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live)

[In this demo we will use Extended Events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=2.55) [to capture query execution data. Just as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=5.173384615384616) [with the first demo, the goal is for you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=7.180866666666666) [to simply see what data we can get. Don't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=8.836266666666667) [worry about the details of setting up an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=10.950076923076924) [extended event session. I actually have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=13.155) [different Pluralsight course for that if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=15.351444444444446) [you're interested. For our Extended Events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=17.78663636363636) [demo we're going to use a stored procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=20.498090909090905) [as part of our testing, and this procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=22.879083333333334) [is going to look a lot like the query we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=25.423599999999997) [just ran. Rather than selecting four](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=29.31226666666665) [columns I'm doing a SELECT \*, which is not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=31.23430769230769) [a good practice, so don't do that in your](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=33.809)[production environment, but this procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=36.3461818181818) [is just called usp\_GetCountryInfo, we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=38.70129999999999) [passing in the Country\_Name, and then it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=41.68679999999998) [the same query we saw before that joins](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=44.39058333333332) [the Countries table and the StateProvinces](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=46.85590909090909) [table, so we'll go ahead and create that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=48.96736363636362) [procedure, and then we're going to create](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=52.284333333333336) [our Extended Events session, and in this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=55.625666666666675) [first section we're just dropping the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=57.97560000000001) [event session if it happens to exist, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=59.74366666666666) [then we're going to go ahead and create a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=61.822333333333326) [session called QueryPerf, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=64.4784) [including the sp\_statement\_completed event](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=66.29175000000001) [and the sql\_statement\_completed event, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=68.08725000000001)[I do have a filter on here, just as a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=70.09019999999998) [reminder that you always want to include](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=73.46454545454544) [one. This is a pretty low level filter.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=75.32081818181815) [It's duration greater than 1000](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=78.24949999999998)[microseconds, which is 1 millisecond,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=80.152) [which is really, really low. I'd include](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=81.77100000000003) [something much larger typically, you know,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=84.27525) [duration greater than 1 second or a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=86.931) [logical IO is greater than 10, 000,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=88.81199999999997) [something like that, but for today this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=90.693) [okay because we're just working in a demo](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=92.98433333333334) [environment. We are writing to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=95.80236363636362) [event\_file target out in C:\Temp, so we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=98.31090909090906) [go ahead and run all of this to create our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=100.86900000000001) [event session, and then we're going to go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=104.48853846153845)[ahead and start that event session within](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=107.76484615384614) [the UI, so let's drop into, let's close](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=110.76638461538464) [that up, and we'll look at Management, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=114.40207692307699) [we'll expand that, and underneath](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=117.67172727272728) [Management we're going to see Extended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=119.639) [Events, and then our Sessions, and we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=121.57263636363639) [go ahead on QueryPerf, and we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=123.72633333333334) [right-click and go ahead and select a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=125.35333333333338) [start. We're going to do a WHILE loop in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=127.74064285714287) [different window here, so I'm going to go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=132.08278571428576) [ahead and take this and we'll copy it, New](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=133.95620000000002)[Query, we'll put this into here, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=135.9785) [we'll run that, and let that go, so that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=138.99849999999998) [just going to run that stored procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=141.37392307692315) [over and over, and here we're going to run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=142.824) [the Adhoc query over and over. So what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=145.98660000000012) [can see here in Management Studio is we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=148.83149999999998) [got our queries running, and for Extended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=150.79549999999992) [Events what you can actually do is you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=152.96892307692312) [kind of get a profiler like view through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=156.202) [Watch Live Data, so I just right-clicked](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=158.4997142857144) [and I did Watch Live Data, and if we look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=160.46006666666668) [at this now we can start to see the events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=162.8307333333333) [come in, and they'll drop in every few](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=165.66128571428578) [seconds, and this is as live as it gets](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=168.171) [with Extended Events. These queries have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=171.4305) [already completed executing, but we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=173.54136363636366) [see them coming through here, and notice](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=175.59009090909097) [that what we're looking at isn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=177.77709090909093) [representative of everything that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=179.582) [executed so far, so if I come over here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=181.14533333333327) [and let's stop these queries from running,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=184.63407692307692) [so we'll go ahead and stop that, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=187.1686153846154) [hope over to our other window, and we will](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=190.35814285714284) [stop that as well, and then you'll notice](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=193.4612142857142) [that if I hope back to live data pretty](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=195.38659999999996) [soon no more events pop in here, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=197.53500000000003) [that's fine. We'll go ahead and stop this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=200.27100000000013) [manually, and then if I want to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=202.88300000000007) [all of the data this was just the live](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=205.775) [data view, so depending on when I turned](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=207.88760000000005) [it on, depending on when I stopped it, I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=209.81799999999998) [can actually stop it and just look at that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=212.16699999999994) [data while the event session is still](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=214.43638461538455) [running. I probably won't have everything](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=216.1519230769229) [that I see in the final output file, so my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=218.06276923076916) [live session was about 143 events, and if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=221.35826666666668) [I open up the actual file you'll see we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=223.87933333333336) [got 228. So now if I highlight any of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=226.77385714285717) [these events I get more information down](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=229.74128571428577) [in the Details pane, and I can take](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=231.571) [logical reads, and I can put that in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=233.571) [top, and I can do the same for duration,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=235.73100000000008) [and if I scroll down we'll get our actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=238.05642857142857) [statement as well. So as I start to go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=240.96085714285712) [through here I can look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=243.70592307692314) [sp\_statement\_completed and I see my SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=245.48284615384628) [\*, which is that query within my stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=247.88328571428565)[procedure. For sql\_statement\_completed I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=251.2501428571427) [see the execution of the stored procedure,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=252.6436666666667) [and for sql\_statement\_completed. If I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=255.29325) [scroll down a little bit further I should](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=258.20250000000004) [also see, sometimes it takes a while for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=261.3885000000002) [that one to pop-up. Let's see, here it is.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=263.988) [For sql\_statement\_completed I also see my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=266.9827272727272) [literal query with the select with only](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=269.134) [the four columns where I'm just querying](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=271.50641666666655) [for United States, so Extended Events is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=274.1084545454546) [one way, right, to look at these different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=277.28454545454565) [query execution metrics on a per query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=280.9682857142858) [basis. Here I can see for this query there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=284.2072857142859) [was 155 logical reads. For this one there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=287.9946666666665) [was 3879. So another way to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=291.5926923076923) [individual query execution, in addition to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=295.4640769230769) [what we saw within Management Studio, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=297.6852727272726) [this is obviously more automated than what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=300.1140833333333) [we saw in Management Studio, and can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=302.52266666666674) [collect significantly more data in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=305.51490909090916) [faster manner than we could in Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=308.74672727272747) [Studio in terms of individual query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=312.35015384615383) [execution data. Alright, so let's hope](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=315.3815384615384) [back to our slides, and we'll start](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=317.4889230769231) [talking a little bit about what we get from the DMOs.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=3&mode=live&start=319.40853846153846)

[Dynamic Management Objects](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live)

[Now that we have a couple options for what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=2.112) [we can gather for individual query data,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=4.110692307692306) [let's look at what we can get from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=5.9329230769230765) [DMOs. Query text and query plans are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=8.73469230769231) [stored in separate DMOs, and again, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=11.157) [query statistics are aggregate. For the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=13.589666666666668) [text we need to use dm\_exec\_sql\_text, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=15.519666666666671) [then for plans we have a few options](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=17.926909090909092) [depending on the plan itself, and those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=21.12254545454546) [include dm\_exec\_query\_plan, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=24.43725) [probably what you'll use the most,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=26.394333333333336)[dm\_exec\_cached\_plans, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=29.350333333333346) [dm\_exec\_text\_query\_plan. When we want to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=30.386333333333333) [see those aggregation statistics we want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=33.10300000000001) [to look at dm\_exec\_query\_stats. If you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=36.27028571428571) [running SQL Server 2016 you also have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=39.138) [access to dm\_exec\_function\_stats, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=42.00099999999999) [has performance statistics specific to functions.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=4&mode=live&start=44.819)

[Demo: Query Execution Data in DMOs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live)

[For this demo we'll take a look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=2.046) [query information that we can get from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=3.7302857142857153) [dynamic management objects. Again, just as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=5.823700000000001) [before, I want to show what information is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=8.139100000000003) [available from what objects. Don't worry](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=11.026545454545458) [about remembering the names of every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=12.960222222222221) [object, that's what the scripts are for.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=14.472888888888885)[For our demo against the Dynamic](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=18.064) [Management Objects I'm going to run some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=20.04850000000001) [queries outside of Management Studio. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=22.559833333333334) [I've got a SQL file here, and I'm just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=25.445588235294117) [going to drag this into Management Studio.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=27.709882352941182) [It's not really that complicated. It looks](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=29.471) [complicated, but it's not. What I'm doing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=32.054636363636355) [is I'm generating some random values that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=34.8795) [I'm then passing in, so that my query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=38.026) [string is different every time, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=41.20663636363635) [getting a bunch of different queries with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=43.62509090909091) [literal values, so that I just don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=45.434909090909095) [the same thing running over and over](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=46.92657142857142) [again. It's just a more interesting work](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=48.063571428571414) [load. So that's just that SQL script, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=49.917500000000004) [then I've got a command file that just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=52.363166666666665) [calls that, so if you open that up you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=55.379833333333316) [see that it just calls that particular SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=58.20066666666666) [file, so we'll just go ahead and run that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=60.28430769230769) [fire that up, and then we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=62.76207692307692) [start with dm\_exec\_sql\_text. So if I query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=65.09112499999999) [just straightaway you'll notice that it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=67.05528571428573) [tells me I don't have parameters because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=68.64871428571433) [this is a DMF, a Dynamic Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=70.84827272727271) [Function. I have to pass in either](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=73.50190909090905) [sql\_handle or plan\_handle, so to make this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=76.32042857142855) [a little bit more interesting we've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=79.16642857142853) [those queries running in the background,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=80.91263636363637) [and then we're going to hit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=82.40237499999999) [dm\_exec\_requests, what's being requested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=84.64262499999997) [right now, and we CROSS APPLY over to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=85.8750909090909) [dm\_exec\_sql\_text, and we pass in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=88.166) [sql\_handle, so let's go ahead and run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=90.357) [that, and we'll just get a little bit of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=92.8285) [output here. So we can see our query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=95.35300000000004) [against WideWorldImporters, and we can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=97.45461538461542) [the text of the query that's executing,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=98.99523076923084) [and if we run this again, we should get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=100.86749999999999) [something slightly different. This'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=103.26599999999999) [change. It keeps showing up with stock](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=104.41473333333334) [item id as the column being selected. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=106.97486666666671) [should change, at some point, to something](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=109.81) [like there we go, InvoiceLineID. Right, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=111.73500000000004) [different queries are being generated and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=113.58781818181818)[run against the system in the background.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=115.02127272727272) [Now if I want to see more than the text,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=116.98342857142859) [let's say I want to look at the plan, then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=120.097) [I'm going to hit dm\_exec\_query\_plan, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=121.65128571428572) [this is another function, so if I run this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=122.97433333333333) [one I'm going to get that same message as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=126.13033333333335) [before, and what I need to do here is I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=128.1604666666667)[need to pass in the plan\_handle, so we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=130.69799999999998) [going to build on that initial query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=133.54599999999994) [against dm\_exec\_requests and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=136.77685714285718) [dm\_exec\_sql\_text, and we're going to CROSS](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=138.58371428571436) [APPLY over to dm\_exec\_query\_plan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=141.16266666666664) [we'll pass in the plan\_handle, and now in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=143.05723076923076) [this output we'll get the same information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=145.5630769230768) [that we had before, which was our query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=147.58953846153844) [and our database, but we also get our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=149.6523076923076) [plan. So if I click on the plan now I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=152.19562500000006) [see that here, but again, this is the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=155.83633333333333)[from cache, so notice we only have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=158.1883333333334) [estimates here. I don't have actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=160.11016666666666) [values. I just have my estimates because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=161.78916666666663) [this is the plan that's being pulled from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=163.6603846153847) [the plan cache. Now I can also retrieve](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=166.1269) [from dm\_exec\_cached\_plans, and this is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=171.0061000000001) [dynamic management view, so I can just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=173.7650909090909) [query without passing anything in, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=176.6410909090909) [this doesn't look too interesting right?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=178.42363636363638) [And we've got one row in here for every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=180.22266666666664) [plan that's in memory, but I don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=182.97066666666655) [any information about what that plan is or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=185.36900000000006) [what query was run, but still the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=187.9670769230769) [information in here that's really of use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=190.54092307692295) [is the object type. Is it a procedure or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=192.70342857142862) [an Adhoc query, and the usecounts can be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=195.087142857143) [very interesting, along with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=197.74677777777777) [size\_in\_bytes. So if I wanted to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=199.43681818181818) [incorporate that information into that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=201.44845454545452)[query I've just added down here a join](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=203.3155384615385) [over to dm\_exec\_cached\_plans, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=206.50630769230781) [pulling that size\_in\_bytes and that object](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=209.04025000000001) [type, so again, all that same information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=212.23433333333332) [that we had before, in terms of the query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=214.33666666666662) [and the text, and let's run it again so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=216.67112500000007) [that we get something against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=218.7107500000002)[WideWorldImporters, but also what kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=220.17049999999998) [query is it? It's an Adhoc query, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=222.18349999999995) [what's the size of that plan in the cache?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=225.09178571428575) [Now remember I said there are times where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=228.515) [I can't retrieve the plan because it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=231.5377692307692) [more than 128 levels deep, and in that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=233.99514285714284) [case you need to hit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=236.26771428571422) [dm\_exec\_text\_query\_plan, and it's another](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=237.923) [function that requires input. I'm not even](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=239.99900000000002) [going to run it here because we'll get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=242.62399999999997) [that same message, so my input here is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=244.0879999999999)[plan\_handle again, and I also need offsets](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=246.9685384615384) [to specify where that statement is in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=250.23269230769216) [batch, and if you don't know you can use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=252.3730769230769) [0, which means the beginning of the batch,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=254.72042857142858) [and -1 which means the end, so we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=257.1535714285714) [simplified this query, we're just going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=259.54599999999994) [back to hitting dm\_exec\_requests and going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=261.3219999999999)[CROSS APPLYing over to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=263.8174444444445) [dm\_exec\_text\_query\_plan, passing in that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=265.577) [plan\_handle, and then our offsets. So if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=268.0254444444445) [we run this one, let's run this and get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=271.8501428571428)[our output here, and once I get this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=275.2887857142855) [output I'm actually going to stop what's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=277.40423076923076) [running in the background. So let's see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=278.76115384615383) [here, I'm going to go down and we'll stop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=280.2278571428571) [this because I really don't think I need](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=282.2415454545455) [this anymore. So the thing here about this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=284.77390909090917) [plan is that you notice that I don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=286.9561999999999) [that link to click on to give me the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=289.28) [graphical plan. What I actually have to do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=291.3246363636362) [is copy this out, and then I need to save](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=293.29812500000014) [it as a file, so even when I paste it in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=295.83) [here, right, it's just the XML. What I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=299.4541764705879) [want to do is I want to go File, I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=301.82099999999997) [to save that as, we'll just put that on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=303.9659999999999) [the Desktop, and I'm going to change this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=306.0083076923077) [because I don't want it to be a SQL file.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=308.028) [What I'm going to do actually here is I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=309.9186666666669) [going to save it as a sqlplan file, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=312.1413333333334) [then once I've don't that we'll close it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=315.0153333333337) [up, and we'll come back, and we'll hop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=317.4055714285714) [over to the desktop, and we'll grab it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=319.741) [from there, and that's painful, right,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=322.8222307692308) [it's not as nice as clicking on the link,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=325.0190714285714) [but for those really deep plans I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=327.45871428571417) [still get that information this way, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=329.9789999999999) [again, still the plan pulled from cache,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=332.4919999999998) [so I still just have my estimates there.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=335.7738571428573) [Alright, now dm\_exec\_query\_stats, right,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=339.671) [so far I've really just looked at the text](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=341.64966666666663) [and I've looked at the plan. What if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=344.8314)[want to look at the execution statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=346.8212142857143) [for the query over the time that it's been](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=348.9847142857143) [in cache and it's been running? So if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=351.37554545454554) [just run dm\_exec\_query\_stats you'll see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=354.034) [that this can return a lot of data. I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=356.1556666666666) [got 3300 rows just on my system here. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=359.6241538461538) [I've got a lot of great info. If I scroll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=362.68175) [over I'll just show you I have things like](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=364.91925) [my worker time information, I've got my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=367.2986666666666) [physical reads, I've got logical reads and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=369.50483333333307) [writes, and I've got duration information,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=372.48345454545444) [right, so this is fantastic output, but in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=374.99290909090905) [this raw format not really useful. I need](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=377.31218181818167) [to filter on something. We'll kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=380.8902000000001) [start with a previous query that we have,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=383.4045714285715) [but I'm going to actually work from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=384.7794285714288) [dm\_exec\_query\_stats, and we'll CROSS APPLY](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=387.06979999999993) [to dm\_exec\_sql\_text, and we'll pass in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=389.2882999999998) [handle from query stats, and then we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=392.1403999999999) [also going to grab the plan from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=394.7815454545454) [dm\_exec\_query\_plan, and I'm pulling a lot](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=397.197818181818) [of, not even a lot really, I'm pulling](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=398.6883571428572) [some information from dm\_exec\_query\_stats;](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=400.5209285714288) [there's a whole lot more. For my filter](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=401.96012499999995) [I'm just looking for queries that have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=404.73099999999994)[executed more than 25 times or anything](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=406.4903333333332) [that has more than 10, 000 logical reads,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=409.35992307692294) [and we're ordering it by the average](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=413.147) [logical reads. Notice that I don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=415.52388888888873) [average logical as a column; I have to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=417.9880000000001) [calculate that by taking the total and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=420.89039999999994) [dividing that by the execution\_count. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=423.4976666666664) [I've got aggregate statistics remember](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=425.71154545454544) [here for a query execution. This isn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=427.4692727272726) [individual query stats, this is aggregate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=430.019) [query stats. So now I can see how many](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=432.3950000000001) [times the query has executed, what the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=434.91308333333325) [average logical reads were, and I can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=436.7138571428572) [what the text is, and I can also see the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=438.9852857142859) [plan, and again, we're pulling the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=441.82114285714283) [from cache, so if I open this up and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=443.8046428571428) [hover over any of these operators you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=446.6206000000002) [see I just have my estimates there. So the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=448.77137500000003) [dm\_exec\_query\_stats is going to give me](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=452.86859999999996) [execution statistics, but again, it's just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=455.4503999999999) [going to be aggregate. They're only going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=457.56299999999993) [to be there in cache for as long as that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=459.7885882352942) [plan is in cache. If that plan drops out,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=463.0338823529415) [if it ages out, or if someone freezed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=465.4393076923077) [procedure cache that information goes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=467.211) [away, and I had mentioned that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=469.1496363636363)[dm\_exec\_function\_stats is a new dmf, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=471.476) [it works just like dm\_exec\_query\_stats in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=474.31759999999986) [that it retrieves the information, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=477.08914285714286) [it's specific to your functions. Alright, let's head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=5&mode=live&start=480.282)

[Query Store and Performance Monitor](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live)

[Query Store is a new feature in SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=2.54) [2016, and it's available in all editions](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=4.861357142857143) [of SQL Server. It is, without a doubt, my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=6.82976923076923) [favorite new feature in the 2016 release](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=9.884230769230767) [because it captures all of the information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=12.234666666666667) [we've been discussing inside the user](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=14.575) [database for which it's enabled, meaning](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=16.86918181818182) [it's stored in that user database. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=19.23485714285714) [means that you get the query text, you get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=22.282692307692304) [the query plan, and you get the execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=25.20492307692306) [statistics for the query. Like the DMOs,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=27.961777777777776) [the runtime stats are aggregated, but they](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=30.254727272727273) [are aggregated across a period of time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=32.27709090909091) [that you can configure, and the data is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=34.69300000000001) [persisted, even through a SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=37.45681818181817) [restart. This is a huge advantage over the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=39.47554545454543) [DMOs. I'm such a fan of Query Store that I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=41.82239999999999) [already have a Pluralsight course on it,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=44.692)[so I will refer you to that course for all](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=46.69400000000001) [demos. I hope you check it out if you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=49.38742857142856) [running SQL Server 2016 or planning to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=51.58664285714282) [upgrade soon. The last built-in tool that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=55.31925000000001) [we can use to look at query performance](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=57.60853846153847) [metrics is performance monitor. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=59.411) [counters in PerfMon are not specific to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=61.166) [any one query, but this information is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=63.52463636363637) [still valuable because it tells us about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=65.63736363636362) [overall performance, and can help point us](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=67.48849999999999) [in a direction for troubleshooting or it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=69.235) [can corroborate other data that we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=71.49790909090906) [captured. Counters exist for server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=73.51740000000001) [instance and database metrics, and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=75.33340000000004) [ones that I mention today do not represent](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=77.27799999999999) [a comprehensive list by any means. With](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=79.55799999999996) [PerfMon I like to start by looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=81.50099999999998) [server performance as a whole, so I look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=83.71853846153847) [at counters for CPU, for memory, and also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=85.95669230769234) [for physical disk. I want to see if we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=89.16787499999998) [sitting at 100% CPU. I want to know what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=92.27160000000002) [we have for available memory, and I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=94.32066666666665) [to know what the disk latency looks like](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=95.8065333333333) [for all the drives that host database](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=98.29000000000002) [files. At the instance-level I'll check](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=100.75400000000005) [page life expectancy to see how long data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=102.39516666666668) [is staying in memory on average, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=104.44621428571429) [I'll start to look at additional counters](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=106.4159285714286) [like Access Methods to see what I have in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=108.18807692307693) [terms of scans and seeks, and locks to see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=110.62292307692312) [if I have atypical or extended locks being](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=114.0711875) [taken. Very often with PerfMon data I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=117.39368749999998) [looking for values that are different to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=119.32863636363638) [the normal, which means I need to know](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=121.15515384615384) [what normal is, which means I need a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=123.39576923076919) [baseline. If you don't have a baseline for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=125.37885714285714) [your system I strongly recommend that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=127.20742857142857) [establish one. Some of the last counters](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=130.49599999999995) [that I'll look at are those related to SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=132.84814285714288) [Statistics, like batch request per second,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=135.246) [compilations per second, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=137.4586666666667) [recompilations per second because I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=138.8589090909091) [to understand the volume of batches and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=140.62236363636367) [see if I have a lot of queries that are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=142.45759999999999) [compiling or recompiling, and if so, then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=144.6562666666666) [I might look at the DMOs or extended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=146.2975384615384) [events to further validate that, and then work to figure out why.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=6&mode=live&start=148.22)

[Demo: Query Metrics From Performance Monitor](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live)

[For the final demo in this module I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=2.047) [to show you what query execution data we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=3.591785714285713) [can get from PerfMon. I use PerfMon all](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=5.365461538461539) [the time. It's a tool that's on every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=7.80669230769231) [Windows box and it's consistent and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=10.463923076923075) [reliable. I'm guessing you're familiar](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=12.51084615384615) [with it, but let's take a look at what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=13.679384615384617) [counters are most useful when we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=15.541) [investigating query performance. Alright,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=19.529666666666675) [final demo for this module, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=21.782500000000002) [going to start by creating the stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=23.592000000000013) [procedure. Slightly different. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=26.4255) [getting person info. This time we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=28.634727272727275) [pulling from the People table and also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=31.093090909090918) [from Countries, and we are passing in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=34.117250000000006) [PersonID, so we'll go ahead and create](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=37.81125000000002) [that stored procedure, and then I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=40.86915384615384) [to run some stuff outside of Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=43.898) [Studio, and we're also going to obviously](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=45.86966666666667) [be sitting in PerfMon, so this is kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=47.66571428571428) [it for what we're doing in Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=49.41042857142855) [Studio at the moment. Same as the last](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=51.36599999999999) [demo, I've got this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=54.38400000000001)[GenerateDifferentQueryStrings SQL file](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=56.02800000000001) [that I'm going to call with this command](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=57.208285714285715) [file, and then this is for the stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=60.074571428571424) [procedure that I just created. We're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=62.86575) [basically going to grab a PersonID from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=64.848) [the table, and then run our stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=67.06000000000002) [procedure, and this is just going to run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=69.087125) [over and over and over again. we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=70.875625) [to call it with the command file, just as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=72.75757142857144) [we did before. So we'll go ahead, and just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=75.19014285714292) [so you can see that, right, this just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=77.88400000000001) [calls that GetPersonInfo SQL file. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=80.75299999999999) [we're just going to double-click and run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=83.47975) [both of those command files, so that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=85.31200000000004) [have a little bit of workload going here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=87.48273333333334)[in the background. And then we'll go ahead](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=89.73020000000004) [and open up PerfMon, and I'm hoping that a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=91.76766666666667) [lot of you have extensively used PerfMon](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=93.91806666666669) [or you're at least familiar with it. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=96.39269230769231) [in, again, every version of Windows, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=99.29914285714287) [it's a go to tool for me, and we'll just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=101.38614285714291) [drag this down here, and if I want to look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=103.90113333333333) [at things like the drawback here with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=105.71646666666668) [PerfMon is that this opens up and it's got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=108.25092307692307) [processor time, and if I want to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=111.46057142857141) [other counters I have to hit the plus](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=113.55114285714279) [button, and then I have to go and select](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=115.2339375) [all of those counters that we talked](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=117.00862499999998) [about, right, that I'm interested in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=118.83300000000001) [viewing, and if performance isn't going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=120.549) [well, if queries aren't running well, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=122.75040000000001) [time that it takes for me to select all of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=124.93885714285716) [these counters and add them in is kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=127.34171428571435) [prohibitive right? I really don't like](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=130.11399999999995) [waiting, and so what you can do instead,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=132.22100000000006) [we'll go ahead and cancel out of here, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=135.169) [we'll close this window, is if you do the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=137.90776923076933)[Windows key and we'll get a pop-up box,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=141.0425) [right, and we can type the run. We'll do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=144.11049999999997) [PerfMon/sys. So this is what you can type](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=151.36333333333332) [from a run command or if I just do Windows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=154.258125) [and do PerfMon/sys we can do that as well.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=157.1725) [So I'm going to go ahead and select that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=159.841) [and what that forward slash sys option](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=161.86278571428582) [does is it pulls up PerfMon with the last](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=163.7388571428571) [counters that I had selected, so when this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=167.12671428571417) [comes up you're going to see that rather](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=169.55907692307696) [than just having my percent processor](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=171.644) [selected I'm actually going to have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=174.716) [additional counters selected because I had](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=177.7374) [them added before. So let's see if we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=180.5058)[figure out why this isn't coming up. Let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=183.15738461538467) [come back and hit our Windows key again.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=184.94766666666666) [There we go. Here we go. It's just a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=187.441) [little bit slow for me today. Let's hop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=189.94660000000005) [over to that view. Let's be patient. Not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=192.5521111111111) [one of my fortes I have to say. There we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=196.17991666666666) [go. So I've got the view actually a little](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=199.72908333333334) [bit different than you might be used to,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=201.74514285714275) [and I'll switch it so that you can see it.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=203.3216666666667) [Alright, let's go to the line graph. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=204.975) [might be what you're used to, but all that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=206.28638461538466)[happens when I do that perfmon/sys is it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=208.48657142857144) [pops open with the last counters that I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=211.24771428571432) [had, and what's really cool about this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=213.98261538461543) [I can actually go to file and I can do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=216.59276470588236) [Save Settings As, and I can save this as a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=218.840411764706) [file, as a PerfmonCfg file, and then just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=221.89761538461542) [double-click and open it that way. So it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=225.31484615384628) [a really cool option, and then I can have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=227.17979999999997) [different configurations, but I've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=229.08736363636365) [this open, and now you can see I've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=230.40918181818185) [different counters selected. So what do I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=233.33385714285714)[have in terms of available memory? What do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=235.72319999999996) [I have in terms of page life expectancy?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=238.0214) [And the graphical view might be something](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=240.091) [that you're used to, but I tend to hop in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=241.7779999999999) [here and look at it as a report because I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=243.96) [can see the information a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=245.99000000000004) [quicker actually, and it's spread out and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=247.87599999999995) [a little bit easier to look at. So I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=249.78726666666665) [see that we've got plenty of memory](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=252.0699333333332) [available. I can see that in terms of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=253.76230769230767) [processor my processors are pretty busy,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=255.84046153846145)[right? We're hovering between 65, 70, 80%](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=258.244) [here. Not hitting much in terms of IO,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=261.54100000000005) [which is great. I don't want to see these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=264.23730000000006) [numbers low. I can see what I have in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=266.30137500000006) [terms of compilations and recompilations.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=267.9669375000002) [So I don't get that individual query data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=269.6839999999999) [here. I get instance-level information,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=272.84200000000004) [and I can get some database-level](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=274.9920000000001) [information, and sometimes when you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=277.6498571428571) [troubleshooting performance that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=280.1891428571427) [information is good to have here, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=281.36659999999995)[PerfMon's something to keep in your back](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=283.71019999999976) [pocket. You're going to get a holistic](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=285.81776923076933) [view of query performance or of system](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=287.886) [performance, but we're not going to get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=289.667181818182) [that individual data that we can see with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=291.5376923076923) [Extended Events or Management Studio or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=293.81153846153836) [the DMOs, but this is still something that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=295.35815384615387) [I think is really useful, and hopefully if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=297.3144615384616) [it's not something you've used before](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=299.43499999999983) [you'll add it to your toolkit. Alright, let's head back to wrap up this module.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=7&mode=live&start=301.40450000000004)

[A Note About Estimated and Actual Plans and Module Summary](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live)

[One last item I want to review before we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=2.156) [wrap up this module is the difference](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=4.162399999999999) [between an estimated and an actual query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=5.900444444444444) [plan. I showed you how to obtain both in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=8.703555555555553) [Management Studio, and based on the name](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=10.900000000000006) [you can probably guess that they are not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=12.516923076923076) [the exact same thing. An estimated plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=14.676307692307686)[only contains estimates about the amount](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=16.81745454545454) [of data that will be retrieved in each](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=18.940363636363625) [plan operator, and those estimates are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=21.867500000000007) [based on the input values used during the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=24.087) [first execution of the query. Think of our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=27.16146153846155) [stored procedure that returns date](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=29.97492307692308) [information for the United States. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=31.46146153846155) [estimates in that plan were probably](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=33.216181818181816) [around 50 rows, right, but if I input a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=34.82527272727271) [different country, such as Canada, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=37.341461538461544) [estimate would still say 50, even though](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=39.073615384615394) [there are way fewer provinces in Canada](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=41.16676923076924) [than there are states in the US, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=43.28884615384617) [because we executed that stored procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=45.69841666666666) [the first time with the value of United](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=47.446000000000005) [States those are the estimates that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=49.39000000000002) [see. If we want to see how many rows the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=51.24721428571428) [optimizer estimated and how many were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=54.197928571428534) [actually returned when the query executed,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=56.07072727272729) [then we need to get the actual plan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=57.964) [those actual values in the plan are based](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=60.54892857142856) [on the input parameters for that one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=63.41149999999999) [specific execution. As we saw in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=66.73999999999997) [demos, we can get the estimated plan in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=68.89028571428574) [Management Studio, we can capture it in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=70.80914285714292) [Extended Events and Trace, although that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=72.99360000000001) [not recommended, and we can get it from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=74.83492307692309) [the plan cache through dm\_exec\_query\_plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=77.01461538461542) [but we can only get the actual plan from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=78.59945454545453) [Management Studio and from Extended Events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=82.053) [and trace, again, not recommended, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=84.20775000000003) [finally, it is possible for the actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=86.53072727272725) [plan to be different than the estimated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=89.339) [plan. It isn't typical, but it can happen.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=91.89749999999998) [So this was a fun module in that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=96.58) [covered the different data that we can get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=98.69379999999995)[from SQL Server about query execution, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=100.7265) [we explored the different sources for that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=102.90875000000003) [data, and there's definitely a few, to see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=105.26280000000003) [that we have several different options at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=108.04200000000002) [our disposal when we're investigating query performance.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0802765f-7967-4052-88b1-7839a3d9b9ce&clip=8&mode=live&start=110.32050000000005)

[Understanding Query Performance Metrics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live)

[Introduction and Query Metrics of Interest](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live)

[Hi. This is Erin Stellato from sqlskills.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=0) [com, and I'm recording this course for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=3.1435833333333334) [Pluralsight. This course is analyzing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=6.1127777777777785) [query performance for developers in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=7.922222222222224) [Server, and this module's topic is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=10.094727272727276) [Understanding Query Performance Metrics.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=12.267818181818189) [Now that we've had an opportunity to see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=16.885) [all our options for data we need to look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=18.679857142857156) [at what that data really means. We'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=20.834333333333337) [focus on duration and resource use, how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=22.80346153846154) [much CPU, how much IO, and discuss what it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=25.270692307692322)[represents and what can affect it, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=28.132384615384623) [we'll also talk about how it can be used](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=30.056307692307712) [for troubleshooting and comparing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=32.354090909090914) [performance before and after changes.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=33.353) [There are four query metrics to use as a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=37.266) [starting point when looking at query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=39.463384615384584) [performance. The first is duration, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=41.09283333333333) [tells us how long it took for the query to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=43.05133333333333) [execute. Now duration is a great starting](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=46.4376153846154) [point, but it doesn't tell us everything.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=48.865) [It's easy to infer that because a query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=50.944583333333334) [takes longer there's something wrong with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=53.3495) [it. Maybe it reads too much data or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=55.1885) [requires more memory than is available and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=57.096384615384615) [it has to spill to disk, but maybe it was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=58.768857142857144) [blocked by something, and in that case,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=61.76742857142857) [there isn't a problem with that query.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=63.83572727272727) [There's definitely a problem, but it's not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=65.881) [necessarily with that query. A slightly](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=68.83499999999998) [better metric is CPU, which allows us to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=71.15042857142856) [see what the query needed in terms of CPU](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=73.66014285714283) [cycles to execute. This can sometimes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=76.82999999999998) [directly relate to duration, but in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=79.12799999999996) [blocking example I gave it won't. CPU can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=81.59200000000001) [also relate to our next resource, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=84.28300000000002) [IO, but you can also have high CPU and low](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=86.72300000000007) [IO. CPU tells us the amount of work that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=89.85299999999997) [has to be done to satisfy the query, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=92.718) [obviously less is better. The same is true](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=95.68869230769225) [with IO, and with SQL Server we can look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=97.89566666666666) [at both logical IO and physical IO.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=99.89066666666663) [Ideally, the data needed to satisfy a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=102.36150000000002) [query already exists in memory, so no](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=105.2) [physical IO is needed. Physical IO is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=107.96690909090908) [expensive. It takes time. Logical IO is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=110.77825) [much cheaper, but even if we have a high](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=113.64883333333333) [logical IO we can still have a problem.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=116.88820000000003) [Maybe we have inefficiencies in our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=119.653) [schema, maybe we have a poorly written](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=121.86185714285715) [query. It's still worth investigating,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=124.43885714285715) [even if it's high, even when it's logical](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=126.56730769230766) [IO. The last resource to consider is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=130.08792307692306) [memory. Memory may be cheap to purchase,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=132.56650000000005) [but using a lot of it in a query is not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=134.84888235294116)[what you want to see. Memory can be high](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=137.53158823529404) [because it's actually needed. Maybe you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=139.84399999999997) [working with a lot of data, even though](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=141.51376923076924) [you shouldn't be, or perhaps SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=143.82084615384616) [has bad information about how much memory](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=146.11333333333332) [it needs and it's over estimating. Having](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=148.6111666666666) [one of these resources with high values](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=150.80563636363635) [can definitely indicate a problem, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=153.05318181818183) [don't be surprised if you see two or more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=155.20172727272734) [resources with excessive values for a query that's not performing well.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=0&mode=live&start=158.01738461538457)

[SSMS, Extended Events, DMOs, and Query Store](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live)

[Within Management Studio you have the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=2.42) [ability to see that live query data, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=4.2924999999999995) [we only get that data for one query or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=6.686857142857143) [batch because you're manually running that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=9.03521428571429) [query in the UI and capturing the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=11.23372727272727) [information. The client statistics that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=14.537090909090901) [you can capture within Management Studio](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=16.557923076923075) [do have limitations. You can see duration](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=18.881307692307686) [information, and you can understand the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=20.984666666666662) [number of modifications that occur, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=22.397166666666656) [it's definitely not as comprehensive as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=24.452) [the execution plan, which really helps you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=26.828) [pinpoint where your query has issues.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=29.550999999999995) [Further, when you're getting that live](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=31.885) [data if you're returning the results to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=33.556818181818194) [Management Studio you create overhead. I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=35.86857142857143) [showed you how to get around that by](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=38.372142857142855) [enabling the option to discard the result](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=40.0292857142857) [set, but sometimes you need to see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=41.643) [output to validate that the changes that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=43.95500000000001) [you've made to a query haven't altered the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=45.77266666666668) [results, and finally, when you're running](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=47.674) [these queries in Management Studio you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=50.13880000000001) [have to save any of that performance data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=52.49436363636363) [manually. It's not prohibitive when tuning](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=55.343818181818165) [by any means, but it's an extra step.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=57.91499999999999) [Extended Events is a step up from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=61.459) [Management Studio in that you can still](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=63.43676923076926) [capture performance information for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=65.531625) [individual queries or batches, but it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=67.130125) [something that you set up and it collects](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=69.09007692307691) [all that data for you. It's much more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=71.11961538461534) [automated. When configuring the Extended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=74.05579999999996) [Events session you determine what data to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=75.99472727272727) [collect based on the predicates, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=78.23281818181822) [again, you should always have at least one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=80.24849999999998) [predicate. The data can be written to a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=83.06583333333327) [file as output and then analyzed, whether](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=85.7888461538462) [you do that in the UI or push it to a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=88.03125) [table and work through your aggregations](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=90.34400000000002) [there. As I've said before, you can do the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=91.7575) [same thing with trace, but for anyone](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=94.33374999999995) [running SQL Server 2012 or higher you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=96.41215384615384)[really want to be using Extended Events.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=98.503) [We leave individual query statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=102.638) [behind when we move to the DMOs, and here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=104.24424999999997) [we switch to aggregate data. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=107.39988888888888) [dm\_exec\_query\_stats\_dmo contains](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=110.12055555555554) [performance statistics for each query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=110.9147) [statement in a cached plan, and it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=112.61819999999999) [aggregated across the life of the plan in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=115.17925) [cache. If the plan ages out of the cache](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=118.37458333333333) [or is removed because of a recompile that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=120.86466666666672) [data is lost, and if you restart the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=123.00084615384615) [instance or run something like DBCC](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=125.45561538461537) [FREEPROCCACHE that also removes the query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=127.758) [stats data. Typically this data is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=130.98299999999998) [something that you would look at while](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=132.82672727272723)[troubleshooting to see what's being](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=134.172) [executed right now, and to see how it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=135.6286666666667) [performing right now. That means if you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=137.9914) [want historical information, like what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=140.25519999999995) [happened yesterday, or last week, or last](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=142.07199999999995) [month you need to snapshot data to a table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=144.49173333333334) [on a regular basis and create a history.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=146.60553333333343) [Setting up that data repository is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=149.32572727272728) [possible, but it's a manual effort, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=151.9968181818182) [is why I love Query Store. Query Store](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=153.96599999999995) [captures plan, text, and runtime stats](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=156.65460000000004) [data for you, and it stores it in the user](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=158.65178571428575) [database. As with DMO data, the execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=161.83107142857156) [data is aggregated, but it's not dependent](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=164.44299999999993) [on how long the plan stays in cache.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=167.06199999999998) [Rather, the execution statistics are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=169.662) [stored for each plan across a time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=171.52199999999993) [interval that you decide; maybe it's 5](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=174.10946666666666) [minutes or 15 minutes or an hour. Query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=176.59773333333337) [Store is a fantastic tool to use when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=179.38845454545455) [trending and troubleshooting query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=181.80809090909085) [performance. I really can't recommend it enough if you're running SQL Server 2016.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=1&mode=live&start=183.08277777777778)

[Demo: Viewing and Interpreting Query Execution Data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live)

[We've got one demo in this module, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=2.024) [it's got a lot of great information in it.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=3.6588571428571433) [We're going to look at query metrics in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=5.603999999999999) [the different sources that we've discussed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=7.521333333333331) [to see how they compare and understand](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=9.120545454545455) [when it's best to use each source. Now is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=11.130625) [the time to pay attention and take notes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=14.308285714285715)[about where to get this information and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=16.417428571428573) [why you should use the different sources.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=18.937499999999996) [So we're back with our WideWorldImporters](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=22.357) [database. Let's go ahead and set that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=24.590714285714277) [database context first. We're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=26.972333333333324) [create a stored procedure that we've used](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=28.799818181818182) [previously. This is the one to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=30.719727272727273) [GetPersonInfo, so we're querying the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=32.89976923076922) [People and the Countries table, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=34.80553846153844) [just pulling back the FullName, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=37.19611111111111) [EmailAddress, and the FormalName, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=39.2819) [we're inputting a PersonID, so let's go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=41.91639999999999) [ahead and create that or recreate it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=45.38490909090909) [perhaps, and then we're going to create an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=48.56036363636363) [Extended Events session, and we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=50.6366) [to again, capture sql\_statement\_completed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=52.46075) [and sp\_statement\_completed, but we're also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=53.96574999999999) [going to capture a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=56.066500000000005)[query\_post\_execution\_showplan. You'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=57.791) [notice that I have use with caution, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=58.87375) [is analogous to don't run this in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=62.781333333333336) [production unless you absolutely know what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=65.08900000000001) [you're doing. So if we look at our EVENT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=66.97269230769231) [SESSION definition you can see that we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=69.65676923076924) [got sp\_statement\_completed,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=72.49300000000001)[sql\_statement\_completed, and that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=73.339) [post\_execution\_showplan. I do have filters](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=76.429) [or predicates here for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=79.22081818181817) [statement\_completed events. Again, it's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=81.42309090909089) [really low value for a duration, only 1](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=83.21674999999999) [millisecond. You would set it to something](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=85.65074999999996) [much more reasonable in your environment.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=87.56249999999999) [Adding a predicate for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=89.17) [query\_post\_execution\_showplan doesn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=91.74428571428574) [reduce the impact of this event session,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=93.0314285714286) [and if you want to understand that in more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=95.07807692307695) [detail, then definitely check out my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=97.52481818181818) [Extended Events course. We are writing to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=99.9542727272727) [the event\_file, and the only thing that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=102.06666666666668) [different between the other event session](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=103.63758333333337) [that I created is that I have this option](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=105.29084615384616) [for TRACK\_CAUSALITY set to ON. What this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=107.88323076923076) [will allow us to do is relate the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=110.02684615384612)[post\_execution\_showplan event to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=113.3655) [appropriate statement\_completed event. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=115.77549999999997) [we'll go ahead and create this, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=118.944) [we're also going to enable Query Store,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=124.63553846153846) [and these are not values that I would](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=126.59392307692309) [recommend for a production environment. I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=128.7561111111111) [am setting this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=130.49366666666666)[DATA\_FLUSH\_INTERVAL\_SECONDS value to 1](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=131.79466666666661) [minute, which is really low. My interval](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=133.52933333333323) [is 5, which is really low, and my storage](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=135.50250000000003) [size is 100 MB, which is low, so please](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=137.818) [refer to my Query Store course for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=140.14600000000004) [appropriate values for production, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=142.69500000000002) [after we're enabling it and setting those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=144.73083333333332) [options I'm clearing out all of the Query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=146.57066666666665) [Store data. Again, not something you'd run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=148.55466666666672) [against production, but since this is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=150.18683333333345) [demo database I want to get rid of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=151.58399999999992) [anything that I don't need here. We're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=153.136) [just looking at a very specific set of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=155.27975000000004) [data. Next, I'm going to remove everything](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=157.70625) [from the plan cache, also not something to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=159.7951666666667) [run in production. DBCC FREEPROCCACHE gets](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=162.80466666666666) [rid of every single plan that's in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=165.18723076923078) [plan cache. It's a sledge hammer. It's not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=168.3238461538462)[recommended. Now before I start the event](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=171.45742857142864) [session I'm going to take this other text](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=173.55069230769232) [here, and I'm going to copy it to a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=175.84408333333334) [separate window, so let's copy it, do a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=178.61683333333343) [New Query window, and then we'll paste it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=181.10659999999996) [in, and what we're doing here is we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=183.60473333333323) [going to set our STATISTICS IO and TIME](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=185.83199999999994) [and XML, so that we're going to grab all](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=188.08700000000002) [that info, and we're going to turn on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=191.14700000000005) [client statistics on the toolbar, so we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=193.54245454545452) [going to click that button, and I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=195.45385714285717) [to set the context to WideWorldImporters,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=197.38128571428584) [and then what we'll do after we start the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=198.88233333333332) [event session is we'll execute our stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=201.30033333333327) [procedure one time, and we will run our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=203.78150000000002) [Adhoc query one time, and then we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=206.6057142857143) [to look at what data we see here in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=209.0525714285715) [Management Studio, and then in everything](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=211.81266666666667) [else we've set up in our event session,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=213.65666666666667) [and in Query Store, and in the DMOs. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=216.02573333333333) [let's scroll up here, and we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=218.85607692307693) [start the event session. We'll hop over](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=222.6486923076923) [here. We will run both of these. We get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=226.36509999999996) [our output, that's great, and then I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=231.10626666666664) [hop back over to this demo code, scroll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=233.08333333333323)[down, scroll down, there we go, and we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=235.4636153846154) [stop our event session because I don't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=238.51592307692314) [need it to be active anymore. So first](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=241.1658181818182) [let's go back to what we've executed here.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=244.13139999999999) [Our first query, that Stored Procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=246.937) [returned one row, and we have our plan for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=249.29549999999995) [that, and if we look in that plan we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=252.3251176470588) [see that we have actuals and we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=254.5621764705881) [estimates, right? We pulled the actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=256.63627272727274) [plan, so we get both values here. If I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=258.40518181818186) [look at our second output, this is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=262.1547692307692) [state information, and we have a second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=265.14700000000005) [plan here, and if I look at that again, we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=267.0906666666668) [grab the actual plan, so we have actuals](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=269.72173333333313) [and we have estimates here. I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=271.9015) [close those because I know that you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=274.8094999999999) [going to remember that we grabbed the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=276.90092307692305) [actual plan in this case from Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=278.6525384615384) [Studio. Now if we look at our Messages tab](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=280.5653076923076) [we get information about IO and duration,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=283.1714285714286) [so we can see that for our stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=285.5964285714287) [procedure we had 87 reads and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=288.6208571428571) [execution time was 103 milliseconds. For](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=291.931357142857) [our Adhoc query we had, what's the math on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=294.7450666666667) [that, 161 reads or so, and the duration](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=298.7866666666668) [was 416 milliseconds. So pretty low values](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=302.6528181818182) [here. You're probably going to have much](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=306.43472727272734) [higher values in production, but let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=308.20680000000016) [check and see how this compares to what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=309.812) [get in Extended Events. So we'll go ahead](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=313.34) [and go out to C:\Temp, which is where we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=315.97120000000007) [have our output file, and we'll drag that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=318.3634000000002) [in, and I'm going to pull some information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=320.50379999999984) [up. I'm first going to pull that GUID. I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=322.6488666666663) [mentioned that we enabled the option to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=325.52376923076923) [track causality, so that we can relate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=327.8318333333334) [events to one another, and those events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=330.20775000000026) [are related by a GUID here. I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=332.76959999999997) [add logical\_reads, I'm going to add](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=336.30449999999996) [duration, which remember duration here is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=338.7434999999999) [in microseconds, so we need to do a little](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=340.8542307692307) [bit of manipulation in our heads, and for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=344.24453846153847) [the showplan we will grab that as well.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=349.5528461538461) [Alright, so now I can see that here for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=353.74300000000005) [this SELECT statement, which is from our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=357.1990000000002) [stored procedure, that our logical reads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=359.762090909091) [were 87, that matches I think almost](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=362.0182) [exactly, right? Let's just double-check,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=365.0996) [87, yep. What we saw in Management Studio](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=367.19581818181825) [and the duration is 103 milliseconds. Yes,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=370.438) [matches, fantastic. Now in terms of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=374.78499999999985) [plan this is the ShowPlan and if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=378.02099999999996) [double-click I can see this here, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=381.2113999999999) [have this in XML format, and to show you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=383.80525) [that it's the actual, if I do a find and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=386.499625) [then I type actual you can see that I have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=388.86105882352956) [actual values here, in addition to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=391.2484615384615) [estimate, so because of that specific](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=393.1890769230768) [event a grabbed the actual plan, so I have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=395.1487142857143) [actuals and estimates. If I wanted to view](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=398.9769285714285) [that in the graphical format I would have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=401.1506666666666) [to take that and save it as a SQL plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=402.5869333333332) [file, as we've done before. You know how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=404.8739999999999) [to do that. Now if we look for our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=407.3131538461539) [sql\_statement\_completed here for our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=411.0156153846156) [logical reads we have 173. That matches](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=412.25361538461544) [what we had before, and we have 416](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=414.18238461538476) [milliseconds for execution, so if we look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=416.89775) [down there we go. So the data from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=419.542) [Extended Events matches what we have in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=422.44969230769226) [Management Studio, but again, grabbing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=425.5812) [that plan, right, using that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=428.8667000000001)[query\_post\_execution\_showplan is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=432.05575000000005) [expensive, so whenever you need that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=433.27350000000007) [actual plan I'm going to recommend that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=436.17883333333333) [you use management studio, but in terms of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=437.82325) [getting individual query stats, Extended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=440.53633333333323) [Events is an option. Just remember to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=442.501) [include a predicate, so that you're not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=445.007) [grabbing every single query that executes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=447.322) [be that is very expensive. Now let's take](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=449.1835) [a look at what we get from cache. So this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=452.2738571428571) [is going against the DMO, so I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=456.236) [grab this here, and just to keep](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=459.2464999999999) [everything separate, so here we've got an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=461.9276666666667) [execution count of one for each of these.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=464.86358333333345) [Let's just make sure we know what we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=466.65300000000013) [looking at. So here's the stored procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=468.4736666666667) [executing, here's our 87 reads, here's our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=471.62833333333344) [duration of 103 milliseconds. Here's the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=474.5047999999999) [Adhoc query, 173 logical reads, 416](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=477.3688888888889) [milliseconds, and if we scroll over we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=481.10955555555546) [got our plan, and you know, right, you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=483.3982307692309) [thinking, is this the actual estimated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=485.605375) [plan? You know it just has the estimates](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=487.1916249999998) [because we're pulling it from cache, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=489.69599999999997) [what I've got when I look at my execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=492.0715384615384) [statistics is because I've only executed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=495.5614615384613) [this one time I'm able to calculate the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=497.9863333333333) [duration for that one execution, along](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=501.285) [with the IO for that one execution, but if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=503.354) [I execute this multiple times, then we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=506.73949999999996) [going to get aggregate data, and I can get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=509.8113333333332) [average duration and average logical](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=512.7580833333334) [reads, but I have to do the math on that.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=514.236) [I'm not getting individual query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=517.9278749999995) [statistics. So let's hop back now, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=519.7738124999993) [we'll run the same query. We'll just stay](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=521.5573636363633) [in this window, and we're going to run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=523.4010769230771) [this against Query Store, and what do we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=525.174615384616) [get here? So here is our stored procedure,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=528.7668000000002) [right? We've got the object here. This is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=532.9652000000004)[our Adhoc query, so if we look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=535.0789999999998) [stored procedure, look at that 87 reads,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=537.5100909090909) [duration 103 milliseconds. For our Adhoc](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=541.8157272727271) [173 reads, duration 416, and remember what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=544.9777692307691) [do we have for the plan in query store,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=548.0502307692306) [it's the estimated plan. and the benefit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=553.2526) [of using Query Store compared to pulling](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=556.7705) [the data from the DMOs is that this is not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=558.9346666666667) [just aggregated like it is in the DMOs,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=561.9146000000002) [but it's retained over time. So you've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=564.4099166666666) [options for where you can pull the data.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=567.8412499999996) [Management Studio is going to give it to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=570.3466666666668) [you live. It's the best way to get the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=572.2965333333336) [actual plan, right? That's what we saw](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=575.1605000000003) [here when we executed the query. However,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=577.6746000000002) [sometimes you want to get those execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=580.3232727272728) [statistics for more more than just one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=583.160181818182) [query, you want it for lots of queries.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=585.271) [That's where Extended Events comes in, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=587.061) [you'll get those individual values. That's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=589.7151666666664) [really great when you're looking for an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=591.8638888888888) [outlier. Let me find the query that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=593.6341111111107) [executes and takes 15 seconds compared to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=596.3022307692308) [everything else, which takes 1, right?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=599.12) [Extended Events is a fantastic use for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=601.7632727272729) [finding that kind of information. If I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=604.836923076923) [want to look at average data, right, that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=607.8851538461533) [aggregate information, then I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=611.2550000000001) [look at the DMOs, but the drawback with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=613.697) [the DMOs is that the information is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=615.9911538461537) [specific to the plan that's in cache, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=618.047) [unless I'm trending that over time, I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=620.5350000000003) [only going to see the performance data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=623.3215833333333) [related to what plan is in cache, and if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=626.352) [need that historical info that's when I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=629.3127692307695) [going to go to query store to pull those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=631.5569999999998) [performance metrics along with the text of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=634.608) [the query and the different plans that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=636.7862727272726) [might have. So the last thing that we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=639.1217692307691) [do here is we'll just clean up that event](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=641.3033076923075)[session, and then we'll head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=2&mode=live&start=643.6135384615382)

[Module Summary](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live)

[At this point, you should have a good](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=1.994) [foundation with regard to the query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=3.9570769230769227) [performance data that we can capture in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=5.5344) [SQL Server, where you can get that within](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=7.987200000000003) [SQL Server, and how you then use it to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=10.100800000000005) [start looking at performance and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=12.22) [troubleshooting issues, and remember that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=14.721428571428575) [it takes practice to become really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=16.787) [familiar with capturing this data and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=18.917) [making use of it. Troubleshooting and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=20.968499999999995) [tuning are skills that take time to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=22.883) [develop, but they are invaluable once you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=24.8885) [have them in your skillset. Now it's time to talk about query plans.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=6040f0cc-e50e-477c-a131-5a02124ab207&clip=3&mode=live&start=27.31100000000001)

[Reading Query Plans](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live)

[Introduction and What is a Plan?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live)

[Hi. This is Erin Stellato from sqlskills.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=0) [com, and I'm recording this course for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=3.682583333333333) [Pluralsight. This course is analyzing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=7.067888888888889) [query performance for developers in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=8.955111111111112) [Server, and this module's topic is Reading](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=11.768461538461537) [Query Plans. In this module we're moving](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=15.370769230769225) [away from execution statistics for a bit,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=17.751250000000002) [and we're going to focus on execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=19.643) [plans. We'll start by making sure that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=22.030874999999988) [are clear on what a query plan represents,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=23.74850000000001) [what it's really telling us, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=25.4265)[we'll talk about the different options for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=27.537000000000006) [reading an execution plan, and what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=29.724600000000002) [information we want to look at first in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=31.68780000000001) [plan because this often helps us determine](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=34.30300000000001) [the next steps when troubleshooting query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=36.67075) [performance. I've stated before that every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=40.58125) [single query that gets submitted to SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=42.42981818181817)[Server has a plan generated, and this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=44.23369230769231) [starts with the query optimizer. You can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=46.80753846153847) [think of the optimizer as a framework](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=49.14307692307692) [within SQL Server for finding a query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=50.88284615384613) [plan. There's a parsing phase where there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=52.75750000000001) [are basic checks of the SQL syntax to make](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=54.81200000000002) [sure it's correct, and from that a parser](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=57.160499999999985) [tree is generated, which is the internal](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=59.27833333333333) [representation of the query. That goes to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=61.77266666666665) [the binding phase where the optimizer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=64.0985) [validates that all these objects exist,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=65.89950000000002) [and they're accessible to the user, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=67.84200000000001) [the output from that binding phase is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=70.22045454545454) [query treat. The query tree then goes into](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=72.57609090909088) [the optimization phase, and the query tree](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=74.76399999999997) [has logical operations in it. These](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=76.81263636363636) [describe what will occur, such as reading](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=79.51045454545451) [data from a table, sorting data,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=82.16425) [performing a join, and the optimizer then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=83.87474999999999) [uses transformation roles to generate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=86.92760000000003) [physical operations from those logical](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=89.67460000000005) [ones. Reading data from a table gets](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=91.56072727272728)[turned into an index seek, a join becomes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=93.9) [a nested loop, and those physical](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=96.60763636363632) [operations are then assembled to create](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=98.622) [the query plan, and you as a developer can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=100.61999999999999) [then use that plan to understand what SQL Server did when it executed your query.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=0&mode=live&start=103.97750000000002)

[What's in a Plan and What's Not in a Plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live)

[Here's a very simple plan, and this plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=1.363) [is for a simple query. It is just select a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=4.347615384615384) [FirstName, LastName, and EmailAddress](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=8.098909090909093) [where the LastName is like Whit, and we do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=9.607636363636363) [have two tables, Person and EmailAddress,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=13.022700000000004) [and we're joining on BusinessEntityID.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=16.117874999999998) [When we look at this plan, if you're not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=19.376) [familiar with plans, the first thing to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=21.636499999999998) [notice is the operators. We have a SELECT,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=23.572500000000005) [a Nested Loops, an Index Seek, and a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=26.39128571428572) [Clustered Index Seek; four different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=29.663857142857157)[operations. If you think of our query we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=31.507000000000005) [asked for a first name and last name from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=34.24033333333335) [the Person table, an email address from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=36.551714285714304) [the EmailAddress table. The Index Seek is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=38.429818181818185) [against the Person table, while we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=41.23554545454545) [the Clustered Index Seek against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=43.977999999999994) [EmailAddress table, and there's a Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=46.28799999999998) [Loop which represents the join between](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=48.16618181818181) [those two tables, and then our SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=49.958) [operator. So our operators represent the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=52.88925000000002) [physical operations that occurred. We also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=55.8368888888889) [have arrows that represent the flow of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=58.4872) [data. Data moves from the Index Seek and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=60.68240000000001) [the Clustered Index Seek to the Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=62.87899999999999) [Loop, and then over to the SELECT. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=64.82499999999999) [there's additional information that exists](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=67.48099999999994) [in the plan that we don't see here, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=69.02972727272726) [the last item that we might immediately](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=71.71015384615384) [notice in this view is the cost associated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=73.95823076923078) [with each operator. Now those costs are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=76.65659999999998) [estimates, but we can see that for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=79.206) [SELECT we have an estimate of 0, and it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=81.39857142857146) [also 0 for the Nested Loop, and then 41](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=84.04500000000002) [for the Index Seek, and 58 for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=87.05100000000004) [Clustered Index Seek, and you may notice](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=89.40184615384614)[that these costs roughly add up to 100,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=91.29023076923073) [which means that the cost of each operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=93.58199999999998) [is relative to the entire query. Cost is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=96.20271428571428) [an interesting item in a plan. It used to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=100.40086666666666) [be equal to the time it would take in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=103.12726666666661) [seconds for a query to run on a specific](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=105.86114285714287) [Microsoft employee's machine, but that was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=108.601) [from the SQL Server 7. 0 era, and remember](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=111.29699999999997) [that SQL Server 7. 0 was released in 1998.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=114.98975) [That's almost 20 years ago, and cost today](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=117.98) [is a unit-less measure when you're looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=121.17333333333337) [at a query plan. Cost does not equal time.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=123.83424999999998) [Cost does not equal CPU. It's used for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=127.027) [relative comparison across plan operators](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=130.77172727272725)[and between plans, and the cost threshold](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=133.06059999999997) [for parallelism instance option refers to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=136.1566999999999) [this very same cost. Operators will have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=139.47844444444448) [cost value and a plan, and it represents](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=142.69000000000003) [IO cost and CPU cost, but the thing about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=144.50600000000006) [the values that you see for cost is that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=147.0941428571428) [they are always estimates. There's never](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=150.06250000000003) [an actual cost cost anywhere in a plan. We](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=152.45750000000007) [talk about capturing an actual plan versus](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=155.63900000000004) [an estimated one, and how you can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=157.99307142857143) [estimated rows and actual rows. There is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=160.9536428571429) [never an actual cost in an actual plan. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=163.48499999999999) [is always an estimate, and that cost will](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=166.43973333333332) [be the same for the same query against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=168.28559999999987)[exact same database regardless of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=171.03770000000003) [hardware. The costs are based on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=173.7731000000001) [algorithms used by the optimizer, and they](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=176.40100000000007) [are hardware independent. I've mentioned a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=179.44180000000014) [few things we can find in a query plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=181.27925000000005) [but what about the things that we don't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=182.882) [see? Well, we don't see the duration of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=184.72999999999996) [the query in the plan itself, and we don't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=187.26830769230767) [see anything about IOs in the plan. That's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=189.9903) [why we use the Set Statistics IO option.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=192.12666666666667) [We don't see anything about locks in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=195.324) [plan, nor do you find any wait statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=197.51885714285703) [data in there, and finally, as I already](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=199.82227272727275) [mentioned, you don't see the actual cost.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=202.45136363636377) [Now I bet you're wondering why I have the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=204.73471428571423) [asterisks next to duration IO and wait](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=207.72922222222223) [stats. Well, you won't see any of this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=210.4467777777778) [information in the estimated plan, but you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=213.4378333333334)[can find duration IO and wait statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=216.12014285714284) [in an actual plan if you look at an actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=219.00114285714278) [plan captured from the latest version of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=222.79266666666666) [SQL Server 2016. The duration and IO](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=225.2198) [information is also in plans from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=227.6013333333333) [latest release of SQL Server 2014, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=229.94866666666655) [there's no wait stats there, but to be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=232.72545454545457) [clear, you need the actual plan for that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=235.62025000000003) [additional information, and if you do not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=237.91425000000012) [have the actual plan, then you won't see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=240.08961538461537) [any of this information, and you will only](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=242.70600000000002) [see estimated values, as I've explained](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=245.6329090909091) [before, and those estimates are based on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=247.54527272727273) [the input values used the first time the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=249.903076923077) [query was executed. I wanted to mention](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=252.5685) [this again, because most of the time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=254.57399999999993) [you'll probably be working with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=256.4357499999999) [estimated plan, so I want to make sure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=257.98224999999985) [you're clear on what data you can find in that plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=1&mode=live&start=260.40953333333334)

[Reading Plans](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live)

[Now that we know what a plan looks like,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=1.543) [and some of the basic information in it,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=3.271000000000001) [how do you read it? And this is fun. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=5.348249999999998) [is where you might find some debate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=9.038181818181817) [between your friends. You might have been](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=11.405454545454543) [told that you should read a plan from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=13.100857142857143) [right to left, meaning you start at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=14.462571428571428) [Index Seek against the Person table, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=17.873999999999995) [then you look at the Clustered Index Seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=21.248363636363635) [against the EmailAddress table, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=23.675272727272713) [you move left to the Nested Loop, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=25.590363636363637) [to the SELECT, or someone else might have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=28.522000000000002) [told you that you read from left to right.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=31.090000000000014) [You start at the SELECT, then you move](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=33.516499999999986) [over to the Nested Loop, and then to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=35.34449999999996) [Seek operations. Both of these are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=38.03380000000001) [correct, but you need to understand what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=39.98007692307692) [right to left and left to right mean. When](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=42.309461538461534) [we talk about the flow of control we read](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=45.63350000000002) [from left to right. We start at the root](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=49.20533333333333) [operator, which is the SELECT. The SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=53.3153333333333) [is what controls our query. The SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=56.15509090909092) [feeds over to the Nested Loop, which then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=58.65607692307692) [pulls the last name and first name from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=60.71638461538459) [the Person table that have a last name](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=62.87792857142856) [like Whit, and then that Nested Loop looks](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=65.10021428571427) [for matching rows that are pulled from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=67.44883333333334) [EmailAddress table via that Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=70.26) [Index Seek. Left to right is control, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=72.48000000000002) [the data moves right to left. Even though](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=76.1165) [the SELECT pulls data from the Nested Loop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=79.52483333333332) [that Nested Loop gets the data via Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=82.16416666666662) [Seeks, and that's the source of the data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=84.24085714285711) [and where it originates. So the data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=86.13) [starts moving from the right with those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=88.8821666666667) [seeks, and then goes through the plan over](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=91.37046153846153) [to the SELECT operator on the left. Again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=93.46030769230764) [control flow is left to right, and data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=97.03354545454546) [flow is right to left. You need to read a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=101.366375) [plan in both directions. Once you have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=106.29325000000003) [plan you don't have it as an image as we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=109.17663157894735) [do here in the slides. The graphical plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=111.45821052631574) [can be viewed in Management Studio, as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=113.66125000000001) [we've seen, and you can also view it as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=116.13983333333336) [XML within Management Studio, which is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=119.1828181818182) [great option if you're searching for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=121.47372727272726)[particular text. You can also use Plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=123.38718181818179) [Explorer, which is a free tool that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=125.33285714285715) [can download to look at plans. Plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=127.42542857142858) [Explorer is available from SentryOne, a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=129.7951818181818) [software vendor, but it is free to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=131.78084615384614) [community, and I highly recommend that you download it and give it a try.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=2&mode=live&start=133.61161538461533)

[Demo: How to Start Looking at a Query Plan - Part 1](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live)

[We have one demo for this module, and just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=2.659) [like last time, there's a lot to cover.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=4.6397499999999985) [We're going to discuss what's essential to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=6.525) [notice when you first start looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=8.24) [query plans in Management Studio, and I'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=10.217181818181816) [point out some things that are not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=12.604461538461535) [essential as well. Now we're going to dig](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=15.538538461538453) [a little deeper into the query plan. We](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=18.465999999999998) [are first going to include the actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=21.254666666666665) [execution plan rather than displaying it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=24.409333333333333) [with the set statistics XML on we're just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=26.750769230769233)[going to have it appear in a separate tab](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=28.905846153846166) [every single time. So we'll run our first](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=32.09400000000001) [query here, and this is the query that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=34.21471428571427) [we're familiar with, right? We're pulling](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=35.70385714285711) [back the state information for the United](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=37.854000000000006) [States, so let's go ahead and execute](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=40.40615384615384) [that, and when we look in the plan what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=42.464692307692296) [take notice of first, right, is those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=46.02027272727272) [operators. Right, we've got our SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=48.556200000000004) [over here, we've got our Nested Loop, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=50.215800000000016) [then we've got a Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=52.34053846153845) [here, and we have a Clustered Index Seek,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=54.174) [so remember when we talk about reading](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=56.868153846153824) [plans from right to left or from left from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=59.33353846153846) [our SELECT over to the right we're talking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=62.85046153846153) [really about control versus data. When](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=65.81327272727275) [people look at the plan, and to really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=67.83657142857143) [make sure that this is clear, they tend to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=69.48114285714288)[think that there's a Clustered Index Scan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=71.9402727272727) [and that's what happens first, and there's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=74.445) [a Clustered Index Seek, and all of that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=76.89436363636365) [happens, and then we go into our Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=79.45461538461537) [Loop, but operators are iterators, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=81.7758461538461) [means that they iterate over rows. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=84.13963636363638) [there's an exception there when we talk](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=86.85090909090908) [about column store, but we're working with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=88.41127272727267) [row store here, so and if you don't know](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=90.03428571428573) [what column store is, then don't worry,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=92.18142857142863) [but with a Clustered Index Scan what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=94.52900000000001) [happens is we start it over here on the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=96.84935714285714) [SELECT, and we're asking for these columns](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=98.7515714285714) [from these two tables, and so it goes from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=100.72823076923078) [the SELECT, and the SELECT is basically](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=104.12192307692312) [saying, hey, I want StateProvinceName and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=106.30875) [SalesTerritory and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=109.35314285714284) [LatestRecordedPopulation. I want this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=110.57371428571426)[information, and it comes over to this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=112.1302857142857) [Nested Loop and the Nested Loop goes to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=114.33828571428569) [this Clustered Index Scan, which starts to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=117.01399999999998) [read through that table, and you can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=119.48849999999996) [right here what that table is. It's the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=121.85961538461535) [StateProvinces table within](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=124.68588888888888) [WideWorldImporters, and in this Properties](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=126.33122222222221) [window it gives us the name of the object](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=128.81016666666667) [down there, and again, I can look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=131.3766666666667) [properties by hovering over it, but I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=133.70400000000004) [also click F4, and when I look at F4 I get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=135.96156250000004)[the same information and a whole lot more,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=139.63762500000018) [and here is where I have the object as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=141.9118571428571) [well, and I can see this in a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=144.2893076923077) [more detail. It tells me what kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=146.6523846153846) [index it is, that it's row storage, as I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=148.49161538461544) [said, what table it belongs to. So here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=150.75475) [the Index Scan starts, and as it starts,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=153.41914285714287) [as it's getting rows back from this it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=156.05171428571438) [pushing those into the Nested Loop, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=158.6692) [the Clustered Index Seek is also occurring](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=160.97854545454547) [over against the Countries table, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=163.48136363636368) [again, we can expand this object over here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=165.37425) [to see that we've got the Countries table,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=167.5615833333333) [and we're looking at the Clustered index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=169.75241666666676) [here, and this is the name of it. So it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=171.61380000000003) [starts to pull rows from the Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=174.03176923076924) [Index, and within this Nested Loop it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=175.60946153846163) [looking to match those based on that join](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=177.69350000000003) [column, and then for the rows that match](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=180.84683333333345) [it pushes that out to the SELECT. So a ton](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=183.05999999999992) [of information just by looking at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=185.79836363636366) [operators, understanding what objects and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=187.94354545454556)[indexes are being accessed, and in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=190.5525) [addition to the actuals and the estimates](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=193.32) [that we start to talk about, you can also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=194.9475000000001) [look at the lines, which are the rows,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=197.85266666666666) [which is the data really moving across the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=201.338) [plan. So here we look and we see that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=203.4633333333334) [estimated number of rows is 53, and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=205.83440000000007) [actual number of rows is 53. That's great](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=207.85692307692307) [when we have estimates that match our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=210.33261538461534) [actuals, and so if we hover over this line](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=212.29842857142856) [we can also get information about the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=214.63264285714283) [actuals and the estimates, and this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=217.10300000000007) [important to understand how much data is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=219.5945) [flowing across the plan because we want to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=221.9686666666667) [reduce that result set as quickly as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=224.47357142857135) [possible. I don't want to move millions of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=226.60457142857126) [rows across a plan, right, from an Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=229.34324999999993) [Scan all the way over to a SELECT, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=232.00359999999998) [then only have, you know, five rows come](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=234.76839999999993) [out of a SELECT, so what I look for in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=236.85433333333333) [addition to the operators initially is,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=239.183) [what do I have in terms of data moving](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=240.86992307692304) [across the plan? Now let's come back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=243.78549999999998) [our Editor window here, and we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=247.57549999999995) [pull this plan from cache. We're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=250.69336363636367) [pull this for the same query, and if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=253.12281250000004) [look here I can see that I have an Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=254.98525000000012) [Scan and an Index Seek, so let's see what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=257.47860000000003) [happens when I run this, and I try and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=259.977) [grab some information from cache, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=262.6243846153846) [let's minimize our Properties window for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=264.787) [now. There I've got the text of the query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=267.74499999999995) [and here's the plan. So it looks just like](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=270.6226666666668) [the plan I was just looking at, right, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=273.1700000000001) [now I've only got the estimates because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=275.742) [I've grabbed that from the plan cache. I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=278.57)[going to leave this estimate here, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=281.69738461538464) [going to come back, and I'm going to run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=284.0924615384615) [this query again, and we'll get the actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=286.6917857142858) [plan again, and what I want to do is I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=288.93464285714305) [want to look at these two side by side. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=291.368) [here's our actual plan, and here's our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=293.7973846153846) [estimated plan, and what I can do is I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=295.7320769230767) [right-click up here, and I can say](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=298.442) [Vertical Tab Group, and then I can look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=300.30120000000005) [them side by side. Now I also, just as a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=302.54152941176477) [side note, I have the ability to compare](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=304.94741176470603)[plans with this Compare Showplan option,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=307.8707499999998) [which is new in the latest Management](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=310.23366666666664) [Studios. You can run this version of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=313.36033333333324) [Management Studio against an older version](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=315.39499999999987) [of SQL Server, like against 2014 and 2012,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=316.983) [and you can use this Compare Showplan, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=319.2162307692309) [it asks me to open a saved plan, which I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=321.61742857142855)[haven't done, and so I'm just going to be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=324.96885714285696) [lazy and look at them side by side. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=326.9010000000002) [again, this is our actual plan over here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=328.72166666666664) [so when I click on this Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=330.5109999999998) [Scan I see my estimates and my actuals.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=332.44620000000003) [Over here I just see the estimates. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=334.819) [I've got absolute differences between the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=338.5596666666666) [two, right? I don't see anything related](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=341.4516363636364) [to real information in terms of what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=345.02736363636376) [actually happened in that estimated plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=347.689909090909) [and there's also some differences in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=349.659) [property. So if I click on that operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=352.35224999999997) [here, and I go into F4, and I start to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=354.32847058823546) [lose a little bit of real estate here, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=356.602) [you'll notice I had mentioned that we get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=359.2784615384614) [actual IO statistics in the actual plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=361.7454545454545) [and I get this in the latest version of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=363.981) [2014 and the latest version of 2016, so I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=366.88320000000016) [can see my actual logical reads right here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=369.62735714285714) [in the plan without doing a SET STATISTICS](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=371.7856428571429) [IO ON. If I come over and I look at my,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=374.0416666666667) [let me just make sure I've got the right](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=377.15036363636364)[operator, my Clustered Index Scan and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=379.08863636363634) [Estimated, I don't have that same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=381.3879999999999) [information over here, right? I'm only](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=383.472) [getting that IO information, hang on,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=386.5476000000001) [let's make sure. Sometimes you've got to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=388.936) [make sure you've clicked on the right](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=390.11899999999986) [thing. There we go. I'm only getting the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=391.90846153846155) [CPU and the IO information here in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=394.4733846153847) [actual plan. If I'm interested in looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=399.72200000000004) [at Locks I don't get that in either plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=403.16750000000013) [I don't see that anywhere here in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=406.835)[properties, and if I looked in the XML I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=409.86014285714276) [wouldn't see that either, so just for fun,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=413.22721428571435) [let's go ahead and close that estimated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=416.1557857142859) [plan. Nope, I'm not interested in saving](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=418.53466666666657) [the changes, and I'm going to close the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=420.775833333333) [Properties, and I'm going to right-click,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=422.56075) [and we'll look in the XML here, and if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=423.9377857142857) [do a Ctrl+F, right, and then we search for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=427.2456428571427) [Lock I don't have anything. I don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=430.92545454545456) [anything specific to locks within our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=435.43089999999995) [plan. Alright, so I've looked at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=439.9626999999998)[planning cache, I've looked at my actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=442.23099999999994) [versus estimate, and I'm going to run this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=443.96707692307695) [query one more time, and then we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=445.7516923076923) [to look at the XML again, and I'm not a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=447.5227500000001) [fan of XML, I'll be really clear about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=449.7196250000003) [that, but sometimes it's really easy to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=452.07849999999985) [find information there versus trying to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=454.32890909090906) [look through the properties window,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=456.3143636363635) [through F4, and that schema is defined,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=457.9415384615384) [and you can look at it, and it changes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=460.0663076923075) [between releases, right? They are adding](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=462.9188571428571)[information into the plan with every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=465.018) [release, and so this is the link that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=467.2139999999999) [can hit and you can look to see what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=469.4228235294118) [different attributes and properties are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=471.496) [available throughout the different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=474.08449999999993) [releases. So if we run this query here we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=476.1552999999999) [still have that actual plan enabled. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=478.2564285714286) [returns a fair bit of information, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=479.7052142857143) [when we look here at this plan now we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=481.5337142857143) [got a different plan, it's a different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=483.7203636363637) [query. This one accesses a Columnstore](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=485.1655454545456) [Index for the OrderLines table. Here we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=487.60800000000006) [got a Clustered Index Scan, so we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=490.56416666666667) [seeing some different operators here, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=493.0847500000002) [even though we don't necessarily know for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=495.2381818181819) [certain yet what they do we can understand](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=497.7422727272729) [what they access. We've got a Hash Match,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=500.6591999999998) [different type of join, we still have our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=503.02523076923075) [SELECT, and if I wanted to look here in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=505.056) [the Properties I can just hit Show](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=507.4995) [Execution Plan XML, and this can be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=509.7191666666667) [overwhelming at first, right, but if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=512.7367499999999) [wanted to look for that time or that IO](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=515.546) [information that I pointed out before I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=518.9570000000002) [can do a search for RunTime, and so here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=521.5648000000003) [I've got this RunTime Information, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=524.908)[I've got information about the rows and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=527.4601818181817) [the batches, and if I scroll over here I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=530.3713076923077) [have ActualElapsed milliseconds, right, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=533.9006923076925) [148, and then I've got my ActualCPU, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=536.1478000000001) [my LogicalReads, and my PhysicalReads, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=540.0088000000001) [information that we didn't get before in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=542.6956000000002) [plan I now have in later 2014 and 2016,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=546.444) [and I also in 2016, I have my Wait](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=550.773) [statistics, so let me just scroll back](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=554.1912000000004) [here, right, and this is really cool](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=556.7929230769231) [because this gives me the different waits](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=559.0533846153846) [that we have in this particular query, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=561.3968333333333) [what the WaitTime was and what the Count](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=564.3121666666667) [was, so fantastic information that we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=567.4322727272728) [never had before, and a plan, which can be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=569.6976153846153) [really useful when trying to understand](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=572.1511538461539) [why a query is not performing well.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=574.7887999999999) [Alright, now I'm going to run both of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=579.035) [these queries together here because I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=581.4363333333332) [to take a look at cost, but before I do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=583.4340625) [that I'm going to go ahead and stop, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=586.0909375000001) [then we'll pick right back up again at the same spot in the next clip.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=3&mode=live&start=587.9943999999999)

[Demo: How to Start Looking at a Query Plan - Part 2](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live)

[Picking up where we left off, we've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=2.495) [two queries that we're going to run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=4.356538461538461) [together. The first is against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=6.536999999999999) [CustomerTransactions. We're just pulling](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=9.079499999999998)[back CustomerID and TransactionAmount for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=10.922666666666665) [a specific CustomerID, and then the second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=13.147111111111107) [query goes against Orders and OrderLines](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=15.76127272727273) [and pulls back, what, six columns there,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=17.918499999999998) [and we have no predicate, so this is not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=20.36499999999999) [recommended for production. We're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=23.248625000000008) [return a lot of data. So we still have our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=24.92235714285714) [execution plan enabled, so we'll run both](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=27.530214285714276) [of these, and the second one, again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=29.876230769230776) [because it has no predicate, pulls back a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=32.309) [fair amount of data, and if we look at our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=34.482333333333344) [plan what I want you to notice first is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=37.18617647058825) [the cost. I haven't really talked about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=39.61194117647062) [cost, and it's something that I've said in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=41.46891666666666) [the slides is always an estimate, and it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=43.67707142857143) [not something that I pay really close](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=46.581642857142874) [attention to, but I think it's still](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=49.04816666666667) [important to understand. So for the top](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=51.32725000000001)[query our query cost relative to the batch](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=53.56800000000001) [is 12, and for the second query it's 88.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=56.09600000000003) [That adds up to 100. So when we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=59.12141666666669) [multiple queries in a batch, and we run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=61.83740000000002) [them in this manner we get the cost per](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=63.850200000000044) [query relative to the total, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=67.24009090909094) [within the query we've got our costs,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=70.05157142857144) [which will add up to 100 there, so the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=72.20607142857143) [Lookup is 93, the Index Seek is 7, that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=75.05557142857145) [100. For our second query we've got 38,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=78.00435714285722) [43, and 19. That's pretty close to 100](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=82.42489999999998) [right? Now the cost is always the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=86.30323076923074) [estimate. We never get an actual, even](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=89.27715384615377) [here in the actual plan. The cost is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=91.85599999999997) [something that, for the most part, you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=94.98925) [ignore, but, I say but, but sometimes it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=98.55791666666667) [a useful starting point. Like to think](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=101.42218181818181) [about what the optimizer thinks is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=103.84475000000002) [most expensive operation in a query, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=106.27316666666673)[here it's saying that the Key Lookup is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=108.78771428571426) [the most expensive operation, and very](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=111.70085714285707) [often actually it probably is. Here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=114.28550000000003) [between the Clustered Index Scan and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=116.83663636363636) [Columnstore Index Scan it's kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=119.15109090909087) [weighting them close to each other. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=120.75466666666665) [Hash Match is less expensive, but that may](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=122.25771428571429) [not be true when you actually execute it.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=124.49542857142862) [So look at those with a little bit of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=126.73485714285714) [grain of Salt, and remember that they](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=129.2574285714286) [don't represent seconds or CPU. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=131.9665) [non-value essentially, and it's just good](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=134.62) [for comparison purposes, if you even use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=137.64999999999998) [it at all. Now let's play a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=140.35142857142858) [with understanding how SQL Server comes up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=143.396) [with that cost because in that plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=145.84075000000007) [right, whenever SQL Server is generating a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=148.45616666666666) [plan it's using a costing algorithm,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=151.49825) [right, trying to figure out what the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=153.84245454545453) [different costs are for accessing data in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=156.27018181818178) [different ways or running through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=158.55500000000004) [different operations, and it comes up with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=160.17) [a good plan fast. It can't go through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=163.1488181818181) [every single option that there is because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=165.99133333333327) [that takes too long, right? So it finds a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=167.9869166666665) [really good plan as quickly as it can, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=169.81828571428565) [it runs with that, but it uses this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=172.08971428571428) [costing algorithm to figure out how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=175.05428571428567) [expensive that key lookup is or that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=177.06669230769234) [Clustered Index Scan. So I just want to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=179.1683076923078) [show you a little bit about that. So we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=181.0856666666666) [are clearing the buffer pool. Again, not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=183.38245454545452) [for production, just like DBCC](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=186.4395454545454) [FREEPROCCACHE, DBCC DROPCLEANBUFFERS is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=188.77579999999995) [sledge hammer that I don't want to run in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=191.21379999999988) [my production environment. This is going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=194.09439999999998) [to remove all of the clean pages from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=195.68907142857142) [buffer pool, so everything is gone. Now we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=198.0232857142857) [have a query against the People table for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=201.55169230769226) [PersonID = 10, and we're going to take a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=205.4843846153846) [look at this, and we're going to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=209.27684615384624) [the plan, and for this Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=212.0248461538461) [Seek, and by the way, we only returned one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=213.756) [row, which is what we would expect based](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=215.89200000000005) [on an EmployeeID, I want to look at here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=218.07899999999998) [the estimated IO cost, and it is 0.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=221.51249999999987) [003125. So remember I had said that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=225.02842857142858) [operators have an IO and a CPU cost? So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=228.34842857142857) [that's what we're looking at here, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=231.45730769230775) [want to try and understand kind of where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=233.93050000000002) [that comes from, so 0. 003. Now we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=236.41650000000013) [going to use this undocumented function,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=239.14655555555555) [PhysLocFormatter, which is unsupported,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=241.7432222222222) [but it is safe to use, and what we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=243.0445) [going to do is this is going to return to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=245.65000000000003) [us the page number where this information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=248.7855714285715) [is located, so it's on 30604, and we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=251.18223076923078) [take that page number here, and we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=255.49530769230782) [pass this into dm\_os\_buffer\_descriptors to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=259.59800000000007) [see if this page exists in memory, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=262.26300000000015) [indeed it does. It has to because we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=264.8309000000001) [asked for that data, so that data has to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=266.8946666666667) [be read into memory. I haven't dropped](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=269.0396666666668) [buffers again, so it's still sitting](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=271.7499999999999) [there. So now that I know that it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=274.22199999999975) [sitting there in cache, right, does my IO](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=276.95100000000014) [cost change? Because you would think that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=279.5679285714285) [if the data is sitting there in memory,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=281.8124285714284) [then SQL Server would know that, and it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=284.35580000000004) [wouldn't have to do IO, so the cost would](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=286.8639230769231) [be different, but if we look at our plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=289.64007692307683) [we see the same thing. We see that it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=292.27708333333345) [still 0. 003125, and that's because SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=295.32892307692305)[Server always assumes that the data is not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=298.14453846153833) [in memory. So that's an important thing to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=301.6886923076922) [consider when you think about cost, right?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=305.154625) [It's not always going to be accurate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=307.042) [because that data could be sitting in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=309.12858333333344) [memory, and it's assuming that it's not.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=311.2661111111112) [Again, we're going to do something really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=313.531) [bad, DROPCLEANBUFFERS. We're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=315.60066666666654) [remove that again. Now if I look at a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=317.15349999999995) [Clustered Index Scan, which means I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=320.0379999999998) [going to read the data from People, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=321.8412857142856) [have no predicate, so I'm asking for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=324.4564285714283) [Person and PhoneNumber, and this is going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=326.287) [to read through that entire clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=328.22583333333336) [index to return that data. There's my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=330.6188333333335) [Index Scan. What do I have here in terms](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=333.44) [of my IO cost, 0. 0609, right? And do I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=337.1615) [have that? Yes, 0. 06. Let's fix that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=341.1612857142857) [there we go. Now how many pages exist for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=344.10871428571437) [this table for this clustered index,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=347.93938461538465) [right? I've got index\_id = 1, which is our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=350.6647692307693) [Clustered Index, so let's take a look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=353.4145000000002)[there. We have 79 pages. Okay, so if we do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=355.42306250000036) [the math on here this is some information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=358.9072500000001) [that's not really documented by Microsoft,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=361.8949) [but it's been determined through some good](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=364.9003) [testing by some reliable sources, and if a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=367.88744444444455) [Random IO cost is 0. 003 and a Sequential](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=371.37649999999996) [IO is 0. 0007, then if we assume one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=376.2769999999997) [random IO to get down to the leaf level,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=380.63285714285723) [and then a bunch of sequential IOs to read](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=384.553) [through the rest of the Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=387.1893571428569) [what do we get for our output? Oh look,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=389.4995555555555) [it's the 0. 0609, right, which matches](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=393.43157142857143) [what we had here from our estimated IO. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=396.8355714285714) [this kind of gives you an idea of what the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=400.27899999999994) [estimator uses, the algorithm that it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=402.809) [starts to use. So let me just verify our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=406.0570000000001) [page and row count again. Let's see, we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=410.12518181818183) [got, what do we have in terms of our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=413.24223076923073) [output, 1117 rows, and if I look at my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=416.482923076923) [estimates here I've got an IO cost of 0.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=420.01399999999984) [0609 and a CPU cost of 0. 0013. Okay, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=423.746125) [I've got 1100 and change for rows, 79](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=429.35737500000005) [pages here. Now what I'm going to do is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=433.10178571428577) [something that you don't ever want to do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=435.91814285714304) [in your production environment, and I say](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=437.6299999999999) [that a lot don't I, but for demos some of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=438.897) [this stuff's really useful. So we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=441.4991428571431) [to leave our ROWCOUNT the same, but we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=443.1663076923077) [going to change our PAGECOUNT. We're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=444.8364615384616) [to up that from 79 to 79, 000. So now SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=447.5078461538463) [Server thinks that we have 79, 000 pages,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=452.26379999999995) [and when I run this query again, right,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=455.3299333333332) [where I'm asking for this information from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=457.9764545454545) [the table, that's going to change what it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=459.925) [costs for that Clustered Index Scan, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=464.1330000000001) [when I look at this Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=466.91915384615385) [we're still just returning the same number](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=468.7382307692307) [of rows that we did before, but if you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=470.53335714285714) [look that estimated IO cost went up to 58.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=472.946) [It was less than one before, and if we do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=477.04) [the math again, right, where we've got our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=480.44642857142884) [random IO and then our sequential IO for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=483.19071428571425) [all those other pages that it thinks it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=485.9541428571427) [has to read, we can see that it matches.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=488.87099999999987) [So we can mess with the optimizer, not in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=492.21) [a good way, but just to understand kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=494.86560000000014) [how it's thinking. Now if we change this,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=497.58345454545463) [and instead we're going to mess with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=500.11) [number of rows, and we're going to put the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=502.635090909091)[pages back to 79. Again, not for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=505.7636000000001) [production use. What do we have in terms](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=508.1638571428572) [of our CPU cost because when we change the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=510.68614285714295) [PAGECOUNT that's affecting the IO. When we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=514.3243636363637) [change the ROWCOUNT this affects our CPU](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=517.7176363636363) [cost estimates. So here we look at CPU,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=521.7413636363634) [and our output has gone up to 0. 123. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=524.8497999999998) [was 0. 0 something before, right, so the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=528.3456428571428) [rows affect this CPU cost. We're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=532.8067857142853) [go ahead and set this back to normal.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=536.3384545454545) [Again, I've given you a lot of information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=538.321) [about cost, and I want you to understand](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=540.7238571428571) [that the optimizer uses a cost based](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=543.553) [model, and that's how it's deciding. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=547.1475000000002)[using information within SQL Server about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=549.6937999999999) [our data, right, to determine how is it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=551.7522307692307) [going to access it, and so cost tells us](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=554.5651538461534) [something about what the optimizer is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=557.6035000000003) [thinking, but when we're going to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=559.587) [troubleshooting and analyzing a plan and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=563.9061999999999) [figuring out where to go next that's one small piece of the puzzle.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=4&mode=live&start=566.3293846153848)

[Module Summary](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live)

[At this point, we know how to retrieve](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=2.566) [both an actual and estimated query plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=4.189384615384616) [and when we look at the plan we understand](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=5.716153846153845) [that the operators provide information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=8.020846153846149) [about how the data was accessed, and that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=9.596666666666664) [there's a lot of information in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=12.322153846153846) [properties for an operator. We know that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=14.415692307692305) [to read a plan we need to look at it from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=16.122375) [the control flow perspective, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=17.993749999999988) [left to right, and also from the data flow](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=19.51461538461538) [perspective, which is right to left.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=22.171)[Neither method is wrong. They are both](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=24.5764) [correct, and we are also comfortable with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=27.017230769230764) [looking at a plan and knowing what initial](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=28.970769230769214) [information to look for, what operators](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=31.641333333333336) [are used, what objects are accessed, how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=33.71366666666666) [much data is moving across the plan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=35.83349999999999) [is that really what we expected? So now we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=38.543363636363644) [have a good start to reading plans, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=41.3492) [let's move on to the next module, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=43.06706666666668) [understanding some of the operators in more detail.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=d573a86b-75e7-4d06-b7f0-cd7d07a75cbe&clip=5&mode=live&start=48.926)

[Operators in a Query Plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live)

[Introduction and What Do You Look for in a Plan?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live)

[Hi. This is Erin Stellato from sqlskills.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=0) [com, and I'm recording this course for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=3.37575) [Pluralsight. This course is analyzing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=6.681888888888889) [query performance for developers in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=8.919111111111112) [Server, and this module's topic is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=11.337333333333333) [Operators in a Query Plan. Now it's time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=13.622333333333334) [to really dig into what we see in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=18.117000000000004) [plan, and we'll start by looking at some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=19.773000000000014) [of the operators that you will see most](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=21.683) [often when you're looking at different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=23.80390909090909) [plans, and we're building a foundation](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=26.173363636363643) [here, so that when you see these operators](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=28.377307692307696) [you know what they do and when you should](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=30.874538461538478) [expect to see them, and then we'll look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=33.50260000000001) [what happens when we make changes, either](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=36.04) [to the query or to the schema, and how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=38.104461538461535) [that can change what operator is used, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=41.1235) [then finally, we'll look at how query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=44.40058333333334)[performance changes when the operator or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=46.931666666666686) [multiple operators change in a plan. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=49.31725) [a lot to cover, so let's start by talking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=52.35706666666667) [about what we look for when we look at a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=54.3556666666667) [plan. Now if you haven't really looked at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=58.55683333333334) [plans until this course you might answer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=60.757538461538466) [with the operators or the cost, as those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=62.454692307692305) [are two things we've discussed, but for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=65.18023076923077) [those of you that have looked at a plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=67.34676923076925) [before, and I have two of them here, where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=69.758076923077) [do you start? I've asked this question](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=72.38309090909085) [many times over the past few years, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=74.04081818181817) [get a wide range of answers. In addition](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=76.0352857142857) [to operators and cost, people state that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=78.59642857142855) [they notice parallelism, those orange](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=81.29) [yellow circles with the arrows in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=83.64500000000002) [middle. They notice warnings, the yellow](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=86.84366666666669) [triangles with the exclamation point. They](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=89.20757142857144)[pay attention to the lines between the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=90.94211111111112) [operators, specifically noting thick](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=93.30888888888894) [lines, which means there's a lot of data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=94.57154545454547) [moving through the plan, and then beyond](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=97.037) [just noting the operators, they look for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=99.46090909090914) [specific operators like Scans, or Sorts,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=102.16566666666667) [or Compute Scalar. Here's the thing, there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=104.805) [is no one right answer when it comes to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=107.97658333333338) [looking at plans. Don't believe a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=111.4869230769231) [statement that a specific operator or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=113.35430769230776) [behavior translates to an absolute](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=115.69133333333335) [problem. I'll talk about the things that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=118.03022222222226) [you should expect and watch out for, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=119.92784615384612) [think of them as areas for you to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=121.89854545454546) [investigate further. Sometimes it's a red](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=124.31890909090907)[herring instead of a red flag. Query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=126.34119999999999) [tuning, in my mind, is just like indexing.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=128.74844444444446) [It's an art and a science, and you have to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=131) [do it a lot in order to become really good at it, so be patient with yourself.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=0&mode=live&start=132.85705882352948)

[Scans and Seeks](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live)

[There are several data access operators,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=1.914) [and the easiest ones to think about are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=3.500000000000001) [scans. Remember that when we talk about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=5.6096666666666675) [tables we have heaps, which are tables](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=7.442500000000003) [without a clustered index, so the data's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=9.328333333333331) [just added to the table as it comes in,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=11.253916666666662) [and therefore it's in no order whatsoever,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=13.21014285714286) [and then we have tables with a clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=14.8591) [index, where the data is ordered by the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=17.963900000000006) [clustering key. For a heap you will see a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=20.21088888888888) [Table Scan operator, which means that it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=22.637133333333328) [has to read through the heap to retrieve](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=24.532266666666654) [data. The comparable operator for a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=27.273125000000007) [Clustered Index is a Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=29.31554545454545) [where it reads through the Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=31.686636363636364) [to retrieve data. You may hear someone](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=34.092090909090906) [say, scans are bad, we have to avoid them](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=36.13766666666667) [at all cost, and that's a very general](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=38.420666666666676)[statement. There are times when a table or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=41.73857142857145) [Clustered Index Scan is the most efficient](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=44.01515384615382) [way to access the data, and there are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=45.87741666666666) [times when it definitely is not. Scans are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=48.37674999999997) [something to investigate further, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=51.28566666666668) [don't assume you must eliminate every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=53.36416666666667) [single one that you see. Our other data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=56.37116666666669) [access operators are for seeks, and we see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=59.7855) [those against Clustered Indexes and also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=62.208166666666656) [NonClustered Indexes. With a seek the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=65.81885714285713) [engine is retrieving rows based on a seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=68.4066153846154) [predicate. For a Clustered Index it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=70.93584615384623) [seeking against the clustering key, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=72.7805) [for a NonClustered index it's seeking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=74.66681818181819) [against the Index Key. Now you may here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=76.81372727272732) [folks say that Seeks are great, and you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=79.43357142857144) [always want Seeks, and again, there are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=81.81071428571431) [situations where that's what we expect and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=83.79583333333332)[what we do want, and other cases where a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=85.743) [Seek isn't as great as it looks. Very](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=88.42218749999995) [often we tend to think of a Seek as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=90.72546666666666) [dropping into a specific part of an index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=92.70066666666662) [and returning a small number of rows, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=94.6167857142857) [a seek can actually read through the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=96.80021428571422) [entire index, which means it's really more of a scan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=1&mode=live&start=98.87318181818179)

[Demo: Data Access Operators](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live)

[In this first demo we're going to take a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=0) [look at some of these different operators](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=3.1548461538461536) [related to data access, and we'll see why](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=5.399727272727274) [the optimizer decides to use them and how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=7.647) [we can change that. Okay, we're back with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=11.119666666666669) [WideWorldImporters and some data access](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=14.979111111111107) [operators in action. I've got a link here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=17.633)[to a blog post of Kimberly's because she](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=20.83484615384616) [writes this great variation of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=24.513666666666662) [sp\_helpindex, and I like to use that when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=27.309777777777768) [I'm tuning and looking at indexes. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=29.720769230769225) [we're going to use that to look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=31.517857142857142) [indexes for the Orders table, and you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=33.406571428571446) [see here we've got our clustered index,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=35.86028571428571) [which is on OrderID, and this is also the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=38.68528571428568) [primary key, and then we've got a few](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=41.49371428571429) [NonClustered indexes on some of the other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=43.624) [columns like CustomerID, and one of these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=46.651499999999984)[has the included columns, and this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=48.80357142857143) [really why I love Kimberly's script](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=50.29907142857144) [because it shows me that kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=51.77536363636363) [information, but now that we know what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=53.724545454545435)[this starts with we're going to go ahead](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=55.4554) [and set the IO and TIME ON for our queries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=57.39193333333333) [here, and we're going to create a copy of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=60.99935714285714) [the Orders table, which I've creatively](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=64.29154545454546) [named Copy\_Orders, and we're just going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=66.42536363636364) [push all that data into that table, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=68.38900000000001) [I'm not doing anything else, other than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=70.55885714285715) [I'm going to run a query against it right](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=72.52535714285717) [here, so we're going to just ask for three](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=74.89215384615386) [columns from Copy\_Orders, and we do have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=77.057) [predicate, right, we're a good developer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=79.64899999999999) [and a good DBA. We put a predicate on here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=81.10271428571431) [of WHERE CustomerID greater than 550. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=83.117) [when we run this it'd be helpful if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=85.49269230769232)[included the actual plan. Let's try that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=88.573) [again. We can see in the output that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=91.00899999999999) [have a table scan. This is a scan against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=93.16833333333332) [a heap, and it has to read through the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=95.29833333333333) [entire table because there's no indexes to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=97.50213333333333) [support our query. There's no indexes at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=100.20633333333332) [all, so any query against this table is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=102.76142857142858) [going to have to read through to find the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=105.41228571428573) [rows that match any predicate that we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=107.86646153846158) [input or if we put no predicate in it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=109.56293333333333) [going to have to read through everything.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=111.01133333333333) [So that's a lot of data, and that's really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=112.49654545454547) [inefficient, and if we take a look at our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=115.559) [IO we can see that that's about 700,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=118.11440000000003) [almost 800 IOs to read through that whole](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=120.50763636363637) [thing, and that took about half a second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=123.26618181818183) [to do that. Now that's pretty lousy,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=125.74319999999996) [right? When you see a heap I'm not saying](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=127.95761538461535)[that heaps in and of themselves are lousy,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=130.884) [okay, that's not my statement. My](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=133.2618461538461) [statement is, if I don't have any index to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=134.975) [support my query one of the first things I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=137.01800000000003) [want to do is, can I create one? Is that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=139.10266666666664) [possible or can I modify an existing one?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=141.5876) [And here we know that we don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=143.93) [anything at all, so can we make this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=146.05094117647053) [better? Absolutely. We can create a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=148.17188235294105) [NonClustered index ON Copy\_Orders, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=150.50977777777777) [has CustomerID for its index key because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=152.55063636363636)[that's what we're querying on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=155.22909090909081) [specifically, and we've asked for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=157.44) [OrderDate and OrderID, and we're not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=160.09749999999997) [querying against those columns, so we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=163.07892307692308)[just include them. So if we go ahead and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=166.3150769230769) [create that NonClustered index, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=169.62928571428574) [we run our query again, let's see what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=171.5565714285715) [get here. We had 700 and some reads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=174.42188888888882) [before, now we have a nice Index Seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=177.0147142857143) [against our NonClustered index, so this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=179.625) [should require way fewer IOs, 122, right,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=182.50990909090916) [compared to the almost 800 before. Our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=185.86199999999997) [time went down just a little bit down to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=189.12574999999998) [420 milliseconds, but sometimes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=192.90349999999992) [improvements are incremental. The IO is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=194.46820000000002)[big improvement here, so I'm not going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=197.0456) [say that indexes are always the answer.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=200.0248) [It's very often an easy win, and it's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=202.17171428571424) [good place to start, particularly when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=204.4885714285713) [you've got a heap that doesn't have any](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=206.13725000000005) [NonClustered indexes on it, and if you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=208.29476923076925) [don't have heaps in your system, then yay,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=209.76315384615393) [it doesn't mean you still don't need](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=212.0280909090909) [indexes. Now let's query our Orders table.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=214.86563636363633) [Same query that we had before originally](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=217.50800000000007) [against our heap, but now we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=219.959) [run this against orders, which does have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=221.671) [clustered index on OrderID, but we know](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=224.56723076923078) [that there is a NonClustered index on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=227.72315384615388)[CustomerID, but I've already given it away](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=229.77749999999995) [here that we're going to see an Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=231.7862) [Scan. So If we look at our plan here we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=235.02780000000007) [got a Clustered Index Scan because even](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=237.20600000000002) [though we had a predicate of WHERE](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=238.8499090909091) [CustomerID greater than 550, we also asked](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=241.15609090909098) [for Customer ID and OrderDate, and those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=244.20950000000005)[were not in that NonClustered index that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=247.41533333333334) [lead on CustomerID. So, in this case, we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=250.25499999999997) [had to read through the whole clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=253.08776923076923) [index, right, 796 rows, and that took](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=255.34984615384613) [about 417 milliseconds to complete. So one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=259.39790909090925) [of the things about seeing a Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=263.09714285714284) [Index Scan or any Index Scan is does it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=265.18014285714276) [have to read through the entire table, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=268.06114285714295) [in this example it did, and I can come](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=270.84742857142885) [back here actually, and I can run this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=273.6612666666665) [query here, and if I look at the IO it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=276.081)[that 796. So without putting any predicate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=281.31433333333314) [on, just saying, give me everything from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=283.86827272727265) [the table, it takes 796 logical reads. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=286.0425714285715) [if I run this query, which says, return](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=288.96714285714313) [the TOP 10 where CustomerID greater than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=292.4264545454545) [550. If we look at this we only get 10](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=296.23318181818155) [rows back where before we were getting 80](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=298.67179999999996)[something thousand, and if I look at my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=300.3868571428572) [plan I have a Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=302.19428571428597) [operator, but I only got 10 rows back, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=304.3656363636364) [did I really read through the entire](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=308.01669999999996) [clustered index, and the answer is no, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=309.9115999999998) [I can confirm that by checking the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=312.47242857142874) [Messages tab, and looking at my logical](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=314.82842857142896) [IOs here, which are just four. Remember I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=317.5314999999999) [said that operators iterate over rows, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=320.71276923076925) [so in this case we asked for top and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=323.56446153846156) [had a predicate of where it's greater than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=327.49371428571425)[550, so it would have found rows and it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=330.56) [would have gone in and pulled a row, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=333.61220000000003) [if the CustomerID was greater than 550 it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=336.51121428571423) [would have fed that to the top, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=338.81578571428554) [back to the SELECT, and the SELECT would](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=341.10200000000015) [have said, well I've got 1, I need 10, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=342.998) [get me another one, and it would have gone](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=345.14942857142836)[through the next row into the clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=347.19846153846163) [index and pulled that out, and if it was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=348.8623076923079) [greater than 550 then it would send it to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=351.3842666666666) [the top, and it probably read more than 10](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=353.96683333333334) [rows. In fact, if we look at Number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=356.59408333333346) [Rows Read it says it read 17, but it only](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=358.68440000000015) [required four IOs. So a Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=361.59975) [Scan doesn't always read through the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=364.73049999999995) [entire Clustered Index. If you see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=367.3752857142856) [something like a top or if you've got a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=369.3081176470588) [min or a max where it can leverage the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=371.1684705882352)[clustered index, then even though it says](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=373.53533333333326) [it scanned it might not have read through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=375.86866666666646) [the entire thing. So just something to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=377.7685999999999) [throw in the back of your mind. You'd have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=379.35454545454553) [to verify it by checking the IO, and just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=381.5477142857142) [to further drive that point home, if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=384.2149285714283) [run both of these together and Execute,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=386.89066666666656) [and we look at the plans, right, Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=389.392) [Index Scan with a Top. We can also pay](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=391.79323076923055) [attention to, by the way, the amount of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=394.06799999999987) [data moving through, right, 38, 000 rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=395.61599999999964) [versus a whopping 10 coming through here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=398.13758333333334) [and again, if we look at the IO is 796 and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=401.126) [378 milliseconds versus 4 and it's not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=406.3312000000002) [even registering it in terms of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=409.34190909090916) [milliseconds here. Alright, so a slight](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=411.5777272727275) [variation of our query. We're going to ask](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=413.85900000000004) [for CustomerID still and OrderID, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=416.69866666666667) [we're taking away OrderDate, and now we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=418.6541666666667) [saying WHERE OrderID greater than 30, 000.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=421.8801666666667) [Remember I have an index that leads on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=425.484) [CustomerID, and remember that my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=429.1053333333335) [clustering key is on OrderID, so let's see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=431.291) [what happens when we look at this. We've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=434.291) [got our Plan, and we have an Index Scan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=436.88853846153853)[Now this is interesting. This is our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=439.358) [index, which leads on CustomerID, so even](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=443.42754545454534) [though OrderID is our clustering key SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=447.4799090909091) [Server said, nope, I'm not going to go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=451.5093636363636) [into the Clustered Index and read through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=454.00953333333314) [that. I'm going to take this NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=455.9340666666663) [index, which leads on something else on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=459.1402727272726)[CustomerID, and I'm going to read through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=461.9540769230769) [it, and it would have read through the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=463.252846153846) [whole thing because it let on CustomerID,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=465.1728181818181) [but I asked for rows WHERE OrderID greater](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=467.234) [than 30, 000, so in this case it scanned](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=470.27114285714293) [through that to find it. Now what happens](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=473.59862499999997) [if I change my OrderID? Let's change it to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=476.39762499999995) [60, 000 and let's run this again. What do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=479.46372727272734) [I have in my output? Now I have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=482.4031428571429) [Clustered Index Seek, so exact same query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=485.261285714286) [but I have a different input value, and in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=487.25114285714295) [this case it said, okay, I'm going to drop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=489.5847142857146) [into the clustered index, and I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=491.92199999999997) [seek through to find the rows that have an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=494.125)[OrderID greater than 60, 000, so this is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=496.74399999999997) [case where with 1 input value I get 1](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=500.412) [plan, and with a different input value I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=504.0460769230769) [get a different plan, and this just has to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=506.10269230769217) [do with the amount of data that SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=508.5613333333333) [thinks it's going to return. So does this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=511.13593333333336) [mean that I want the seek, right?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=514.4454999999999) [Sometimes you hear that scans are bad,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=517.469) [seeks are better. Let's look at what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=519.5676000000001) [happens when I run them side by side. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=521.9526666666665) [here I have my two different plans. One](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=525.1161333333333) [does my Index Scan of the NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=526.6532000000001) [Index, which is smaller, it's not as wide,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=528.2513) [right, as my Clustered Index, and here I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=531.8136999999998) [have my Clustered Index Seek, and if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=534.4254999999997) [look at our IO we've got 149. What was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=537.1702142857143) [first again? Our Index Scan, right, so 149](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=540.7618571428575) [to scan that NonClustered Index, and about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=543.7489090909094) [400 milliseconds versus 235 to seek a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=546.6913333333333) [portion of the Clustered index, and 333](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=550.6055) [milliseconds. So even though this was a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=554.0753636363635) [little bit more in terms of IO the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=557.212)[duration was less, so these are things to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=559.5548571428576) [start to look at when you see seeks and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=561.9058333333334) [scans, and when you're trying to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=564.5780833333334) [understand if it's the right thing. Now I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=565.9313636363634) [could force a scan here. So I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=567.7323333333333) [run those first two queries and then my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=570.1323333333331) [third query I actually am saying I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=572.4814) [you to use this particular index, so for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=575.0462000000001) [the case WHERE OrderID greater than 60,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=577.5720909090911) [000 use that index for me please. So let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=579.9344666666666) [go ahead and run that. So we've got our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=584.3036666666663) [three different plans, Index Scan, Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=587.8839230769229) [Seek, Index Scan. Remember these last two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=589.6133076923072) [are for the OrderID greater than 60, 000,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=591.9239999999999) [and if we look at the IO, right, 149 for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=594.816) [the NonClustered, 235, and then 149. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=598.9590769230772) [SQL Server, even though it would be less](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=601.9563999999998) [in terms of IO for it to read through that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=605.4651999999994)[NonClustered index, there comes a point](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=608.4335384615382) [where it can make a decision of, okay, I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=609.85) [going to go to the Clustered index and do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=611.9720714285716) [a seek, and these are things that are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=614.3033076923076) [based upon statistics and other algorithms](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=616.6079230769229) [that the optimizer uses and looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=619.3815000000002) [these things and understanding what it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=622.3914615384615) [decides to do and why. This is part of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=623.9648461538461) [that art and science that I was talking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=626.1704615384616) [about. It takes a little bit of time,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=627.9593846153849) [right, in terms of tuning, and these are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=630.3226666666665) [the things that you want to look at when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=632.5648) [you are looking at plans and playing with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=634.7062) [different values, right? What are my IOs,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=636.793125) [what is my time, and what are the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=638.7630000000001) [different input values that I am going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=641.0550000000005) [have because even though this may run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=644.1111428571431) [better one way, if it most of the time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=647.0081428571434) [you're going to be inputting higher values](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=649.8197142857148) [like this we may want to see that other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=651.9799090909091) [plan. Okay, now let's check our indexes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=655.2370909090909) [one more time here, and let's take a note](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=657.433285714286) [of, oh, you know what, this is a good time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=660.1633846153846) [to mention, when you have the actual plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=663.0072307692309) [on, and you run this helpindex it can take](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=665.1754285714285) [a long time, so I tend to turn it off, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=667.525) [what I want to point out here is that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=669.9119999999998) [we've got our unique index here on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=672.4269999999998) [OrderID, and then we've got this one on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=674.9294999999995) [CustomerID that we've kind of been playing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=676.3860000000003) [with, and the ID for that is two. So I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=677.5811249999999) [just want to take note of that. I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=680.1123749999995) [to turn my actual plan back on, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=682.3822666666669)[going to check the index usage stats.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=684.6418666666672) [That's a tricky one to say.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=686.6858181818183) [Dm\_db\_index\_operational\_stats, so I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=688.536) [see for every index what do I have in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=690.3661818181816)[terms of singleton lookups, and what do I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=694.1238571428571) [have in terms of range\_scan\_counts? We're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=696.3432857142857) [going to take a look at both of those. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=698.2091818181818) [we're going to look at this for Sales.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=701.8777857142857) [Orders for both my Clustered Index and for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=704.0040714285713) [the NonClustered index, which leads on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=707.0022000000001) [CustomerID. So we've been using both of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=710.3406000000004)[these a fair bit, okay, in terms of our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=712.6682000000002) [singleton, in terms of our range scan, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=715.325) [let's rebuild both of those, and that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=717.9459230769228) [going to clear out the values that we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=720.3810666666667) [for index operational stats. So let's just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=723.9678666666671) [double-check that and make sure that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=726.3046363636365) [information is, yep, we're zeroed out.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=727.7899090909095) [Perfect. So now let's see what happens](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=729.8283333333335) [when I've got this query, and this is just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=732.5291666666672) [like what we were looking up before, where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=734.9167142857141) [I'm asking for CustomerID and OrderID from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=737.3401818181818) [Sales Orders, but this time I have OrderID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=740.5678181818181) [equals, right. Rather than a greater than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=743.7724999999998) [I am asking for an equality, so let's run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=746.3718666666666) [this one, and if we look at our plan you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=749.2236666666666) [can see that I have a Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=752.0633571428572) [Seek, and if we look at our results we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=754.0719285714287) [have one row returned, and if I look back](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=757.1869999999997) [into dm\_db\_index\_operational\_stats I want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=760.6548) [to note what type of seek this is, and you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=763.0699999999999) [can see that it's called a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=768.1006666666667) [singleton\_lookup, which means that it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=770.5146666666667)[dropped in, and it returned one row, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=772.3286363636363) [in returning one row it also knew that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=775.1656875) [there was going to be one row. So what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=778.0991875000001) [happens when I run this same query, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=781.4937142857144) [now I ask for CustomerID equals 1065, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=784.8045714285719) [this is only going to return one row. I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=788.1903333333335) [know that, and I have a NonClustered index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=791.9336666666666) [to support that, so let's run this and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=794.1950000000004) [take a look for sure. So I have an Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=796.3490000000002) [Seek here. It's against a NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=798.9558333333334) [index instead of a Clustered index, but if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=800.5168333333336) [I now run the query against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=804.0153076923074) [index\_operational\_stats what do I have for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=806.791) [that NonClustered index? I have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=810.3723333333334) [range\_scan\_count. So in both cases I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=813.4884999999999) [returned one row, and in one of those it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=816.1394999999998) [was a singleton lookup, and in the other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=818.6942000000003) [one it's a range scan, and the reason this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=820.3331333333339) [occurs isn't because this was a clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=823.69) [index, and this was a NonClustered. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=826.5121428571429) [reason it occurs is because this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=829.6204444444444) [unique. This index is defined as unique,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=832.1365555555553) [and this NonClustered index is not defined](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=834.324) [as unique. So when you're looking at seeks](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=836.7574615384616) [my point is here, when you're looking at a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=841.601153846154) [seek, and it returns only one row, there's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=845.5534166666669) [different kinds of seeks that individual,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=848.1738571428572) [that singleton lookup where it knows that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=851.041) [it's only going to get one row back](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=852.8098461538463) [because the index is defined as being](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=855.1663076923078) [unique versus what we call a range scan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=858.107384615385) [so a seek can be a range scan because it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=860.7477333333331) [doesn't know that there's only one row](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=863.147066666666) [with our specific customer id that we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=865.7594999999997) [asked for, so it drops into the index, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=868.3177999999999) [then it has to read forward to make sure,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=869.9899999999997) [or backwards, to make sure there's no](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=872.2316666666667) [additional rows that meet that criteria.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=874.5288333333334) [So we call that a little bit of a range](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=876.1270000000001) [scan, or not a little bit, it is a range](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=878.667) [scan, but I want to highlight this just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=882.0220000000003) [one step further with this last query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=884.8266666666667) [against Sales Orders where CustomerID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=887.5975000000003) [greater than -1. Now we assume that all of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=889.6518333333332)[our CustomerIDs are positive numbers,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=893.5525833333329) [right? So when you run this query and it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=895.4438181818183) [returns 84, 000 rows when you look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=898.7087333333333) [plan you notice that this is an Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=901.920533333333) [Seek, but you know we have no rows in here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=904.4637647058821) [with an ID less than 0, so this had to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=907.2531764705875) [read through the entire NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=911.0569230769232) [index. It's basically an indexed scan, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=913.1761538461541) [it calls it an index seek, so my point is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=915.9140000000001) [that when you see scan, when you see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=919.3614999999999) [seeks, it's a good start, but you should](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=921.6284999999997)[make sure that it's returning the amount](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=924.4586153846155) [of data that you expect, right? And the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=927.4276923076928) [next seek here that's returning 84, 000](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=929.7836363636364) [rows when there are 84, 000 rows in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=931.7629333333332) [whole table is slightly suspicious to me.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=935.0161333333327) [Alright, we're going to clean this up, and then we'll head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=2&mode=live&start=937.4064)

[Nested Loop and Lookups](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live)

[The Nested Loop is the first join operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=2.019) [that we're going to tackle, and we've seen](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=3.8780769230769234) [it in a few plans already. With the Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=5.807785714285713) [Loop we've got two inputs, which are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=8.111142857142854) [represented by the blue and purple lines](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=10.284333333333336) [in the icon. The blue line, which circles](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=12.610200000000008) [around to the left, represents the outer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=15.070333333333336) [dataset, and the purple line, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=17.119) [circles around to the right, represents](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=19.106636363636355) [the inner dataset. With a Nested Loop rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=21.179083333333335) [from the outer set are read in, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=24.507749999999998) [rows that satisfy the join predicate are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=28.017076923076914) [retrieved from the inner dataset. For](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=30.655) [every one row in the outer dataset we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=32.795) [have one or more rows that match from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=35.94876923076923) [inner dataset, and if no matching row is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=38.99007692307691) [found in the inner set, then the next row](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=42.08133333333332) [from the outer dataset is retrieved, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=45.47914285714285)[the process continues. We expect to see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=47.983642857142826) [the nested loop with smaller amounts of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=50.258666666666656) [data. We don't expect it when we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=52.3615833333333) [thousands of rows being returned, and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=55.03791666666665) [also see it with lookups. Because the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=57.38546153846154) [amount of data being returned with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=59.66207692307694) [Nested Loop is typically low one of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=61.848923076923086) [things to watch out for is inflated IO.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=64.21138461538465) [Very often the rows that are being matched](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=67.12630769230772) [from the inner set require random IO, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=70.24) [that quickly adds up when you have a lot](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=73.456) [of rows coming in from the outer dataset](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=76.54364285714287) [that match to rows on the inner side. And](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=78.91107142857147) [I mentioned lookups briefly in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=83.88) [previous slide, and you may also hear the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=85.596) [term bookmark lookup, and these are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=88.20015384615382) [specific to Nested Loops. We have two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=90.54846153846148) [kinds of lookups and the first is a key](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=92.87323076923076) [lookup, which occurs when we retrieve a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=95.15092307692302) [row from the clustered index based on the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=97.60692307692304) [clustering key. The other lookup that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=100.525) [might see in a plan is a RID lookup where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=102.961) [RID stands for Row ID, and you see these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=106.48842857142856) [against the Heap table. Remember that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=109.7271428571428) [data in a heap is not ordered because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=111.80853846153845) [there is no key, so rows are found using](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=114.16099999999999) [the row id. If you have heaps you might](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=117.25699999999993) [see these. If you don't have any heaps in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=119.55699999999997) [your system, then I wouldn't expect you to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=121.459) [see these. As I said, our lookups indicate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=123.99740000000003) [that we have random IO occurring, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=126.40799999999996) [that's something to pay attention to when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=128.437) [you see either a key lookup or a RID lookup in a plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=3&mode=live&start=130.2080000000001)

[Demo: Nested Loops and Lookups](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live)

[Now let's take a look at some examples](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=2.527) [where we see a Nested Loop operator used](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=4.30357142857143) [to join data between two tables, and also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=6.359230769230769) [how the Nested Loop appears with lookups](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=9.252153846153847) [for both clustered indexes and heaps.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=12.412600000000001) [Alright, time to take a look at some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=15.526) [Nested Loops. We'll set our database](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=17.905199999999997)[context again, to WideWorldImporters, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=19.884500000000003) [we're just going to SET STATISTICS IO ON](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=21.619) [here. I'm not so worried about time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=24.41900000000001) [because a lot of these are running so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=25.774428571428565) [quickly that we're not seeing drastic](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=27.115) [changes in time. So we've got a first](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=29.66366666666666) [query here. We're going to expand what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=32.016571428571424) [were working with last time, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=33.7422857142857) [going to join between OrderLines and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=35.83200000000001) [Orders, and we're looking for a particular](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=37.706) [CustomerID. So we'll go ahead and run this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=41.91212500000002) [query. So let's look at our output and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=45.30249999999999) [here we've got our friendly Nested Loop.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=48.464749999999995) [So if we look at this what is our outer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=51.074) [input, what is our inner input, and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=54.40066666666668) [outer is the top here, so this is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=57.16476923076924) [NonClustered index against orders, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=60.46707692307695) [this Seek predicate here is CustomerID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=63.0668) [equals 185, so this is the NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=66.416) [index that leads on CustomerID, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=69.28981818181819) [it also has OrderID in it, and so the rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=72.03685714285716) [from here that match, right, the first row](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=75.71971428571435)[comes over to this Nested Loop with its](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=78.26230769230772) [OrderID, and then there's an Index Seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=81.108) [over here against the NonClustered index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=84.545) [on OrderLines, which leads on OrderID, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=87.94933333333331) [it finds a matching row, if there are any,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=92.125) [returns those back to the loop over to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=94.94200000000002) [SELECT, and then it goes and it gets the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=97.41299999999997)[next row over here that has a CustomerID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=99.6071999999999) [of 185. It pulls that in, it goes over to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=103.34399999999997) [the NonClustered index to see if any rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=106.5372) [match on that OrderID, and if so it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=108.76742857142857) [returns those to the SELECT, so that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=111.24285714285712) [what the Nested Loop does, very simply.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=113.77022222222222) [Now I remember I said that we typically](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=117.201) [see this with small datasets, and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=119.39115384615386) [dataset coming out of here is 155 rows,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=121.54937500000001) [and we end up with 521 in total, right,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=124.70687500000004) [because I had said that for every row that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=127.92442857142856)[comes out of our outer set there could be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=130.4727142857142) [0, 1, or more rows that match here from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=133.2906666666666) [our inner set, so not unexpected to see a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=136.1812142857143) [higher number of rows. Sometimes you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=139.03614285714275) [see less if they don't match. But what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=141.003) [happens if we reverse this? Meaning, I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=143.83330769230773) [going to force the order on the join, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=146.41038461538474) [that OrderLines to be my outer table, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=149.37733333333335) [if we come back here really quick, right,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=151.7682666666667) [Orders is the outer dataset, OrderLines is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=155.31254545454541) [the inner dataset, so with my force I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=158.40030769230768) [going to make OrderLines be the outer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=160.92953846153839) [dataset. And notice, do not recommend this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=163.28399999999993) [hint. Right, not for something you want to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=165.74449999999985) [drop into your code. If we look at this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=168.5135454545454) [execution plan now it has changed. We no](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=171.34181818181824) [longer have a nested loop, we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=173.5983076923077) [switched into something we haven't even](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=175.4193846153847) [talked about yet, which is a Hash Match.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=176.98659999999998) [So I have said I want you to do this, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=179.093) [it said, well, I'm not going to use a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=181.54600000000013) [Nested Loop for that, and in fact, if you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=183.41125000000002) [look at the cost for this, right, if you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=185.20562500000005) [look at the Estimated Subtree Cost it's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=187.75299999999996) [one. It was much lower for the Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=190.09527272727274) [Loop. We'll come back and take a look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=192.42036363636367) [that. Now if I said, okay, we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=194.58242857142864) [force the order, right, I've got my OPTION](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=196.75884615384612) [FORCE ORDER here, and I'm telling you that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=198.81976923076914) [you have to do a Nested Loop, so I am](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=201.2254615384616) [totally ignoring any wisdom from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=204.3930769230769) [optimizer, and I'm saying this is what I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=206.3172307692307) [want you to do, and this is the reason I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=208.18533333333332) [don't recommend the hits. The optimizer's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=209.64866666666663) [pretty smart. There's a lot of smart folks](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=211.73642857142863) [that write that, so I usually think that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=214.44328571428568) [it makes pretty good decisions. It's an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=217.017) [edge case where it doesn't, but here's my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=219.5480833333333) [plan now, and it said, okay sister, you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=222.0791875) [want me to do a Nested Loop that's what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=224.00768749999997) [I'm going to do. Look at this big old](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=226.25128571428573) [input that's coming in, right, 265, 000](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=228.58742857142863) [rows coming into the Nested Loop, so for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=230.95750000000007) [every single one row that comes into my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=233.60685714285714) [Nested Loop then we've got to go over here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=235.76228571428564) [to my orders, and find the row that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=238.1396428571428) [matches, and then push it out. So it did](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=240.21907142857128)[what I asked, but it's much more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=243.26780000000005) [expensive, and you can see that it ended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=245.708) [up going parallel, right? We've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=247.86133333333342) [parallelism introduced now. So if I run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=249.51049999999998) [all of those together let's select all of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=251.51424999999995) [them, and then run we get the same output,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=255.39876923076926) [right, across the board, but here we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=260.5115) [see what we have in terms of our plan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=262.68350000000004) [if you look at the costs, right, even](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=265.6110000000001) [though they're estimates, I still think](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=268.03222222222223) [they're always interesting to look at. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=269.37155555555546) [cost for this plan where I said force the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=270.9033571428572) [order and you have to do a loop, 97%](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=272.857) [compared to 1% and 2, and if we look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=275.9625294117649) [our IOs here, right, we go from 350 reads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=279.904625) [up to 420 when it switched to the Hash](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=285.22193749999974) [Match up to over half a million when I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=289.2997142857142) [said, nope, you have to do the Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=291.8280714285711) [Loop, and you have to force the order. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=293.91733333333326) [interesting changes you can make, just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=296.27730769230766) [sometimes to sort of get a feel for what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=298.0371538461537) [the optimizer doesn't want to do, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=300.74690909090907) [again, I don't recommend putting those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=302.9633636363635) [into your code. So with our Nested Loops](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=305.111875) [what we're looking for is inflated IO, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=307.74183333333343) [by the way, right, this is a case where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=310.14366666666666) [I've got really inflated IO. That's not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=312.4716666666667) [something I want to see for a Nested Loop,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=314.2804666666666) [and I also want to pay attention to scans](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=316.60006666666635) [on that inner side. So let me show you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=319.421) [what we mean here. Let's run this query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=322.02643750000004) [and take a look at our plan. So nice thin](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=323.9039375000001) [line here in terms of the rows coming over](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=326.9250000000001)[just one, but I've got a Columnstore Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=329.93514285714286) [Scan going on on my my inner dataset,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=332.83228571428594) [which is something worth noting here. Is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=335.9313333333334) [there really no better way to get the data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=338.8112857142857) [than a Columnstore Index Scan because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=341.5408571428572) [usually these are used for aggregations](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=343.4832727272727) [and for large sets of data. So I take a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=345.6710909090908) [look at this and I think, hmm, what's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=349.0855) [going on here? Now on the OrderLines table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=351.81308333333334) [there is a NonClustered Index that leads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=355.06975) [on StockItemID, right, and I asked for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=357.78033333333343) [that. I said, okay, StockItemID is 185,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=360.38666666666694) [and these are the other columns that I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=363.23350000000005) [want. So what happens if I try to force it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=366.41400000000004) [to use that particular index? Let's see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=369.94400000000013) [what we get, and let's actually before we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=372.1018571428571) [do that let's take a quick note here.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=373.67328571428556) [We've got 500 reads or so, so let's run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=376.459) [this one, and now it says, okay, you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=380.959) [wanted me to use that NonClustered Index,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=384.2911538461537) [which it did, but lo and behold, it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=387.012) [couldn't satisfy everything with that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=389.7953333333333)[NonClustered Index, so we get a Key](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=391.6313) [Lookup, right, from our Nested Loop here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=394.7414) [and it had to get the Quantity column from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=397.43571428571425) [there, and then it feeds into the other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=400.686) [Nested Loop over here. So is this a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=403.60066666666654) ["better plan? " Hmm, I have a lot more IOs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=406.46399999999994) [in effect here, so even though I wasn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=409.9789999999998) [loving the fact that we had a scan on that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=412.05719999999997) [Columnstore Index it was choosing that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=414.56333333333333) [because it was more efficient. So then I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=417.2233333333333) [might say, well, that NonClustered Index,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=420.23730769230775) [I think I can modify it, right? It's got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=421.83192307692326) [StockItemID in it, and it had a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=424.2341666666666) [PickedQuantity in it, which I was asking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=426.109) [for, and so now I'm going to also add](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=427.7485000000001) [Quantity, because that's what it was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=429.94159999999994) [missing, right? If we come back and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=431.6023999999998) [look at our plan, and we look at the key](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=433.1516470588236) [lookup our output here in that list it had](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=434.81105882352955) [quantity. So let's just change this. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=438.3823333333331) [this isn't always the solution, right, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=441.23636363636354) [let's see. If I do that, and then I run it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=444.235) [again, what do we get? It says, here is my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=449.59750000000014) [Clustered Index Seek against that, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=453.63307692307694) [then here is my Index Seek against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=455.854) [Index that I just created on OrderLines.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=458.43) [So have we made a big improvement here?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=461.59218181818187) [Let's see what do we have in terms of our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=466.59) [IO? Yes, right? So we went from 100 and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=468.9418181818184) [something down to a very few amount of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=471.9307142857141) [IOs, so indexing can sometimes solve your](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=474.9416) [problem. Again, it's an easy win, but take](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=478.25120000000004) [caution, right, when you're changing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=481.48433333333344)[indexes that exist or adding new ones](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=483.456) [because, of course, there is always](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=485.77579999999983) [overhead when you've got indexes involved.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=487.9993333333333) [So we'll go ahead and set this one back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=490.458) [what we had before, and then we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=494.2515714285715) [to create a copy of our Orders table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=496.78069230769233) [again, right, creatively named](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=498.804076923077) [Copy\_Orders, and we're going to create a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=500.06710000000004) [NonClustered Index here, which is on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=502.424) [ContactPersonID. So let's create that, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=507.2154285714287) [then a simple query. We're asking for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=510.21288888888876)[ContactPersonID, OrderDate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=513.7702000000002) [CustomerPurchaseOrderNumber against that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=514.969) [heap we just created based on our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=516.5330000000001) [ContactPerson, so we know that it should](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=519.9140714285713) [be able to at least use the NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=521.685571428571) [index, right, and then this is where we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=523.8495) [going to see that row ID lookup. So we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=526.4315000000004) [still have our nested loop, and in our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=529.5281666666663) [Index Seek if we look at the predicate we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=531.7406) [can see it's looking for the value that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=533.1253999999999) [we've requested for contact person ID, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=535.8679090909089)[we didn't have all of the columns that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=538.8326000000001) [needed here, so this is where we get the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=540.8810000000005) [Row ID Lookup back over to the heap based](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=542.9347500000001) [on that row ID to pull the additional](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=544.9951875000004) [columns that we needed, the OrderDate and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=547.5261666666667) [the PurchaseOrderNumber. Feeds that into](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=550.108) [the Nested Loop, and then that comes out](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=552.2798750000002) [to the SELECT, so again, when you see this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=554.6897857142859) [Row ID Lookup one of the things that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=556.682) [could do potentially is whatever columns](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=559.8285384615385) [are missing you could add to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=561.8831818181817) [NonClustered index. Now that's not always](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=564.1798181818177) [possible, I understand that, and in a case](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=566.0070769230767) [where it's pulling 7, 8, 12 columns from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=568.3492307692302)[the heap, from the heap which has 300](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=571.2195000000003) [columns, right, then you're creating a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=574.1561111111112) [very wide, NonClustered Index, but here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=576.310777777778) [we're going to go against Orders, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=578.8638000000001) [a clustered index. So same query we were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=582.196923076923) [looking at before, but let's go ahead and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=584.520615384615) [run that, and if we look at our plan now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=586.6226250000001) [we have the same shape we had before,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=589.0838750000001) [we've got an Index Seek, and then we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=591.3640833333332) [a Key Lookup, so rather than a Row ID or a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=593.6534705882355) [RID Lookup we've got a Key Lookup because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=595.9537647058829) [again, that NonClustered Index didn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=598.3547272727275) [include one of our columns. It didn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=600.007) [include OrderDate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=602.8598888888886)[CustomerOrderPurchaseNumber, so it had to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=603.675) [go pull those from the Clustered Index. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=605.6641666666666) [we could change that NonClustered Index,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=608.8981249999999) [right? Highlight this whole thing, and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=611.5928749999998) [can include OrderDate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=614.066666666667) [CustomerPurchaseOrderNumber in there, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=615.079) [then if we rerun this, lo and behold,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=618.4492222222223) [we'll get rid of our Nested Loop entirely,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=623.6134285714285) [and we just have an Index Seek because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=626.150571428571) [this index now covers that query. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=628.827909090909) [doesn't have to go back to the Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=631.1101) [Index. Everything it needs is in that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=632.7988999999999) [NonClustered Index. Again, that's an easy](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=635.2157499999998) [win, but it's not always a possibility,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=637.7110000000002) [but doing so definitely reduces the amount](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=640.791) [of work that the optimizer and that SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=643.0245833333332) [Server have to do. So let's go ahead and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=645.4445999999999) [clean that up, and then we'll head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=4&mode=live&start=647.9183999999997)

[Merge Join and Sort](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live)

[If I had to pick a favorite join operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=1.945) [it would probably be the Merge Join, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=4.200142857142857) [know that sounds crazy, but that might](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=6.146846153846153) [tell you how much of a geek I am. I also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=7.3610769230769195) [have a favorite DBCC command, but that's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=9.713071428571434) [conversation for a later time. Anyway, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=11.632499999999999) [Merge Join. Let's talk about that for a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=13.619909090909092)[second. In the Merge Join you've got data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=16.199545454545458) [that comes from two ordered inputs and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=19.062999999999995) [they are joined, and the rows that match](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=21.578307692307693) [from those two ordered inputs are what are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=24.276769230769236) [returned, and the key here is order.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=27.244909090909086) [You're going to see that or you're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=30.078) [to hear that a lot of times here. Ideally,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=31.500500000000013)[with a merge join the data comes in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=33.35990909090909) [already ordered, meaning it's coming from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=36.85518181818181) [an index where the index has the data in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=38.923571428571435) [the order that the next operator needs it.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=41.611357142857166) [If that doesn't happen, then SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=45.06000000000002) [can interject a sort, which is something](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=47.871249999999996) [that's going to be noteworthy if you see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=50.23083333333332) [that before a merge join. Now in cases](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=52.53754545454544) [where we don't have unique data on both](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=55.007999999999996) [sides of the datasets that are coming in,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=57.967999999999975) [what you can see is a work table being](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=60.476571428571425) [generated, and you only see that if you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=62.994) [running statistics IO, but if SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=65.64563636363638) [doesn't know that for each side of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=67.99914285714284) [input there is only one value, then the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=70.71742857142853) [Merge Join is of a many-to-many type.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=73.665) [You'll see that in the properties of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=76.311) [plan, and because it doesn't know that for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=78.34053846153844)[sure it has to create a worktable to keep](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=80.35560000000001) [track of where it is as it's rolling](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=82.59540000000005) [through that dataset, and looking for rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=85.81450000000001) [that match. I mentioned that sometimes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=89.27600000000002) [you'll see a sort get injected, and this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=91.41607692307691) [is the sort operator here. Sort operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=93.71823076923074) [is very simple, right? It orders rows.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=96.4126) [Whatever is being pulled from the previous](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=99.21072727272728) [operator comes into the sort operator, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=101.99609090909095) [those have to be output in a specific](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=104.13907692307689) [order, and then pushed onto the next](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=106.54433333333333)[operator. This is a stop-and-go operation,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=109.12966666666664) [and what that means is that the data comes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=110.90592307692305) [into the sort operator and all of the data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=113.58035714285714) [has to be sorted before it moves to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=117.39057142857142) [next operator. I've talked before about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=120.47608333333336) [how operators are iterators and they go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=122.1465833333334) [row over row. A sort here is a bit of an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=124.78966666666669)[exception in that it can't pass rows to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=127.59364705882355) [the next operator until the sort has](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=129.2152941176471) [completed in its entirety. The other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=132.46480000000003) [drawback with the sort is that it requires](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=134.92745454545454) [memory. It's got to have some space to do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=136.65327272727265) [that sort operation and maintain that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=139.23946153846154) [list, which means it needs space in memory](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=141.0366) [to do so, and if it doesn't have the right](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=143.5613999999999) [estimate, in terms of how much data it has](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=146.58957142857147) [to sort, then it's possible that when it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=149.14235714285726) [asked for the memory that it needed to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=151.5308461538462)[sort those rows it didn't get enough](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=153.89716666666666) [because it's estimates were off, and in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=155.86474999999996) [that case what can happen is the data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=157.87333333333336) [spills to disk. Writing anything to disk](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=160.2040000000001) [and then having to read it back is a slow](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=162.19971428571424) [operation, so sorts are definitely](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=165.004) [something that we want to pay attention to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=166.98400000000007) [in a plan because they're stop-and-go,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=169.95363636363635) [because they need memory, and because of that possibility for spilling to disk.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=5&mode=live&start=171.73454545454535)

[Demo: Merge Join and Sorts](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live)

[In this demo we'll look at both merge](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=2.356) [joins and sorts. They're not operators you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=5.130545454545453) [will always see together in a plan, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=7.522636363636363) [after this demo you should understand why](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=10.2994) [you might. Alright, for our merge and our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=13.179200000000003) [sort demo we'll go back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=16.1005) [WideWorldImporters, and before I enable](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=18.199) [the actual execution plan we're just going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=20.467333333333336) [to verify what we have for the purchase](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=23.24569230769231) [orders and the purchase order lines table.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=25.815538461538466) [So let's just take a quick look here. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=28.50069230769231) [for PurchaseOrders we have our primary](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=32.20772727272727) [key, which is on PurchaseOrderID, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=34.84009090909089) [we've got three NonClustered indexes on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=38.41633333333333) [SupplierID, DeliveryMethodID, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=42.059) [ContactPerson, and then for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=43.576571428571434) [PurchaseOrderLines we have a primary key](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=45.6) [on PurchaseOrderLineID, and then we've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=49.444499999999984) [some NonClustered indexes, one which leads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=52.01909090909092) [on PurchaseOrderID. So if we enable our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=53.9587272727273) [actual plan, and then we run this query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=58.37650000000001) [which is just joining those two tables](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=63.12390909090909) [together, right, PurchaseOrders and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=65.40909090909088) [PurchaseOrderLines, and it's joining them](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=66.95044444444444) [on the PurchaseOrderID column, and again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=69.17155555555556) [on the OrderLines table we have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=71.86109090909093) [NonClustered Index that leads on this, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=75.013) [in this case all I have asked for is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=76.84323076923073) [PurchaseOrderID and PurchaseOrderLineID.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=80.91650000000001) [So if we run this query and we look at our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=83.421) [Execution Plan we'll see that we end up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=87.96546666666669) [with our Merge Join because the data here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=90.53285714285715) [is sorted. So we get a clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=92.36257142857147) [Scan against PurchaseOrders, and our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=95.72133333333332) [output here is the PurchaseOrderID, and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=97.82323076923078) [get an Index Scan against the NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=100.1025384615385) [Index on PurchaseOrderLines where our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=103.425) [output is also the PurchaseOrderID along](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=106.79166666666666) [with PurchaseOrderLineID, and because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=111.51714285714287) [those two indexes have that data sorted by](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=114.04090909090908) [PurchaseOrderID it can feed into the Merge](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=117.65254545454539) [Join and then into our SELECT. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=120.40949999999997) [sometimes what we'll see in this case is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=123.17333333333333) [the optimizer scanning a smaller index. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=126.83999999999996) [if we look at this plan it scans the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=129.9113846153846) [Clustered Index for PurchaseOrders, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=132.80384615384602) [depending upon the size of the table could](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=134.53123076923075) [be pretty large. So we've got Sales.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=137.58415384615373) [Orders, and we also have Sales.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=140.1315454545455) [OrderLines, so I'm going to take the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=142.2353636363637) [actual plan off for a second, just so that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=144.17759999999998) [this runs a little bit faster, and if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=146.565) [look at Orders and OrderLines for Orders](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=149.2476428571429) [our clustering key is on OrderID, and for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=151.9931666666667) [OrderLines our clustering key is on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=157.01383333333348) [OrderLineID, but again, we have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=159.7300909090909) [NonClustered index here that leads on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=161.92172727272725) [OrderID. So if we look at this query where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=164.3605714285715) [we're joining between Orders, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=168.093) [OrderLines, and again, we're joining here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=170.79899999999995) [based on OrderID, which is the primary key](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=172.93925) [for Orders, and there's a NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=175.03858333333332) [index that leads here on OrderLines, what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=177.20549999999997) [do we get when we enable the actual plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=179.83672727272727) [and then look at this output? So this one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=183.107) [returns about 265, 000 rows, which is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=186.2582857142857) [fair bit more than we saw before, and now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=188.86718750000003) [we see something different. So remember,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=191.44175000000016) [if we look at this query we have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=193.247) [NonClustered index on OrderID on the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=196.22150000000002) [OrderLines table, and our clustering key](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=198.8085) [is on OrderID in Orders, but if we look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=201.99950000000004) [this plan, and we look at the orders, we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=206.1098666666666) [see that rather than scanning that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=209.45463636363638) [clustered index it actually chose to scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=212.27845454545462) [a NonClustered index, which leads on an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=215.64600000000002) [entirely different column of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=219.11100000000005) [ContactPersonID. So the choice here is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=220.94099999999997) [that the optimizer said, it's way more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=223.61099999999993)[expensive for me to go through and scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=225.8943333333333) [the Clustered Index because in this case](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=228.11718181818182) [it's pretty big, and so it's going to scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=230.02245454545456) [a NonClustered. It can pull the OrderID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=232.5845384615384) [from that, you see that in the Output](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=234.621) [List, and then it does the Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=236.49619999999996) [against the NonClustered index on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=238.64281818181817) [OrderLines that leads on OrderID. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=241.17190909090903) [doesn't have OrderID in order here from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=244.05936363636363) [the Orders table, so it can't do a Merge](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=246.56790909090907) [Join. It has to do a different join, in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=248.99942857142858) [this case, it's a Hash. So sometimes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=251.1176153846154) [you're going to expect or you're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=253.28492307692318) [think, okay, I have the data ordered and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=255.55853846153846) [indexes in both tables, but it didn't use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=257.49330769230767)[them, and it can choose to not use them](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=259.58859999999993) [because it decides that it's more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=262.006) [expensive if it were to scan the Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=263.69661538461526) [Index, so it scanned a smaller index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=266.04954545454547) [because overall the amount of IO it had to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=268.71336363636385) [do there was less. Now if I change this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=272.19140000000016) [notice that I've left the FROM. I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=275.7312727272728) [to make sure we can see both of these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=278.4753333333333) [here. My FROM is the same, my JOIN is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=280.11933333333315) [same, my JOIN column is still OrderID, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=282.7481999999999) [you'll notice that in this first query I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=285.3071666666667)[selected OrderID from the Orders table,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=289.0198333333335) [and I selected OrderLineID from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=292.0099999999999) [OrderLines. Now the only thing that I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=294.58749999999975) [changed here is my OrderID is coming from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=297.7759999999999) [OrderLines as well, so both columns are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=301.34) [coming from OrderLines, but I'm still](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=304.04479999999984) [joining over to Orders, so just before I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=306.04571428571427) [run this we'll confirm, right, that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=308.29028571428563) [accessed both objects here, and we have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=310.39514285714284) [Hash Match. Now if I run this one we get a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=312.9214285714285) [different plan. Because I'm pulling both](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=316.96890909090905) [columns from the same table, and because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=318.97111111111116) [there's a foreign key constraint between](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=321.4348181818182) [the two tables, it can actually just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=324.16427272727276) [access OrderLines. It doesn't actually](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=327.3279090909091) [have to go to the Orders table, so a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=329.57654545454545) [simple rewrite of this, changing OrderID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=333.4936363636365) [to be from Orders instead to OrderLines](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=336.13181818181823) [works and becomes a much more efficient](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=339.330181818182) [query because I have a constraint in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=342.07191666666677) [place, a foreign key constraint in place.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=344.631) [So something interesting to think about as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=347.35909090909087) [you're creating your objects and defining](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=350.0138181818182) [your constraints. It definitely can affect](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=352.20545454545453) [query performance, in this case, for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=354.56177777777776) [better. If I scroll up, and I run both of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=357.5081428571429) [these separate from just, obviously, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=362.07885714285743) [differences in the plan, which we already](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=363.93445454545446) [know are coming, if I look at the amount](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=365.582) [of IO, right, I've saved a little bit in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=368.1590000000001) [terms of the IO. Here I had to do 149](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=370.6318) [reads against orders, but here I can do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=373.14779999999996) [466. So your constraints are important to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=376.29423076923064) [the optimizer and how it makes decisions,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=379.378) [and they can definitely affect](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=381.93084615384635) [performance. Now we're going to create a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=383.75430769230803) [copy of the Orders table, and also a copy](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=385.6869999999999) [of OrderLines, and we're going to make](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=388.039) [some slight changes to our key. So this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=389.7959999999998) [just going to be a copy first as a heap of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=392.15100000000007) [the Orders table into Copy\_Orders, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=395.26400000000024) [we're going to put the primary key on this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=397.2384615384616) [Copy table, still on OrderID, and it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=400.6148461538464) [ascending. So once that gets created, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=404.6045714285714) [now we just have one index, it's just our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=406.70900000000006) [Clustered Index on that clustering key of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=409.5181818181818) [OrderID. Now we'll make a copy of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=412.56827272727264) [OrderLines as Copy\_OrderLines, and this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=415.96349999999995) [going to be a little bit different. I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=418.923) [going to kick this off and talk through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=420.1132857142859) [it. So here our primary key is OrderID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=422.33849999999995)[descending and OrderLineID descending, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=427.6684999999999) [this is a little bit different than what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=429.83854545454545) [we had originally. We're switching this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=432.072) [around. So OrderID is descending,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=434.16085714285725) [OrderLineID is the second one. It is also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=435.97433333333333) [descending. So this is the same query we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=438.9725384615384) [had before, but now we're going against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=442.0833076923076) [the copy tables, right, so Copy\_Orders,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=444.89266666666674) [Copy\_OrderLines. We're joining still on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=447.33066666666684) [OrderID, and I've asked for OrderID from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=449.09118181818184) [Orders, and OrderLineID from ID, so I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=451.461) [expect that it's going to access both of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=454.03646153846165) [them, but think about what it's going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=457.0168) [try and do in terms of a merge. Is it able](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=460.10799999999983) [to do the merge? It is because both of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=464.0946250000001) [those are ordered based on OrderID, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=467.1765625000003) [remember Orders was created ascending, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=471.2714000000001) [OrderLines was creating descending, and so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=474.65240000000006) [in case you're not aware, an index is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=477.29060000000015) [really just a linked list of pages, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=480.12230769230774) [those pages point to each other, and so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=482.67906666666664) [one of the things to pay attention to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=484.91159999999996) [here, I'm going to highlight this, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=486.86) [going to use F4, so that we get some more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=487.956) [information, and if we scroll down here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=490.63649999999996) [you'll see that it says, Ordered is True,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=492.906) [which is great, and then notice that it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=495.426) [says here Scan Direction FORWARD. Now I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=498.4395) [had created the Clustered Index on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=501.272)[OrderLines to be OrderID descending and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=503.564) [OrderLineID descending, and when we look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=506.19533333333334) [here, and we look at the Scan Direction](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=509.5053333333334) [notice that it says BACKWARD because it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=511.9771538461537) [can read through that index backward and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=514.0901538461538) [still do a Merge Join because the OrderIDs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=517.3602307692304) [are still ordered then. So just be aware](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=521.4360000000001) [that you could read forward or backwards](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=525.2351428571429) [through an index. Now we'll close this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=527.8236428571431) [Properties window, so we get some real](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=529.596) [estate back, and now we're going to drop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=530.75625) [this constraint, so we're going to alter](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=532.7877692307688) [our table, we're going to remove the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=534.6347999999999) [constraint entirely. So this puts this to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=536.3693999999998) [a heap, right? We don't have any indexes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=538.4867647058824) [at all on this. So if I rerun this same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=541.0815882352941) [query between these two, this is where I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=543.8874) [like to play guess what the optimizer's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=545.8985999999999) [going to do. I no longer can guarantee to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=548.0146666666664) [SQL Server that the data's in any order](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=550.4238571428574) [because it's a heap, so it can no longer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=552.393) [do a Merge Join. It has to change](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=555.1040769230768) [entirely, and this query becomes much more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=557.4787142857142) [expensive, you'll notice. This runs in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=559.5257142857141) [Parallel. We haven't talked about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=561.1943999999999) [Parallelism yet, but the circles with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=562.5133999999996) [arrows indicate that that's occurred](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=564.4123636363639) [because this has become more expensive. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=565.7837272727278) [has to scan the Orders table and get all](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=568.2355384615382) [of that information, and then it has to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=571.3884615384615) [scan the OrderLines table, and then it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=573.8383076923075) [pushes that into a Hash Match, a different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=575.6812666666668) [type of join. It can't do the merge. If I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=577.5298000000006) [run this again, and I force it to do the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=581.4631764705881) [merge; I'm saying, nope, I know better](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=586.092) [than you, this is what I want you to do,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=587.5785000000002) [if we look at this plan it will do what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=589.768125) [have asked. Notice that it still runs in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=592.34625) [Parallel because it's a more expensive](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=594.6975000000002) [query, and in order to take this data from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=596.58) [the heap and order it what it does is it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=599.4359999999997) [injects that Sort, so it says, okay, I'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=602.3853333333335) [order the data like you said, but it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=604.4760000000005) [going to come at a cost to you. This is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=606.4703846153849)[more expensive, and if we look at this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=609.035) [Merge Join you'll notice that it's a Many](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=611.5469999999997) [to Many. Down toward the bottom there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=613.574769230769) [you'll see Many to Many is True because it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=615.0948461538455) [doesn't know that the data in Orders is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=617.7628571428569) [unique based on OrderID. Now if I recreate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=620.4540000000001) [the Clustered index on Orders based on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=623.8660000000003)[OrderID, but I don't define it as the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=626.6436428571427) [primary key, which means I'm saying, I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=629.723071428571) [not saying specifically that it's unique.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=632.6454999999999) [If I run this one more time, same query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=635.183) [here we'll see that it still decides to do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=638.9863999999999) [a Hash Match rather than a merge join.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=642.2370909090909) [Even though the data's ordered, it doesn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=644.144) [know that the data is unique in orders](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=646.2965) [based on that OrderID, so it says, I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=648.766357142857) [going to go with a Hash Match instead of a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=651.2526428571423) [Merge with a Many to Many because that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=653.6960666666666) [Hash Match is less expensive in its mind.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=655.423) [So let me drop that constraint now on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=659.717) [OrderLines, and on OrderLines we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=664.4483333333332) [to recreate this based on OrderID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=667.7946666666666) [ascending, and OrderLineID ascending. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=670.7366666666663) [we'll drop that, we'll recreate the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=673.0702000000001) [Clustered index, we'll run this again, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=675.835) [at this point I haven't guaranteed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=678.0225) [anything in terms of any uniqueness, so we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=679.95) [still see that Hash Match. It's going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=682.8700000000001) [scan the Orders table, it's going to scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=685.8847499999999)[OrderLines, it's going to output, it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=689.0574166666663) [going to match based on the OrderID, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=691.1923333333333) [then push out the rows that match. So if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=693.9109333333333) [don't tell SQL Server what rows are unique](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=696.7602666666669) [it can choose a more expensive option in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=699.849846153846) [terms of how to join that data. And again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=703.749538461538) [here if I force the merge it can do that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=708.3249999999997)[but it still runs in Parallel because it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=713.1946363636364) [expensive, and here it's going to be a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=716.3211818181819) [Many to Many is true because it doesn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=718.5002666666663) [know what level of uniqueness, if any,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=720.544) [exists. So we'll go ahead and drop those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=724.7448750000003) [tables, and we'll talk just a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=727.4139999999999) [here about our Sort. So how else can SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=729.8322307692307) [Server order data? Well, if we select here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=732.9753076923075) [from Orders and OrderLines, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=735.4359166666669) [joining on OrderID, and here I've said](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=737.1314166666672) [SELECT \*, so I'm not even asking just for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=739.3635714285715)[specific columns, this is an anti-pattern](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=742.1938333333333) [in terms of coding where I've asked for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=743.578833333333) [everything to come back, and if we look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=745.7165714285715) [this output, and this takes a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=748.667285714286) [longer because we're returning more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=750.9942727272727) [columns, and it has to scan this Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=752.387) [Index against SalesOrder, and then against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=756.8880909090906)[SalesOrderID it does a scan, and then it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=759.4174999999999) [has to sort that data into Order based on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=761.6614999999996) [OrderID, and then it has to do the Merge](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=764.9213999999998) [Join here because this table, if you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=768.549) [remember OrderLines, has a NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=771.7627777777781) [index on OrderID, but I asked for all of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=773.6333846153847) [it's columns, so it's going to scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=776.4905384615386) [through it, it's going to order it using](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=778.6116923076925) [the Sort, and then it goes through with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=781.0026666666666) [the Merge Join. Now it knows Many to Many](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=783.2959999999997) [here is False. It knows that the rows are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=785.6055999999996)[unique, but having to scan and then sort](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=787.78) [takes a lot of work. Now if I run a query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=790.7941538461539) [that just asks for, let's say, the TOP](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=794.6516250000003) [1000 rows from SalesOrderLines. It's just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=797.2831250000007) [going to pull back the top, and we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=799.3742) [talked about this a little bit before](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=802.0049230769231) [where it doesn't scan the entire Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=803.6881538461539) [index here, it just scans until it pulls](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=805.5855384615386) [out the top 1000 rows, but typically when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=808.0803076923082) [people are asking for data they like to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=810.8580000000002) [see it in a particular order. So let's say](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=813.6279999999999) [that I decide to ORDER BY Description.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=815.9410000000005) [Well even though I've only asked for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=817.8954999999999) [top 1000 rows, because I want it ordered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=820.366166666666) [in a particular way there has to be a Sort](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=823.2369999999999) [in here. So this plan goes in Parallel,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=826.7317999999999) [you can see that. It does our scan, it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=829.2192666666664) [scans through the entire object, it sorts](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=832.6368461538461) [the data, and then here it pulls out the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=835.6802307692308) [top 1000 rows. In this case, if you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=838.8582727272726) [sort the data client-side rather than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=842.6557692307692) [within SQL Server you can avoid that sort](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=845.4245384615385)[being injected into the plan. So here for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=849.2984999999996) [this query against SalesOrder I'm not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=852.7112727272728) [asking for everything at this point, I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=854.6618181818184) [just asking for three columns, and so this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=857.3684999999999) [query I don't have any OrderBy. So for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=860.5896666666666) [this query I just have a scan of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=863.7634615384615) [Clustered Index. Now if I change this to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=867.5635384615381) [say, okay, let me order by the CustomerID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=870.3611999999997) [what do we get here? We get our Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=872.965466666666) [Index Scan still, but now I've said I need](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=876.4492857142858) [it ordered based on CustomerID, so we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=879.6646428571429) [see an OrderBy CustomerID Ascending at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=881.9223571428573) [bottom, and then it comes out to our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=884.2456153846153) [SELECT. Now we know we have this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=887.198846153846) [NonClustered index that leads on Customer](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=889.6246153846155) [ID, so what happens if I say, okay SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=891.681230769231) [Server, I want you to use this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=896.1199999999995) [NonClustered index? And it will. It will](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=899.7039999999992) [scan that index, and it's ordered by](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=902.5506923076923) [CustomerID, so it comes out in the right](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=905.1024615384616) [order, but it has to do a lookup over to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=907.512235294118) [the Clustered index to pull the other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=910.434)[columns that I've asked for, to get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=912.6314166666671) [OrderDate and ExpectedDeliveryDate. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=915.1058) [ends up implementing this as a Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=916.6915833333333) [Loop, which we've seen before, but if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=918.2916666666663) [compare the cost of this you'll see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=921.1582857142856) [it's more expensive, which is why it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=925.0628571428568) [doesn't choose to use that NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=927.9852499999997) [index. Right here the cost is 4. 4. In](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=930.3207499999994) [this case, our cost is 16, way more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=933.6779999999999) [expensive, and in terms of the IO that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=936.6204) [have it's 835 IOs to look at the Orders](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=939.8442000000001) [table, but it's 258, 000 where it goes to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=942.9520000000002) [the NonClustered index, and then does the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=945.9670000000006) [Key Lookup over against the Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=949.2881538461539) [index. A good way to address this would be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=952.2743076923078) [to add our NonClustered index to support](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=954.7674285714285) [it, which leads on CustomerID, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=956.5426666666667) [has the other two columns that we want, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=958.4933333333337) [I'm basically just creating a brand new](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=961.1099230769229) [index here to support that, and now if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=963.212615384615) [select this and run that query my plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=967.3657999999997) [just does a scan against that NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=971.0427777777777)[index. It doesn't have to do a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=973.1832222222218) [NonClustered index scan over to that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=975.3060769230772) [lookup. So if we run all of these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=977.1231538461543) [together, so our original query where we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=980.0059999999997)[looked at the Clustered index, the second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=982.586) [query where we used the NonClustered index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=984.7921666666665) [that then did the SEEK over to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=987.1132727272728) [Clustered, and our last one, if we look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=990.0943636363639) [all of these together, and we look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=993.025) [change, right, here's our three different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=995.915) [plans that we've looked at, and in terms](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=997.9069999999999) [of our IO we go from the 835 reads, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1000.7384999999998) [258, 000, which is astronomical, down to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1004.4972499999993) [the 213 when we have the index that covers](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1006.9247692307692) [and supports that query. So in some cases](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1010.0345) [that can definitely provide a benefit with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1013.4624999999999) [indexing. There's always multiple](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1016.4279999999999) [considerations there. Our last option](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1018.1079999999997) [here, our last query to run is same three](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1019.7794615384615) [columns against Orders, but this time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1022.2738461538462) [we're going to say by CustomerID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1024.0314545454546) [descending, so rather than ascending,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1025.808) [which is the default, and we still have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1028.0002222222224) [the same plan because again, it can read](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1030.7678461538462) [through that index forwards or backwards,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1032.7955384615389) [so if we happen to F4 here, and we look,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1035.2169166666672) [scroll down, and we look at the Ordered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1039.17925) [True, and Scan Direction Backwards, so it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1041.6519166666665) [can read through that backwards. Alright,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1044.475545454546) [we'll clean up from this, and then we'll head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=6&mode=live&start=1047.571)

[Hash Join](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live)

[The last Join operator is the Hash Join,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=2.039) [and the Hash brings in two unordered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=4.968714285714285) [inputs, so the Merge, that data had to be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=7.502000000000001) [sorted, with the Hash it does not, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=10.526000000000003) [what happens with the Hash is it takes in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=12.970866666666668) [those unsorted rows or unsorted inputs,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=15.682076923076924) [and then it finds the rows that match, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=17.488538461538464) [that's what it outputs. Now with a Hash](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=20.222000000000005) [Join you're typically going to see larger](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=22.694000000000013) [result sets, and this is a more expensive](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=25.02491666666667) [Join operator because what happens is for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=27.94609090909091) [that outer dataset that comes in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=31.607727272727285) [operator builds a Hash table, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=34.421) [based on the key value, so every row gets](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=36.598) [hashed, and is being held in memory, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=39.93561538461537) [then for every row of the inner dataset](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=43.030499999999996) [that comes in the Hash gets calculated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=45.34649999999997) [there, and then it probes into that table,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=47.7872)[that Hash table that it built, looking for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=51.76) [matches, so this is efficient when you've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=55.30933333333332) [got large datasets. It's more efficient](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=57.96330000000001) [than, say, a Nested Loop, but it's a red](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=59.721900000000026) [flag. It's something to watch for when you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=62.431) [see it in a plan because it's possible](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=64.7512857142857) [that if the estimates aren't correct for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=66.78442857142852) [what the Hash needs that can spill to disk](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=68.78661538461537) [just like our Sort operator can. It is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=71.74346153846149) [also a stop and go operation, in that that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=75.0599230769231) [Hash table has to be built before the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=78.79819999999998) [inner set can start being hashed and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=81.93739999999994) [compared against the values. So the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=84.79571428571427) [benefit here is that that data doesn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=86.94307692307693) [have to be ordered, and we can read large](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=88.4448461538462) [result sets, but it means that we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=90.76800000000003) [reading large result sets. If SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=92.81900000000007) [hasn't estimated memory properly, then we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=95.77660000000003) [could possibly spill that data out to disk.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=7&mode=live&start=99.553)

[Demo: Hash Join](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live)

[We'll look at our final Join operator in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=2.065) [this demo, the Hash Join. We're back with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=5.652692307692307) [WideWorldImporters. We'll go ahead and SET](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=8.881700000000002) [STATISTICS IO ON, and also include our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=10.855100000000007) [actual plan, and this is the query we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=13.357285714285714) [going to work with here for a little bit,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=16.255) [so it's against StockItems and OrderLines,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=18.90653846153845) [and it joins based on StockItemID. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=21.188250000000004) [we'll just run this first query and look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=24.9445) [at what we get for the plan. We've got a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=28.516500000000004) [Hash Match, which is what we've been](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=32.261250000000004) [talking about, and what we have is for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=33.70616666666669) [build we have a Clustered Index Scan where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=36.51299999999999) [the output is the StockItemID, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=39.249) [StockItemName, and UnitPrice from the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=42.444600000000015) [StockItems table, so that drops into this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=44.97375) [Hash Match where it builds that table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=47.765) [based on the Join column, which is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=50.45774999999999)[StockItemID, and from our Columnstore](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=53.3850833333333) [Index Scan we get the remaining columns,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=55.166272727272734) [the StockItemID, OrderID, OrderLineID, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=57.643) [PickedQuantity. So this is a simple query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=60.83633333333333) [alright, against two tables with a Hash](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=63.59392307692307) [Match, and we have a smaller dataset here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=66.066) [coming into the top, which is what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=69.388)[expect. So just for fun, let's see what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=72.27014285714287) [happens if we reverse that. So we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=74.7124285714286) [to run DBCC FREEPROCCACHE to remove](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=77.42349999999998) [anything from cache. This is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=79.524) [sledgehammer approach, right? Really not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=81.31133333333335) [for production, but in a demo environment](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=82.991) [that's fine, and our second query has the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=85.742) [OPTION FORCE ORDER at the bottom, so if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=88.49300000000001) [run both of these we're going to get the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=91.44087499999999) [same shape in terms of the plan, and that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=94.38949999999997) [we're going to have a Hash Match for both](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=96.95766666666664) [of them, but notice that for the second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=99.22146666666659) [query, the dataset for the build is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=102.00376923076921) [output from OrderLines, and this is a lot](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=104.89133333333334) [more data. This is 265, 000 rows, whereas](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=107.76466666666667) [what we had coming out of the StockItems](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=110.9674285714286) [table was only 227. So in terms of IO, if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=114.28) [we look at our Messages tab you'll see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=117.81125000000006) [that the IO is the same, right? So what do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=121.27355555555556) [we see here in terms of how expensive one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=126.6822) [is over the other, and why does it really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=128.80079999999998)[matter? Well, if you look at the second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=130.9894285714285) [query you can see that the estimated cost](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=132.966) [is a little higher, right, 58% versus 42%.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=134.7296923076923) [So if we look at our cost here for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=136.89860000000002) [Subtree it's 0. 75, for that second query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=140.45393333333342) [where we forced the order it's 1. 04. I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=143.451) [don't really see a huge difference here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=146.86575) [right, but notice the Memory Grant; 29,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=149.43299999999996) [584 compared to 3512. So the difference in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=153.39200000000002) [changing what dataset is for the build](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=160.0373333333334) [doesn't always show up in terms of IO, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=163.03571428571428) [maybe not even really show up as cost, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=166.21346153846153) [there's a big difference in terms of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=168.8006153846154) [Memory Grant when we ask for that larger](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=171.42876923076923) [dataset to be the build. So this is why](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=174.254) [we're always looking to make sure that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=177.0047857142857) [input into that Hash Match that what comes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=179.47176923076924) [into the build is the smaller dataset. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=181.97515384615392) [how could we address this Hash Match](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=185.05971428571422) [overall? Let's take our actual plan off](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=187.92821428571415) [and look at the indexes for these two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=190.3624) [tables. So on the OrderLines table in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=193.06160000000003) [terms of StockItemID, which is the column](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=195.47899999999998) [we're joining on, we've got a NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=197.8505) [index on just that, but we also have this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=199.8909999999999)[NonClustered index, which is on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=202.7503333333333) [StockItemID and PickingCompletedWhen, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=204.44366666666656) [includes OrderID and PickedQuantity, so if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=206.48566666666667) [we come back here and we look at our query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=209.6788823529412) [we can see that we've asked for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=211.9982941176472) [PickedQuantity, StockItemID, OrderLineID,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=214.90966666666665) [OrderID. Hmm. Let's see here. Let's look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=217.53716666666665) [at our output. Our clustering key is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=221.8863333333333) [OrderLineID, so just as a reminder here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=225.6360909090909) [in this NonClustered index we've asked for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=229.159) [OrderID and OrderLineID is also going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=233.69627272727277) [be part of this index. So everything we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=237.3915882352941) [need is in that NonClustered index. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=240.33182352941176) [over here this isn't a huge table. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=242.94050000000001) [clustering key is StockItemID, and so it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=246.16850000000008) [can access that, and again, there was only](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=248.95684615384616) [227 rows on this table, so it's pretty](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=252.1125384615385) [small. So let's see what happens if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=255.37699999999998) [tell SQL Server, well, you've got this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=257.3865) [NonClustered index here that has](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=258.986) [everything we need, why don't you use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=260.9125384615386) [that? Let's see what we get. And so SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=263.6096923076926) [Server says, alright, I'll do what you've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=269.65557142857153) [asked, and now we get a Merge Join because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=274.1281818181818) [remember, that NonClustered Index on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=276.17281818181806) [OrderLines led on StockItemID, so it can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=277.9599999999999) [pull all the columns that we need from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=280.69) [that NonClustered, and the data's ordered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=283.34279999999984) [with the same column StockItemID as the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=285.2656363636364)[Clustered, so that can feed right into a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=287.47) [Merge Join. So why didn't it do that to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=290.23400000000015) [begin with? What happens if we compare](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=292.8648750000001) [those two? So this is the original query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=294.8047500000002) [right here. Here is the second query where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=297.48115384615386) [we've asked it or where we forced it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=300.2168461538461) [really to use that NonClustered index, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=302.29561538461513) [we're going to look both at the plan and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=304.3748461538462) [the IO information, so here's our first](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=307.49438461538483) [query. Hang on, I'm going to click over to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=310.4304285714286) [Editor, and then I'm going to click back](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=311.73399999999987) [to the Execution plan. There we go. So the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=312.944) [top one with the Merge Join, estimated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=315.5072727272727) [cost 72, much higher than our second query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=317.6677272727273) [with our Hash estimated cost of 28%. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=320.6743846153848) [the Merge Join, the memory requirement for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=323.758) [the Merge Join, there really isn't one,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=325.8299999999999) [and if we look at our Hash, again, there's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=327.7933333333333) [that 3512 that we saw earlier, so where's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=330.39507692307694) [the big difference here? It's in the IO,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=334.00369230769235) [right. This merge had 1400 reads against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=337.77107692307686) [order lines, whereas with our Hash we only](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=341.2064615384614) [had 523. So this query that uses the Merge](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=344.4770000000001) [Join, more expensive because of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=347.871) [additional IO that it has to do in order](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=349.9229999999999) [to use that NonClustered index. So what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=353.6712222222222) [happens if we make this NonClustered index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=356.90792307692305) [just exactly how I want it, and what I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=359.31915384615377) [need specifically? Well, let's see. Let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=363.5975000000001) [run this, and this time instead of doing a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=366.758) [FREEPROCCACHE I'm going to just throw an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=369.0979999999999) [OPTION RECOMPILE on here, so that it will](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=370.7649230769231) [consider that new index that I created,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=372.6) [and it doesn't. It goes to the Hash Match,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=377.56859999999983) [and it still uses this Columnstore, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=381.8654999999999) [remember, the Columnstore data is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=384.5591) [organized differently on it's pages, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=387.1895999999999) [that data is compressed, whereas the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=390.134) [NonClustered index that we just created is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=392.6540000000001)[RowStore, and we didn't compress it. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=396.1735454545456) [what happens if we create that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=399.7018461538462) [NonClustered index, a second copy of it,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=401.5789230769233) [and this time we compress it? So you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=403.7051666666667) [see I've got DATA\_COMPRESSION = PAGE. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=405.6985) [maybe my issue is there's too much IO it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=408.4416923076923) [has to do when it's not compressed, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=412.932) [let's create that, run that query again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=414.9559999999999) [with my OptionRecompile, and now, ah ha.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=419.1600909090908) [This is what I want to see, right? This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=425.189) [second input is the Index Scan against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=428.0587142857144) [compressed copy that I created. So there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=431.04462499999994) [comes a point where it may choose a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=434.2078333333333) [Columnstore index, which has more columns](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=437.5831666666667) [than it needs because the data is actually](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=439.76733333333334) [smaller than a NonClustered index, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=442.448) [has just what it needs, but here because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=445.1305454545453) [I've compressed it it will make that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=448.25421428571434)[choice to choose it. So if we do a final](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=450.3267142857145) [compare, if we look at our query, and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=453.2471176470587) [force it to use that Columnstore index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=455.8512941176467) [right here, our second query was that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=458.9670833333332) [original NonClustered that exist, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=462.519) [third query, the NonClustered that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=465.51971428571443) [created, and then the last query we let](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=467.75446153846156) [the Optimizer choose where it should](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=469.8233846153846) [choose that NonClustered that was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=472.5442727272728) [compressed. So let's just look at this one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=475.00654545454563) [last time for the output, so we'll have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=477.5341333333333) [four query plans, and we'll also take a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=479.86) [look at the IO to see how much IO SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=483.74450000000013) [Server had to do. Alright, so here's our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=488.3268571428572) [first one with the Columnstore, and for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=491.1182857142859)[all of these, right, I'm verifying that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=493.71200000000005) [our input into the Hash, the outer input,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=496.50733333333346) [is that Clustered Index Scan against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=499.54907692307694) [StockItems. That's not changing. Here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=501.7921538461539) [we're using that original NonClustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=503.60919999999993) [that exists, and that's probably the most](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=505.41319999999985) [expensive in terms of the cost estimate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=507.50099999999986) [right, 38%. Scroll down here. Here is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=509.8775) [non-compressed index, and then at the very](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=515.0735) [bottom down here we have our Compressed.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=518.394846153846) [If we look at the IO here we get five](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=521.512) [hundred, 1400 against that original](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=525.3848571428566) [NonClustered, 700 against the first row](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=527.4487272727273) [store index that I created, and then down](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=530.5370909090913) [to 420 when I compressed it, so that 420](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=533.8760000000002) [just a little bit under that 523, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=536.7560000000007) [why in the end it ended up going with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=539.118411764706) [that. Remember that compression's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=541.332941176471)[available in Enterprise edition. It's also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=543.0172857142857) [available in Standard edition for SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=545.7974999999999) [Server 2016 SP1 and higher, so there's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=548.3849999999998) [definite benefit not just in terms of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=551.5746153846152) [disk space that you save, but also in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=554.5038461538455) [terms of what the optimizer knows about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=557.4503076923078) [how much space those indexes consume on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=560.0096666666667) [disk, so that can definitely provide a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=562.4433333333334) [little bit of benefit, a little bit of a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=564.3583076923077) [boost for some queries. Let's go ahead and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=565.9312307692309) [clean up those indexes we created, and we'll head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=8&mode=live&start=568.0053333333335)

[Compute Scalar](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live)

[The last operator that I want to cover in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=2.149) [this module is the Compute Scalar](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=4.525642857142857) [operator, and the Compute Scalar evaluates](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=6.4296) [an expression that's passed into it, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=9.9312) [the output from that is a scalar value,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=12.976133333333335) [and a good example of where you see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=15.564400000000004) [Compute Scalars is with something like a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=18.59923076923077) [function. Now Scalar's are a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=21.489153846153844) [tricky because the costing for the code](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=24.032461538461533) [within that expression that's evaluated,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=26.518) [particularly when that's a user defined](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=29.030222222222214)[function, cannot exist, and so as a result](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=32.00523076923077) [the CPU cost that gets estimated can be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=35.86615384615386) [really low, and that's totally misleading](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=39.1980909090909) [to the optimizer. Sometimes that's very](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=41.459) [trivial, but sometimes that low estimated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=44.755399999999995) [cost can be very problematic in the plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=47.98100000000001) [and it's really tricky because the plans](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=52.093)[don't always show the objects that are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=55.06450000000002) [accessed, so your function can reference](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=57.99383333333333) [tables, and when you look at the plan for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=60.41433333333332) [the query those tables don't actually show](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=63.89415384615383) [up within the query plan. So sometimes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=66.50676923076924) [it's very hard to understand what's really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=68.97836363636367) [going on, and you have to dig into not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=71.31546153846153) [just plan, but also the query to make sure that you understand what's being called.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=9&mode=live&start=73.96353846153842)

[Demo: Compute Scalar](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live)

[For our final demo in this module we will](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=2.382) [look at the not always so innocent Compute](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=4.7838) [Scalar. It's an operator that's easy to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=7.188636363636363) [overlook in a plan, but after this demo](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=10.001363636363637) [you'll understand why you may have to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=12.466999999999995) [start doing a little bit more research](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=14.406) [when you see it. Alright, last demo for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=17.674363636363637) [this module. Back to WideWorldImporters,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=21.707333333333338) [and we'll enable our execution plan again.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=24.414) [So the Compute Scalar, as I've said, can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=28.377) [be pretty trivial or it can be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=30.61242857142857)[significant, so I'm going to run SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=32.7025) [COUNT against Sales Orders, and I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=35.596999999999994) [to run SELECT COUNT\_BIG against Sales](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=38.3853) [Orders, and this is just an example here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=40.65390000000002) [where you see it as not such a big deal.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=42.7305294117647) [So the first query is just my SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=45.157) [COUNT, and there's a Compute Scalar in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=46.84869230769233) [here, and you may or may not know that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=48.58414285714286) [COUNT\_BIG is used implicitly when you do a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=51.635785714285724) [count, and then what happens behind the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=54.16383333333332) [scenes is it then converts it to an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=56.279) [integer, which is what we see here with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=58.64486666666665) [this Compute Scalar. So I look at this and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=61.05383333333334) [I think, this isn't such a big deal,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=64.10333333333334) [right? If you look at the cost between the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=66.06714285714284) [two of them they're both 50%. There's no](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=68.1029090909091) [big deal. Let's see, 0. 255 here, and I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=70.67018181818187) [got 0. 255 here, so the Compute Scalar](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=73.74193333333332) [that I see here is not that big of a deal,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=76.519) [but now let's look at a function. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=80.96605555555557) [here's a function that goes against Sales](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=84.18391666666668) [Orders and Sales OrderLines. It joins on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=86.89933333333336) [OrderID, and we're inputting into this a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=89.7789090909091) [specific SalesPersonID, and based on the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=92.87736363636367) [ID that we put in we want the query to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=94.78766666666664)[COUNT the number of DISTINCT StockItemIDs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=97.723) [that they have sold, so we'll create this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=100.51419999999997) [as a Scalar User Defined Function, so just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=103.72238461538461) [this dbo. CountProductsSold, declaring I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=106.41715384615384) [passing in the ID. Within here I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=109.20300000000002) [declaring a SoldCount, which is going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=112.74953846153845) [be my output. So let's go ahead and create](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=115.3104615384615) [this function in the WideWorldImporters](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=119.62299999999998) [database. So now if I run a query against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=122.30216666666662) [the People table, and we're asking for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=126.26093333333338) [FullName, which we're going to display as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=129.5474) [the SalesPerson, and then we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=131.58720000000008) [put our function in here, and that output](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=133.67642857142854) [is going to be NumberOfProductsSold.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=136.08671428571424) [There's a different way I could write](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=137.254) [this, but this is just a simple example of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=138.7876923076923) [a function that you'll see in a query, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=140.89992307692313) [we're just saying WHERE SalesPerson equals](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=144.44615384615392) [one. Alright, so we get back 10 rows, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=147.28830769230782) [if we look at our plan we see we've got an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=150.61649999999992) [Index Seek against a NonClustered index,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=154.33684615384615) [and then a Key Lookup against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=156.06853846153845) [Clustered index, Nested Loop, and we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=158.07118181818183) [this Compute Scalar in here. Now where in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=160.05027272727273) [the world am I accessing my orders and my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=163.02853846153846) [order lines table. I don't see anything](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=166.16700000000003) [that references that, and that's because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=168.0990000000001) [it's all hidden within this Compute Scalar](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=170.06809090909093) [with a cost of 0. So let me see if I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=172.548) [find it with STATISTICS IO, right, because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=176.43952941176485) [STATISTICS IO shows me the tables that are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=178.70845454545454)[accessed, so same plan, nothing changed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=181.2982727272727) [here, and no, all I see is the access](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=183.76449999999994) [against the People table. I don't see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=187.621) [anything for Orders or OrdersLine, so how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=189.89663636363633) [do you find these? Well, one thing you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=192.23778571428574) [do is you can use Extended Events or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=195.36014285714293) [Profiler, and this is the syntax to CREATE](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=197.93199999999993) [the EVENT SESSION, and we'll go ahead and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=200.43153846153845) [I'll print that so that you can see it,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=202.89984615384614) [and then we're also going to have it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=204.95257142857145) [executed, so that it will start right](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=206.26228571428578)[away, but we're just creating an EVENT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=207.61169230769224) [SESSION, and we're going to have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=208.995) [sp\_statement\_completed and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=211.58549999999997) [sql\_batch\_completed for our particular](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=212.449)[session. Notice I'm filtering on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=214.9314) [session\_id 51, that's what we're connected](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=216.9564) [with, and it's going to write out the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=219.063) [output to C:\temp. So if we come here, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=222.25209090909095) [we're going to say, ALTER the EVENT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=224.90085714285712) [SESSION, and we'll start that up. Good to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=226.59585714285708) [go, and then we will run our query again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=229.43079999999992) [and then we'll go ahead and stop, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=232.97166666666666) [after we stop that if we open this up and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=237.59299999999993) [we go to our Temp folder, here's that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=242.91346153846158) [information, we'll drag that in, and now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=246.62238461538473) [let's display in here both our text and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=249.56614285714284) [for our statement\_completed. We'll put the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=252.873) [statement in there as well. So this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=257.0026363636363) [specific to our event session. I'm not so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=261.0457142857143) [worried about that. This is for our plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=262.6502857142858) [Here's what I'm really interested in.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=264.83881818181806) [These are the queries from our function,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=266.743) [and if we add duration, and we add logical](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=269.19708333333347) [IO you can see that in the Extended Events](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=272.53657142857145) [output we can see the individual queries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=276.10635714285723) [that are run, and because of this scalar](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=278.3754615384615)[function it's running a query for every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=281.078) [single entry that there was. So this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=284.7039999999998) [executes 10 times, so we have 10 queries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=288.0833846153846) [against that table, which don't show up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=291.2409230769231) [anywhere in our plan. We can find them](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=293.7085) [here in Extended Events. You're probably](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=296.2755) [not running this type of event session all](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=298.1381666666667) [the time, but if you're running 2016 you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=300.4548333333333) [can use this new DMO,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=303.9423636363638) [dm\_exec\_function\_stats, which I had](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=306.366) [mentioned earlier. So if we run this we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=308.4793333333332) [can say, oh, here's our function, here's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=311.88240000000013) [how many times it's executed, and here's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=314.61986666666695) [what we have in terms of, let's say,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=316.8377692307692) [average IO and max IO. So this gives us a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=319.135) [little bit more insight into what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=322.1535714285716) [functions are running, which can show up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=324.05746153846155) [in our plans as these Compute Scalars,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=326.495076923077) [which really don't have a cost of 0,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=328.84909090909093) [they're really a lot more expensive, as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=331.412) [you can see from that output. Now what's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=333.66115384615387) [really interesting here is that if I ask](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=336.17669230769235) [for the Estimated Plan, so if we look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=338.52746153846175) [Display Estimated Plan here what we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=341.81780000000015) [see in the bottom half is the access](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=344.628066666667) [against those tables. So this Compute](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=348.88500000000005) [Scalar is actually this function down](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=351.83480000000003) [here, this dbo CountProductsSold, and here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=354.28040000000004) [we can see it. So I've said before that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=356.1380000000001) [the estimated and the actual plans are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=358.77133333333336) [typically the same, but not always, there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=360.834) [is an exception, here's an exception, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=362.9381999999998) [again, unless you know what you're looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=364.93527272727266) [for, and unless you're aware that, gol,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=366.852) [this can really hide something expensive,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=369.4542500000001) [you won't know to try the estimated plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=371.67684615384616) [or to check your function statistics, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=374.5876153846155) [be aware when you see those in the plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=377.03225) [So let's clean up, and then head back to the slides one final time for this module.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=10&mode=live&start=380)

[Module Summary](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live)

[And that wraps up our whirlwind tour of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=2.536) [plan operators. We only hit a few. There](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=5.492800000000001) [are over 100 operators in SQL Server 2016,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=8.375714285714286) [and our goal in this module was to gain an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=11.234) [understanding of the ones that we see most](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=13.886857142857137) [often because that's what you're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=16.50166666666667) [see repeatedly, and that's really where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=19.220583333333344) [you need to start when you're looking at a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=20.725818181818184) [plan. Then we looked at ways that we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=23.086599999999997) [change a query or the schema to change](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=26.14839999999999) [what operator the optimizer decides to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=29.316916666666668) [use, and a consequence of that change in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=31.894416666666668) [operator is sometimes a change in query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=34.89569230769231) [performance, hopefully for the better, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=37.499) [not always, and as you know by now, as is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=39.89300000000001) [hopefully very clear, performance is not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=42.995571428571424) [just about duration, right, how long it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=44.724) [takes the query to run. We also have to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=47.06258333333332) [look at resource use, IO, CPU, and memory](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=50.139857142857146) [because this information is also very](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=52.95357142857144) [helpful in understanding why a query may](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=55.05766666666666) [not perform well, but we're not quite done](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=57.50883333333333) [with plans. There's more good stuff in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=60.03133333333333) [there, so let's move on to the last module and take a look.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=702a449f-92c5-4f33-b3f5-c6f64cb98337&clip=11&mode=live&start=61.845214285714285)

[Important Information in a Plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live)

[Introduction and Input Parameters](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live)

[Hi. This is Erin Stellato from sqlskills.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=0) [com, and I'm recording this course for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=3.329083333333333) [Pluralsight. This course is analyzing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=6.457666666666667) [query performance for developers in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=8.334333333333335) [Server, and this module's topic is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=10.494454545454545) [Important Information in a Plan. Beyond](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=12.60863636363636) [just looking at the operators and basic](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=15.389181818181816) [information that you see immediately in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=18.688363636363636) [plan, like cost, there is additional](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=21.385909090909085) [information that you can find throughout](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=23.658) [the plan that provides more detail about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=25.89) [what happened during query execution. A](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=28.589500000000008) [few examples are the number of rows that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=30.86276923076923) [were estimated to return, and how many](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=33.40492307692307) [actually did return, whether the plan was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=36.17490909090909) [parallel, the type of predicate, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=39.67236363636363) [whether there were any warnings in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=41.57315384615384) [plan. Now these are just a few examples of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=43.53476923076923) [the information we can find, and there are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=45.89684615384613) [others, such as the input parameters. When](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=48.2165) [you initially execute a query the values](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=51.07318181818182) [that you use for that first execution are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=54.29) [stored in the plan that's put into the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=56.661692307692284) [plan cache, and this is great information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=58.93553846153846) [that you can use when troubleshooting](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=60.782461538461526) [because there are cases where a query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=62.44579999999999) [generates one plan with one set of input](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=64.48) [values, and then a different plan with a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=66.9446153846154) [different set of input values. That's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=69.52224999999999) [called a parameter sensitive query, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=71.62245454545454) [how this manifests in a production](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=73.85118181818179) [environment is that you'll have a user](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=75.917) [stating that a query intermittently](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=77.94699999999995)[doesn't perform well. Sometimes it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=79.943) [executes quickly, and other times it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=82.2465) [slow, and the user may not make the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=84.08999999999997) [connection that query performance changes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=86.74009090909094) [based on the values that they enter in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=88.51645454545461) [application. As the developer you may take](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=91.96400000000004) [the query and run it, and if it runs just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=93.973) [fine on your machine, then you need to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=96.6612142857143) [find the plan that's in cache and see if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=98.7509285714286) [it's the same plan as the one that you get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=101.45199999999998) [when you run the query or if it's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=104.93949999999994)[different plan, and if it's different,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=107.8592307692308) [then you need to know what the input](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=109.764) [parameters were for that query that's in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=111.84584615384618) [cache, and see what plan you get when you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=113.73617647058823) [run the query with those values. So being](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=116.38747058823526) [able to quickly find that information in the plan is invaluable as a developer.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=0&mode=live&start=118.804)

[Demo: Finding Input Parameters in a Plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live)

[In this demo we'll look at how you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=1.919) [find the input parameters that were used](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=4.023714285714287) [when a query was executed and a plan was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=5.8315) [generated, whether that plan is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=8.704750000000002) [estimated or the actual plan. For the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=11.714) [first demo in this module we'll go back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=14.847999999999999) [our WideWorldImporters database, and we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=16.846) [SET STATISTICS IO ON, and we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=19.461000000000002) [run a query that has two different input](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=22.98733333333334) [parameters, the exact same query. So we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=25.254) [going to query CustomerTransactions for a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=27.279800000000005) [particular CustomerID, and we're asking it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=29.83066666666667) [to GROUP BY the CustomerID, and we're also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=33.196) [going to return the SUM of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=36.23257142857145) [AmountExcludingTax. So I'm going to run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=38.91136363636363) [both of these queries, and we'll make sure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=41.319545454545434) [to enable the actual execution plan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=44.72099999999999) [when we run both of these you'll see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=47.596666666666664) [when we look at the plans we get two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=49.23166666666665) [different plans. The first plan is an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=51.429230769230756) [Index Seek with a Key Lookup that feeds](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=53.68538461538458) [into a Nested Loop, and then we've got a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=55.738399999999984) [Stream Aggregate here, which is where the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=57.851) [SUM occurs for that AmountExcludingTax](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=60.14445454545456) [column, and then our SELECT, and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=61.9307) [second query is a Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=65.26060000000003) [that feeds into that same stream aggregate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=67.75199999999998) [with a SELECT, and you'll notice that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=69.908)[second query has a missing index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=72.82492307692313) [recommendation as well, because this is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=75.098) [query that is sensitive to different input](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=78.24800000000002) [parameters. When we pass in different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=81.014) [values we get different query plans, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=83.138) [if we look at the distribution of data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=85.86741666666666) [here, and if we look at the CustomerID,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=88.95454545454545) [and then just the COUNT of these entries,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=91.988) [and we order by the COUNT descending.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=95.0589333333333) [You'll see that we have some big variation](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=97.746) [here. We've got CustomerID 1 and 401 with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=101.25711111111106) [values in the 20, 000's and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=104.39499999999997) [everything else is 300 and lower, so if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=107.094) [come back and we look at the input](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=109.04100000000004) [parameters that I used one of those was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=111.09393333333333) [401, which is a very non-unique value, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=114.11366666666663) [I'm purposefully using this data as an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=117.45775000000002) [example of how you would see a query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=120.85683333333338) [behave if it was sensitive to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=123.63212499999997) [different input parameters. Now this is an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=125.73693749999994) [extreme. It may not be this extreme in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=127.7412857142857) [your environment. There's a point where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=129.9458571428571) [the optimizer's going to decide that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=131.78033333333332) [scan might be more efficient than the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=134.0261666666666) [Nested Loop, and that's just going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=136.43684615384612) [depend upon the data, and how unique it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=138.875) [is, but here's a good example, and that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=141.22814285714276) [what we're going to use here. So we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=143.52114285714288) [going to create a procedure that uses this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=145.6337142857144) [query. So it's the same query that we were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=147.77276923076926) [running before, and we put this into a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=150.209) [stored procedure that passes in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=153.29146153846153) [CustomerID because very often we see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=155.79379999999998)[stored procedures in production](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=159.24860000000007) [environments rather than queries that just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=161.3931111111111) [have literal values because the benefit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=163.89577777777768) [here with the stored procedure is that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=165.89899999999997) [that plan gets put into cache, and then it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=167.94474999999994) [gets used over and over again, so we don't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=170.80728571428577) [have to compile a plan every single time.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=173.80627272727276) [If I left this as an Adhoc query where I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=176.663) [had a different input parameter, a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=179.62585714285717) [different literal value, a different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=181.5224) [customer ID every single time, then every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=183.30090000000007) [single time that query was run with a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=185.551) [different value the plan would have to be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=187.917) [compiled. So the idea is that that stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=191.36944444444438) [procedure is a little bit more efficient,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=193.86438461538452)[but what happens is we get this parameter](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=195.9608) [sensitivity, so we're going to run that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=198.58319999999998) [stored procedure with our non-unique](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=200.462) [value, this 401, so when I run this and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=201.75449999999998) [look at that plan, there's that Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=202.58484615384612) [Index Scan, so the query went through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=204.7317) [compilation and optimization, it decided](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=209.148) [that this is the best plan, and this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=210.9393636363636) [the plan that's now sitting in the cache,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=213.85899999999998) [but if I run that same stored procedure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=215.91233333333327) [with different input values, which are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=218.366)[definitely more unique because we looked](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=220.38620000000003) [at that distribution of data you'll see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=222.1658000000001) [that it ends up using the exact same plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=224.29284615384609) [because that's the one that's in cache, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=227.07615384615386) [regardless now of what value I pass in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=229.7093846153846) [it's going to do that Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=232.4878461538462) [every single time, so how this can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=235.41153846153856) [manifest for users is that if someone runs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=238.1737692307692) [the query in this format and that's the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=241.30871428571427) [plan that gets into cache first, then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=244.01842857142847) [everything else that runs is going to use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=246.40076923076924) [the same plan and perform that Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=249.15584615384626) [Index Scan, which could be very expensive](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=251.29372727272724) [if it's a really large table. So what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=253.227) [can do here to test that is we run it with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=255.79143750000011) [a different value, and we look at what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=259.1574666666667) [happens when we put a recompile on here.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=261.90040000000016) [So when I run this and I look at the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=264.30212500000005) [and I see, oh, I have a different plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=267.323) [and it runs really efficient when I run it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=270.2782142857144) [here with a RECOMPILE, so then what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=273.0108235294119) [start to do is we think, well okay, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=275.1924705882356)[user runs it, and it runs with a full](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=277.67971428571417) [scan, but I run it with that value, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=280.2080714285711) [recompile it and it gives me a seek with a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=283.1991250000001) [lookup. So if we take this from cache,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=286.41760000000005) [then we can look to see what the query was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=289.37920000000014) [originally compiled with. So now I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=293.02266666666674) [to look to see what exists in cache for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=295.37225000000007) [this stored procedure. So here is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=298.22581250000025) [stored procedure, and if I scroll over we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=300.1314000000001) [can get the plan, and this is where I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=302.04020000000025) [going to start to look to see what my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=304.68200000000013)[input values were for the query, so from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=307.571) [here I'm going to use F4 and I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=310.2787333333332) [get additional information about the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=313.9040000000001) [over here on the right and I can see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=316.4160000000003) [for my parameter compiled value it was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=320.1117333333332) [401. This is so simple, right, it's under](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=322.55146666666633) [Parameter List, and if I did a right-click](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=325.04800000000006) [here, and I went into the XML, so if we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=327.4990714285715) [going to do Ctrl+F, and we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=330.52978571428605) [look for, what we actually look for here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=333.10015384615383) [is, if I could spell, compile,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=335.758)[ParameterCompiledValue. So I can see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=340.9145714285714) [this is 401, and I can again, get this in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=343.37177777777777) [the XML or I can get it in the Properties](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=346.5673333333333) [window right over here, and I can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=350.14679999999987) [also, we've got to expand it, there's the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=353.142) [401. So now let's come back to our query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=357.7082222222222) [here. So if I wanted to remove this plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=360.565222222222) [from cache I could do this carefully. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=364.37580000000014) [if I look at the Results tab from my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=367.67539999999997) [original query, and you know what, I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=369.61399999999986) [going to close this so we get a little](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=371.3086923076923) [more space. If I come down here, there we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=374.08830769230775) [go, here is our plan\_handle, so we'll copy](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=376.9763333333335) [that, and we'll drop this in here, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=379.79457142857143) [going to remove that plan from cache. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=383.3842857142857) [sledgehammer approach is to just run DBCC](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=386.693) [FREEPROCCACHE, but that removes every](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=389.577) [plan. I'm going to selectively just remove](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=391.44199999999995)[this plan from cache, and then I'm going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=394.6530000000001) [to rerun it, rerun my stored procedure,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=398.011909090909) [but this time it's an input value that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=400.579) [selective, so when I see the plan here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=402.95842857142844) [this is my Index Seek with my Key Lookup,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=405.27406666666667) [and if I rerun this for all these values,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=407.6638666666667) [including 401, which was not unique, we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=411.7750909090909) [all have the same plan, and notice that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=415.93029411764707) [the lines here are a little bit different.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=419.9006470588234) [My estimate, in terms of number of rows,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=423.871) [and my actuals are very different, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=425.9177692307693)[this shows up really in terms of the IO.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=427.78354545454545) [For the most part, the Nested Loop serves](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=430.423) [this query very well. It's a low number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=433.39499999999975) [reads, but in the case where we put in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=435.9373333333334) [non-unique value this ends up being really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=438.05) [high. So there's a tradeoff here, right?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=440.3258750000001) [Which of those plans is better for that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=442.29250000000013) [stored procedure in general? And one of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=444.5614285714286) [the ways to look at that is to have that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=446.7574285714287) [query execute the first time with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=450.53528571428575) [value that generates the plan that has a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=453.62828571428577) [scan, and then let that run over and over,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=456.2284285714284) [and you'll see in that case that it's got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=458.80107142857145) [the scan every single time, and so you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=461.3577142857145) [see what the IO is in terms of what that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=463.72333333333324) [requires. Then what you do is you drop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=466.7966666666663) [that and you put the Nested Loop in, as we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=468.4354) [just did, and let it run with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=470.5628461538462) [different input values. Then we can query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=472.98623076923093) [the plan cache one more time, so we look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=475.05725000000007) [here at the plan cache, here's our query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=477.67231250000026) [and what we can see from this is if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=480.377) [just verify what we have for our plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=484.043) [right now we have the Index Seek with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=485.752142857143) [Key Lookup, and again, if I went into the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=488.18878571428576) [properties and I went over to my SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=491.65314285714305) [and I expanded my Parameter List, now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=494.2054999999999) [we'll see that, okay, the input parameter](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=496.36566666666664) [here is 1050 right? his is our more unique](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=499.00933333333313) [value, but the interesting thing to note](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=501.99115384615374) [in this output right here from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=504.050769230769) [dm\_exec\_query\_stats is that my average](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=507.43749999999994) [logical reads and then my min and my max,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=510.53) [for the scan that data is stagnant, right?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=513.7011764705884) [The average logical reads, the min and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=516.52) [max, those all end up being the same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=518.1582857142853)[because it does a scan every single time,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=520.0674615384614) [so that's pretty constant, but here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=522.7893076923074) [because I have that Nested Loop where I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=525.096076923077) [have the NonClustered Index Seek and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=528.5256153846159) [the lookup against the Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=530.9795) [there's a lot of variability depending](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=532.8456666666667) [upon how many rows are returned, so my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=534.4636666666669) [minimum logical reads and my max logical](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=536.88175) [reads will have great variation. So here I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=539.3778333333333) [can compare this against the IO for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=542.5103846153844) [scan and i can determine which plan is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=545.6565384615384) [better, and really what's probably best is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=548.2448461538457) [to put an index on here that addresses](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=550.5566923076923) [this query, so that I don't have that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=553.2705384615384) [lookup. Long term that's the solution, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=555.5165000000001) [this is how a parameter sensitive query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=557.3913076923077) [can show up in your system, and these are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=559.5424615384619) [kind of the steps that you want to go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=562.0384666666666)[through to look to see what's the plan in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=564.1972666666667) [cache, what are the values for the plan in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=565.8786666666664) [cache, and then determine how to act from there.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=1&mode=live&start=568.252)

[Trace Flags](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live)

[Trace flags are used to change the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=2.473) [behavior of the engine in SQL Server and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=4.025384615384616) [there are numerous trace flags which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=6.029555555555556) [exist. Some are documented, and therefore](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=8.050222222222223) [supported, and some are undocumented, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=9.807555555555554) [thus not supported. Because the trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=11.667) [flags change the behavior of the engine in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=13.835999999999997)[some way sometimes that means the trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=16.604999999999997) [flags change the performance of queries.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=18.992) [Understanding what trace flags are being](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=21.551333333333336) [used by the engine can be very helpful](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=23.626499999999997) [when troubleshooting performance and that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=25.747833333333322) [information is now available in execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=27.683666666666664) [plans in SQL Server 2014 SP2 and SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=30.41181818181818)[Server 2016. You can determine whether the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=35.53036363636365) [trace flag is enabled at the session or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=38.08192307692308) [global level, and also whether it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=40.117) [present at compilation and execution time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=42.58600000000001) [using the IsCompileTime attribute. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=45.297) [new information is documented in the kb](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=47.79209090909091) [article referenced here, which you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=50.347727272727276) [find just by searching for the number](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=52.865545454545455) [3170115. As you'll see in our demo, it's really easy to find within the plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=2&mode=live&start=56.18481818181819)

[Demo: Trace Flags in a Query Plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live)

[In this demo we will see how we can find](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=2.236) [information about the trace flags that are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=4.287428571428571) [enabled when a query executed by looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=6.5345) [at the execution plan. So let's look to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=9.863000000000001) [see how we can find information about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=12.856749999999998) [trace flags in our plans. We'll again, use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=14.767312499999994) [the WideWorldImporters database and we'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=17.2249)[include our actual plan, and before we run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=19.046400000000002) [any queries we'll just check to see if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=21.364571428571438) [have any trace flags enabled for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=23.904500000000002) [instance, and we do. This is 3226, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=26.848000000000006) [disables logging of successful backups to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=30.24415384615385) [the error log. There's still an MSDB. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=32.815384615384616) [is one that I recommend turning on for all](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=35.37984615384616)[environments, and I set this in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=37.71576923076923) [startup parameter for the engine. So we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=39.74415384615385) [have this 3226 enabled, it's global, it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=41.899) [not going to affect query execution, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=44.37000000000001) [we'll still see it in our plan. So if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=46.94779999999999) [go ahead and run this first query nothing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=50.33359999999999) [crazy going on here. We're just pulling](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=52.1085333333333) [data from StockItems and also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=54.93666666666667) [StockItemHoldings. We're joining based on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=58.17111111111111) [StockItemID, and we have a couple things](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=59.85600000000001) [in here for our predicate. So let's run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=61.67250000000003)[this query, and if we look at our plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=64.55450000000002) [and we bring up F4, so we get additional](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=67.85116666666667) [information, and we go to the SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=70.88491666666673) [operator, and we scroll down over here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=73.42307692307692) [you'll see at the very bottom we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=75.991) [trace flags, and so we can see that at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=78.16059999999995) [compile time we had 3226 enabled, and at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=81.41933333333333) [execution time, which is isCompileTime](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=86.86066666666665) [False, that really means execution time,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=89.58433333333335) [3226 was in effect as well. So when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=92.311) [isCompileTime is true those are the trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=95.40576923076921)[flags that are enabled for compilation.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=97.953) [When isCompileTime is false those are the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=99.792) [trace flags that are in play during query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=103.01146153846153) [execution, so in this case both of them](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=106.5) [were there. Now let's make this a little](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=109.41599999999994) [bit more interesting, and we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=111.52961538461535) [add a trace flag to our query using the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=113.145) [OPTION QUERYTRACEON, and this trace flag](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=117.23099999999994) [that I'm putting here, 9130, is an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=119.68266666666668) [undocumented trace flag, and I have a note](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=122.3840833333334) [here that says, understand trace flags](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=124.50438461538465) [before you implement them. This is a trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=125.991) [flag I'll refer to also in a later demo.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=128.82928571428573) [Again, it's not documented, so it's not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=131.68099999999998) [something that you want to use in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=133.36799999999988) [production, but for our purposes right now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=135.24346153846147) [it's safe to use. So we'll execute our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=137.19430769230755) [query, and we look at our plan, and this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=140.493) [is our plan, and it's a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=143.73593333333335) [different than what we had before because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=144.62766666666673) [of that trace flag. What that trace flag](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=145.77238461538462) [did is it introduced this filter operator.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=148.1219230769231) [So if I go to my SELECT again, this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=150.93599999999998) [where even though this information is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=155.4226153846154) [great within F4 I have to do a lot of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=157.2844615384616) [clicking, and I don't want to do a lot of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=159.97818750000008)[clicking, I'll be really honest with you,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=162.2625625000002) [so if I right-click and say, Show](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=163.74500000000003) [Execution Plan, very conveniently, the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=165.4492) [trace flag information is right at the top](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=167.70019999999997)[of the XML, so this it gets really easy to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=170.55726666666672) [read compared to trying to navigate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=173.1979333333335) [through Properties, so we'll just close](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=174.96427272727277) [Properties and look at the information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=176.767) [here. So for compilation we had both 3226](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=178.86014285714293) [and 9130, so this affected the compilation](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=181.94976923076922) [of the query, which was fine, that's what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=184.60576923076923) [it's designed to do. For execution 9130](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=187.05992307692298) [wasn't in play, just 3226, so because this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=190.0549230769231) [is the actual plan I can see both](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=194.7693846153847) [compilation information and runtime or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=198.33218181818174) [execution information specific to trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=200.319) [flags. Now adding a trace flag using query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=203.9098333333333) [trace on is one option. Another option is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=207.36499999999992) [DBCC TRACEON and the trace flag input](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=211.63927272727273) [here. So sometimes what you'll see is code](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=217.0509090909091) [that turns on a trace flag, then the code](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=219.41946153846155) [runs, and then it turns off the trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=221.93649999999997)[flag, so 1224 disables lock escalation.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=225.0018333333332) [This is a documented and less supported](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=227.82272727272726) [trace flag, but this is a very potentially](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=231.129) [dangerous in terms of performance trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=234.177) [flag, so this isn't one to play with. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=236.08633333333333) [just another example that I have just for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=238.674) [some variety, so again, understand trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=241.01800000000006) [flags before implementing. There's some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=243.35879999999997) [good documentation related to each of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=245.79890909090906) [these trace flags. So same query as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=247.85963636363627) [before, but now we're just going to turn](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=249.84771428571423) [the trace flag on and then turn it off. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=251.76314285714273) [if we execute here and we look at our plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=254.03) [you'll see that filter's gone that we had](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=256.57733333333334) [because we're not using 9130. If I look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=259.61466666666655) [my execution plan we can see here for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=262.8106000000001) [compile time for true we've got both trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=265.4058000000003) [flags and for execution those are both](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=268.39130769230763)[true as well, so both of those trace flags](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=271.2085384615383) [were in play are compilation and for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=275.0090000000001) [execution. Now, and you'll also notice](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=277.98225000000025) [that we have the scope, so this tells me](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=279.71450000000004) [that 3226 was set globally, whereas 1224](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=282.068) [was set at the session level because I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=285.00046153846154) [used the DBCC TRACEON. I can use DBCC](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=288.256) [TRACEON to set something at the global](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=291.2239999999998) [level. I have to include another parameter](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=293.67066666666665) [to do that, so this is great to know that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=296.0045833333333) [it was just set at the session level for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=299.0093124999999)[this particular query execution. Now if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=302.5783333333334) [I'm interested in understanding what's in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=305.96559999999994) [the cache, because we've been looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=307.1793999999998) [the actual plan, I can pull this from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=309.08323076923074) [cache, and you'll notice that I've got a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=311.482) [couple of entries here because we have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=314.7486666666665) [little bit of variation in what we've been](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=317.3728571428571) [running, right? So if I start to scroll to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=319.3545714285712) [the right I've got an OPTION QUERYTRACEON](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=322.5500000000001) [there, so if I look at that we'll start](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=325.25) [with that one, and if I look at the XML](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=327.6361250000001)[what you'll notice is that we just have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=330.7863846153846) [compilation information. So this is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=334.23807692307673) [variation where we ran it with 9130,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=336.5748461538461) [obviously, right? That's pretty](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=339.15407692307684)[straightforward, and let me close that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=340.9308181818182) [and then let's hop up to this one and see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=344.0502727272728) [what we can deduce from looking at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=347.6500625000002) [plan. Let's go into the XML. Here we can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=349.98156250000045) [see this is where we had 1224 enabled,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=352.2393999999998) [right, at the session level, so I can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=354.2423846153846) [that it's at session level, it was present](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=356.7838461538461) [at compilation, but because it's the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=359.4196363636364) [estimated plan that's sitting in cache I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=361.566) [don't have any information about the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=363.9727272727271) [execution. I have to do the actual plan to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=366.0890769230769) [see that, and then finally if I go to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=369.4239230769229) [last entry here and I look at the XML,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=373.3885294117645) [this was the very first execution we did](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=377.015) [with no additional trace flags enabled](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=380.1156666666667) [either with the query option or with DBCC](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=382.5303636363637) [TRACEON. So it's important to note here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=385.98781818181845) [that those variations do get stored](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=388.39450000000016) [separately because different trace flags](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=390.369) [were involved when those queries were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=392.3673333333335) [executed, so if you start to see multiple](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=394.4887692307692) [entries for the same, what looks like the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=396.579846153846) [same query in the plan cache, definitely](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=398.8630909090909) [worth investigating in a little bit more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=400.9760833333333) [detail, as we did here, because even](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=403.1746666666665) [though this first query and this third](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=405.5945) [query looked exactly the same there's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=408.3093333333333) [subtle difference in the plan in that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=411.09269230769223) [there were different trace flags enabled,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=413.9034615384614) [so definitely something to watch out for,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=415.9095) [and very useful information to have when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=418.2923636363637) [troubleshooting and looking at query performance.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=3&mode=live&start=421.01663636363656)

[Cardinality Estimator Version and Issues](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live)

[When you submit a query to SQL Server and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=1.693) [it goes through the optimization process](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=3.31023076923077) [the query optimizer evaluates the cost of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=4.843545454545454) [one or more plans, and then decides which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=7.694454545454545) [plan to ultimately execute. One factor](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=11.278000000000006) [used to determine cost is the number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=13.739692307692307) [estimated rows that will need to be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=16.202461538461534)[processed for each operator, and that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=18.192153846153854) [also known as the Cardinality Estimate.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=19.791384615384633) [The Cardinality Estimator or CE component](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=22.197333333333333) [was significantly changed in SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=25.41) [2014. This was the first redesign since](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=28.71514285714286) [SQL Server 7. 0, which was released in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=31.371076923076913) [1998 as a reminder. Whether or not the new](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=34.193733333333334)[CE is used when you upgrade to SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=37.49433333333336) [2014 or 2016 is determined by you. It can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=41.116000000000014) [be enabled in different ways, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=44.746833333333335) [provides a lot of flexibility, but it also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=46.25233333333335) [means there is the potential for queries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=48.47333333333333) [to use a different cardinality estimator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=50.603666666666655) [than you're expecting, which is why it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=53.348624999999984) [useful to verify the cardinality estimator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=56.18354545454547) [version that's used by checking the query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=58.23936363636366) [plan. In addition to understanding what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=62.13485714285712) [cardinality estimator version was used,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=64.49422222222222) [there are also issues related to incorrect](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=66.38518181818182) [estimates that you'll find in the plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=69.72545454545455) [What you're looking for when you look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=72.26671428571429) [the plan is if you see a significant](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=74.48614285714287) [difference between the estimated number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=77.17400000000004) [rows to return and the actual number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=79.307) [rows that were returned. When there is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=82.533)[large disparity between the two you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=85.10200000000002) [end up with a lot more data moving through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=86.77500000000005) [the plan than is actually needed. Remember](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=89.79100000000003) [we talked about looking at query plans and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=92.59307692307692) [do we see thick lines or a lot of data? If](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=95.23369230769225) [the estimation of data is incorrect, then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=99.45846153846152) [more data can actually flow through](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=102.36963636363636)[operators, which causes more IO or more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=104.89945454545456) [CPU or more memory to be used than is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=107.98014285714284) [absolutely necessary. When you find](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=112.16257142857135) [incorrect estimates in the plan you want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=113.89946153846152) [to start by looking at statistics in SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=115.78353846153841) [Server, as well as checking the version of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=118.45516666666666) [the cardinality estimator, and looking to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=121.3310909090909) [see whether you have objects like table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=122.92763636363634) [variables or table value functions in play.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=4&mode=live&start=126.992)

[Demo: Examining CE Version and Estimates](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live)

[In this demo we'll look at how you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=1.648) [find the cardinality estimator version](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=4.213692307692307) [that was used for a query within the plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=5.633571428571429) [and we'll also look at some disparities](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=8.149714285714287) [between estimates and actuals, so you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=10.52757142857143) [understand what to look for when you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=12.985166666666668) [looking at plans. We're going to look at a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=15.708750000000004) [couple things related to cardinality in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=18.539714285714286) [this demo. We're going to go back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=20.20342857142857) [WideWorldImporters and we'll make sure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=22.947499999999994) [that we have our actual plan, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=24.772083333333324) [going to set this database to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=27.44399999999999) [compatibility mode of 110 and also ensure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=29.751) [that it's using the old Cardinality](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=32.03125) [Estimator by setting this database scoped](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=34.386874999999996) [configuration option of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=38.748124999999995) [Legacy\_Cardinality\_Estimation. We're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=40.422999999999995) [to set that on. So this is as if we had](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=41.844999999999985) [taken a SQL server 2012 database and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=46.45326666666668) [restored it into 2016. This would be the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=49.16553333333336) [state that it would be in, and so it would](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=51.054937499999994) [be using the old Cardinality Estimator. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=53.48914285714285) [this query is just against OrderLines and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=57.04991666666667) [Orders joining on OrderID based on a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=60.84333333333333) [specific Description and OrderDate, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=64.20975) [I'm not really that concerned, at this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=66.2076666666667) [point, with the query itself, it's more,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=68.8465) [let's see how we find here in the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=71.27433333333336) [what Cardinality Estimator version we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=74.7079166666667) [using, so again, if we pop open F4, our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=76.665) [good friend, and we go to the SELECT,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=79.7863125) [you'll see right here Cardinality](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=82.72255555555556) [Estimation model version, it says 70. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=85.26533333333336) [70 means it is the old CE from SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=88.47775000000001) [7. 0. Now if we make a change here where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=92.69462500000006) [we set the compat mode to 130 and we set](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=96.05550000000004) [legacy Cardinality Estimation off we will](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=99.77390909090907) [basically bring this up to the current](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=103.37663636363631) [compat mode, and we'll be using the new](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=106.25369230769229) [cardinality estimator, and we'll go ahead](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=108.40507692307688) [and execute this query, and again look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=110.73566666666669) [the plan, and hop onto the SELECT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=113.95035714285714) [operator, and now you can see this version](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=116.24885714285715) [is 130. And this is tied to the compat](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=118.94071428571428) [mode for the database, so I could set the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=122.18842857142856) [compat mode to 120, and still be using the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=125.13314285714286) [current Cardinality Estimator, but it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=128.0902) [would say the estimator model here is 120](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=130.4612) [so that is tied to the compat mode. Now I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=133.92199999999997) [can also set the CE using this query trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=137.76080000000002) [on hint that we've seen a couple times](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=140.95940000000004) [before. If I have everything set as I do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=143.56328571428574) [right now, where I have compat mode 130,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=146.22342857142866) [and the legacy estimator is off, if for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=148.90438461538469) [specific queries I want to use the old CE](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=151.64249999999998) [I can use trace flag 9481 as we see here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=154.76324999999986) [in this query, and so for just this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=158.79933333333332) [specific query it will use the old CE and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=162.48306666666662) [conversely, if I had the old CE enabled](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=166.6222499999999) [for the database and I was using a compat](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=170.30024999999978) [mode of let's say 110, and I had some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=172.60850000000005) [queries that performed better with the new](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=174.71561538461538) [CE I could use trace flag 2312 for those,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=176.52592307692305) [but in this case we're running everything](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=179.583) [current using the new CE but I have this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=182.67000000000002) [one query that I want to use the old](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=185.26676470588234)[Cardinality Estimator, so when I run this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=187.692) [query and I look at that plan, and I hop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=189.7440769230769) [onto the SELECT you'll see over here that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=192.91473333333334) [it is using the old CE, so we have 70](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=195.73820000000006) [there. So that's what you need to check in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=198.78806249999997) [the plan to determine what version of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=201.348) [Cardinality Estimator is being used, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=204.16618181818177) [that will show up in the estimated plan as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=206.39723529411765) [well in the plan cache. How do I identify](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=209.91994117647056) [problems related to those estimates? Well,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=213.68277777777774) [we're going to start with a basic query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=216.13485714285713) [that I'm going to add-on to, but just so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=217.69371428571418) [that we know from where we're starting,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=219.72000000000003) [I'm declaring a Start and an EndDate, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=221.561) [I'm creating a table variable, and we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=224.9696666666667) [going to insert into that table variable](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=227.6277272727273) [two columns that we pull from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=229.85309090909098) [StockItemTransactions and also StockItems](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=233.1771111111111)[joining on StockItemID, and we're looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=235.582) [for entries in a particular date range as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=238.81000000000006) [we identified with those two variables in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=242.53875) [the beginning. So this code, if we run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=244.96249999999998) [this, you're not going to see any output](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=247.13014285714289) [because all I did was insert the data into](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=249.097) [that table variable. So we'll add-on,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=252.0594999999999) [right? So this is the same code at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=253.8323076923077) [beginning. We're declaring the variables,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=256.18823076923076) [we're declaring the table variable, we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=258.01400000000007) [inserting into that table variable, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=260.3503076923077)[then we're going to query it. So we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=262.6381538461539) [going to query OrderLines and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=266.08425) [StockItemHoldings, and this table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=268.9798749999999) [variable. The data that I'm actually](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=270.3825) [pulling in this combination isn't so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=272.0294999999999) [important as much as the pattern. You'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=274.0293333333333) [see this type of pattern in code where you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=276.64378571428574) [push data into a table variable and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=278.99985714285737) [you join back to it from other tables that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=281.3943846153845) [already exist, and here we've got the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=284.426) [joins based on StockItemID, and we do have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=286.97909090909104) [a predicate, so we're reducing our result](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=289.8026666666666) [set. So let's take a look at all of this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=292.19083333333316) [together. And this query just takes a few](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=296.6494999999998) [seconds to execute. We're only looking for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=298.4223000000001)[about a weeks' worth of data. This top](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=300.43359999999996) [query is just our insert into the table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=303.2399090909091) [variable. I'm more interested in this plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=305.77954545454554) [down here. So you'll see that all the way](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=308.8900000000001) [on the left we have access of that table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=311.25226666666686) [variable, and note that the estimated](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=313.2579230769231) [number of rows here is 1, and the actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=315.4774615384617) [number of rows is 1504. So there's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=318.9814999999999) [difference between our estimate and our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=322.40683333333305) [actual. Now 1500 rows, is that huge? It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=324.64875) [not awful, so I want you to note that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=327.49071428571426) [there's a difference there in terms of our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=330.2151428571427) [estimate and our actual, and note that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=332.56085714285706) [that feeds into a Nested Loop. Now what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=334.54685714285694) [happens if I expand that date range? So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=337.6000833333335) [we're going to say, okay, now we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=340.97683333333333) [to go from, here, I'll point this out just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=343.32750000000004) [to make sure we're clear. I had said we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=345.089909090909) [were looking at a weeks' worth, but I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=346.58200000000005) [didn't define that, so here we're looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=348.0980000000001) [at August 1st to August 8th, and if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=350.39592857142844) [scroll down I'm going to expand that, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=353.85) [we're looking August 1st to August 31st,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=356.11830769230767) [so now we're looking at a full months'](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=358.0987692307693) [worth of data. Exact same query where you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=360.3498461538464) [push into that table variable, and then we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=362.54976923076913) [join to it again, and now when I run this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=364.719) [query, again, it takes a few seconds, I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=367.9256666666668) [got a little bit more data because I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=370.21321428571423) [got a wider date range, and you'll notice](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=372.0377857142855) [here we have the same shape in this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=374.2616153846154) [pattern where we feed into a Nested Loop,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=376.725) [but now you can see that for this Table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=378.4695333333335) [Scan it estimated one row again, and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=380.7932307692307) [have over 6000 rows, and this is feeding](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=383.98215384615366) [into a Nested Loop, and remember that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=386.4906923076922) [Nested Loop is really designed for smaller](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=388.591) [result sets, so when I see 6000 rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=390.9957692307692) [hoping into that, and then feeding into](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=393.7605) [another Nested Loop that's a little bit of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=396.22274999999985)[a red flag in my mind, and here's an issue](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=398.61831249999994) [if you're not aware related to table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=401.2989374999998) [variables. They always estimate one row](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=403.77928571428583) [because when the table variable is created](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=406.0825454545456) [there's nothing in it, so the estimate is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=408.7843571428571) [just a value of one. Now I can get around](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=411.8272142857141) [that. I can force a recompile, and this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=415.6057857142856) [isn't always ideal, but this is one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=418.6086428571426) [option, but for that query I can throw](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=420.86328571428584) [OPTION RECOMPILE on here at the bottom, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=423.369) [that it will look to see what's in that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=426.0987142857142) [table variable, and it will give me a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=428.79169230769224) [better estimate, so when I run this query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=430.5135384615382) [you'll see that the estimated number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=432.9162857142857) [rows is much more accurate than what we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=435.2172857142857) [had before, and in fact, our second query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=437.6728333333333) [has a different plan entirely. Rather than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=440.81612500000006) [seeing that Nested Loop we have a Hash](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=444.14700000000005)[Match here, which is fed by a Clustered](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=446.64300000000014) [Index Scan and this scan against the table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=449.1625714285714) [variable, which we saw before, but notice](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=451.69) [that it doesn't feed into the Nested Loop,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=453.5870000000001) [it's the bottom half of that Hash Match,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=455.8526363636363) [and the estimate here is 6267 rows, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=458.281) [that matches the actual, so with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=461.5603333333334)[recompile we get a better estimate, and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=464.01235714285707) [get a different plan entirely, and if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=466.1786428571426) [compare the two, I'm going to run them](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=468.42564285714286) [both. So this is a lot of text, a lot of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=470.72107142857146) [code that I'm going to highlight here, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=473.03737500000017) [I'm going to run it one way with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=475.1564666666667) [original query that I had without the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=479.2130666666668) [recompile, and then we're running it the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=482.01924999999994) [second way with the recompile, and you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=484.36016666666643) [know what the difference is in the plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=486.1828461538461) [we saw that, but what I want to highlight](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=488.029)[here is the difference in the IO, so here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=490.5772857142859) [for this first, this is the insert into](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=493.3707142857143) [the table variable, and then this is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=496.12614285714295) [query with the Nested Loop, and it's doing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=499.01481818181816) [over, it's doing 1. 8 million reads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=502.137) [against OrderLines. Now if we scroll down](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=505.14466666666664) [and we look at this query, holy cow. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=507.7705384615384) [we're down to only 523 reads, so this is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=510.9643846153846) [significant improvement by putting that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=514.6382307692305) [recompile on there. It's a huge reduction](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=516.4375) [in IO. Now the recompile isn't the only](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=518.9213333333332) [option. Let me just scroll down to where](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=521.3626923076921) [we were. This is where we had forced the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=523.6531818181819) [recompile. Now another option we have is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=526.0848181818187) [trace flag 2453, and I've got some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=529.1694615384617) [references here that I definitely](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=532.453) [recommend that you review because this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=534.303) [not the exact same thing as using a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=536.7808181818182) [recompile. There are slight differences](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=539.2920909090908) [between this trace flag and the recompile,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=540.8680000000002) [and you should be aware of them. This is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=542.988625) [available all the way back to 2012 SP2.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=545.2786) [It's in 2014 CU3, and it's also in 2016.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=548.065) [So we'll run this with the trace flag](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=551.7148) [enabled, and the only difference is that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=554.6133333333333) [we have DBCC TRACEON at the start, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=556.242)[then as we scroll down we've got DBCC](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=558.4323076923077) [TRACEOFF here at the end. So I'll run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=560.82) [that, and you'll see here in the output](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=563.5005714285711) [that we get the same plan that we had](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=566.1684666666667) [previously with the recompile. Right here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=569.1270666666672) [we have our Clustered Index Scan, we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=571.0412307692309) [got the Table Scan down here with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=573.1385384615389) [accurate estimate, so using that trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=576.0473333333334) [flag is another option for how you can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=578.6128333333336) [address that. If we look at the IOs we see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=580.8494999999997) [we're down here just in, you know, less](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=583.2438666666662) [than 1000 IOs, which is really great. We](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=585.314375) [could also try a temp table. That's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=588.2615999999999) [another way to try to address this. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=590.3517999999997) [rather than inserting into the table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=592.7781666666667) [variable we just insert into the temp](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=594.795166666667) [table, which does get better statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=597.1307272727273) [than the table variable, and I don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=599.0949090909093) [to add a recompile or use a trace flag](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=601.4059285714285) [here, and then we just join to that temp](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=603.798) [table, and drop when we're finished. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=606.8130000000003) [just to prove this one out to you I'll run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=609.0928749999999) [that one, you'll see we get a good plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=611.7916249999995) [with a good number of IOs, right. We have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=614.958818181818) [the same shape that we had before with the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=618.6983076923076) [Clustered Index Scan and the Table Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=621.2106923076918) [against that temp table that feeds into](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=623.226307692308) [our Hash Match, and in terms of the IO](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=625.2665384615391) [here, right about the same. So what I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=628.282923076923) [really looking for in terms of issues](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=631.0217499999999) [related to Cardinality Estimates are, are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=633.4384999999996) [those estimates and actuals in line, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=635.9382000000002) [if they're not, then understand that I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=639.1252222222223) [moving, potentially moving a lot more data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=642.4377777777781) [across the plan, which can affect not just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=644.753) [the join operator, but the entire shape of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=647.239) [the plan in terms of what operators are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=649.815) [used, and what objects are accessed. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=652.545) [changed entirely when we used either the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=655.0809166666667) [recompile or the trace flag, so make sure](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=657.6913333333335) [you're looking at those estimates and those actuals.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=5&mode=live&start=663.183)

[Operator Execution Statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live)

[The SQL Server team has done a great job](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=1.937) [of adding additional information into the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=4.306250000000001) [query plan in recent releases, and SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=6.208999999999999) [Server 2016 was no exception. In fact,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=8.805999999999997) [they ported this information back to SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=11.837499999999995) [Server 2014 Service Pack 2 as well, and in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=14.872) [this case I'm specifically talking about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=18.237999999999996) [the operator execution statistics. So at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=21.068714285714286) [the operator level we can look at CPU,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=24.067363636363638) [duration, and IO information, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=26.948818181818183) [fantastic information that we can get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=29.47672727272728) [right within the plan. Rather than having](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=32.078) [to run statistics IO or statistics time to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=35.434500000000014) [get that data we can get it from the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=38.69771428571429) [directly, which means we get much better](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=41.58342857142859) [detailed information when troubleshooting,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=44.42599999999999) [particularly because these exist for each](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=46.27575) [operator, not for the plan as a whole, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=49.71225)[we can look at IO information specifically](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=53.39242857142855) [for a seek compared to a scan, for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=56.0523) [example, rather than looking at the IO statistics, which are cumulative.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=6&mode=live&start=58.68670000000003)

[Demo: Execution Statistics for Operators](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live)

[In this demo I'll show you how to find](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=2.424) [those execution statistics for each](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=4.833923076923077) [operator within query plans from SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=6.4995) [Server 2016 and SQL Server 2014 SP2. For](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=10.066500000000001) [this demo with operator statistics we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=14.483666666666666) [going to use the same query we used in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=16.017666666666667) [looking at Cardinality Estimate issues, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=18.96) [we'll set our database context, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=21.456000000000003) [also going to enable statistics IO and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=24.016749999999995) [statistics time just for some comparison](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=26.437) [purposes. Let's include our actual plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=30.73042857142858)[and then just as a reminder, we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=33.67736363636364) [declaring a StartDate and an EndDate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=36.720181818181814) [we're declaring a table variable, we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=38.91127272727272) [pushing data into the table variable from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=41.30444444444444) [StockItemTransactions and StockItems, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=44.568) [then we're querying against that table](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=47.060500000000005) [variable, along with OrderLines and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=51.20725) [StockItemHoldings. So we'll highlight all](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=55.342875000000014) [of this, and we'll run that, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=57.76076923076924) [we'll take a look at our plan, and again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=60.94230769230772) [we're looking at the information that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=64.27353846153844) [get specifically per operator, so if I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=66.90638461538461) [look at the Messages tab, which we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=69.70423076923075) [looked at a little bit before, I can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=72.10119999999998) [what we have in terms of execution time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=74.49579999999992) [right down here. This is, this first set](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=78.05587499999999) [of numbers is specific to loading data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=81.37030769230769) [into the table variable, and then the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=83.69053846153847) [second set is related to joining to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=86.39107692307697) [table variable and our other tables to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=89.43430000000001) [OrderLines and StockItemHoldings, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=91.38940000000005) [remember, we had a ton of IO against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=92.6684) [OrderLines, and the total duration here is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=95.55) [about 4. 5 seconds, right, 4500](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=100.01850000000002) [milliseconds. So we get some overall](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=103.84864285714289) [numbers, and then if I look at the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=105.89699999999998) [I'm not so worried about this top query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=108.43499999999995) [right, I'm more worried about the second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=110.71449999999999) [query where we've got this table scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=112.77733333333335) [here, and the row estimates are off. We're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=115.20866666666672) [estimating one row, and we're actually](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=118.1544) [having 6000 come through the plan, and it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=120.489) [goes into a Nested Loop. So I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=122.5874615384615) [understand, based on what I see in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=124.92846153846156) [Messages tab, that I have a lot of IO, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=127.67369230769239) [that it takes 4. 5 seconds, but if I look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=130.3694117647059) [at the plan here, how do I know where SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=132.91742857142856) [Server is really spending the most amount](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=135.7917142857142) [of time? Because there's decent sized](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=138.81909090909096) [lines, there's a good amount of data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=142.0667272727274) [moving through the plan in different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=144.16799999999995) [places, so I've got 6000 rows coming](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=145.728) [through over here, and 500 down here from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=148.8036923076924) [this Clustered Index Seek, and then from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=152.34016666666668) [the Nested Loop into this other Nested](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=155.49075000000005) [Loop I have, let's say, you know, 598, 000](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=158.7321428571429) [rows, and I can assume that as this data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=162.98721428571437) [is moving through the plan, and I'm](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=166.1996923076924)[pulling more rows that it's starting to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=168.34654545454546) [take longer, but I don't know for sure,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=169.86745454545456) [unless I have those operator statistics,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=172.68200000000004) [so I'm just going to start over here on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=175.062) [the right, and if I select F4 on my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=177.98250000000002) [keyboard, then I get this additional](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=180.85533333333333) [information, and this is really what we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=182.65933333333336) [diving into. Here I have IO Statistics,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=185.2978) [and I'm really interested in looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=188.648) [logical reads and physical reads for this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=191.12090909090907) [particular operation. Now if I had lob](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=193.54254545454543) [data, then I'd be more interested in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=195.89581818181813) [looking at the IO specific to the lab](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=198.3448571428572) [data, but that's not a factor here. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=201.162) [what do I have in terms of IO, and down](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=203.40450000000007) [here what do I have in terms of time?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=206.14627272727273) [Where is the time being spent? So it's not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=208.393) [so much in that first operation. I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=212.74840000000006) [come over here to my Nested Loop, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=216.2967058823529)[can get the same information here. What do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=219.19788235294106) [I have in terms of time? It's not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=221.86563636363638) [significant. Okay, and there's not a lot](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=224.8001818181819) [of data coming out of this Table Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=227.16028571428572) [here, so I can't think that I have a lot](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=229.818) [of IO related to that, and if I look at my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=233.74666666666664) [statistics, actual time statistics let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=238.22500000000008) [expand that, no, that doesn't seem to be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=240.32000000000014) [significant either. IO, not huge as well.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=243.67200000000008) [So, as you can see, I can start to drill](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=245.97249999999994) [into each of these operators and look to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=248.89749999999984) [see where my work really is occurring. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=252.8335) [in this Index Seek against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=256.8113846153846) [NonClustered index in terms of the time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=258.8176923076924) [we're still pretty low in terms of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=261.2440833333333) [milliseconds relative to our overall](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=264.1846666666665) [duration, and if we look at the IOs it's,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=266.1791666666667) [you know, 3000, still pretty low. Come](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=269.00666666666666) [over here to my Nested Loop. What do I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=271.36590909090916) [have for time here? Still not huge. Now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=274.7012) [what do I have for my Key Lookup? I see I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=277.9069375) [definitely have a lot of rows involved,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=280.8762500000003) [and now if we start to look at the IO, ah](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=283.10939999999994) [ha. Right, this is where a lot of that IO](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=287.338533333333) [occurs, and we know this, right? This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=290.06359999999995) [isn't a surprise if we think about the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=291.87378571428576) [behavior of a Nested Loop. I had said when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=293.87207142857164) [we talked about Nested Loops earlier that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=296.5496153846153) [with that Nested Loop this Key Lookup is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=299.04969230769217) [lot of random IO, and if I have a lot of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=301.99905882352954)[data that I'm having to lookup, which, in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=305.5945454545455) [this case, is over 300, 000 rows, that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=308.8149090909093) [turns into over a million reads, and in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=312.10199999999986) [terms of our time, if we look at this and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=315.21026666666666) [expand that out there's over a second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=318.3415999999999) [spent here doing those lookups for all of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=321.0927500000001) [those 300, 000 rows. And finally, if we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=324.71625000000023) [come over to our last Nested Loop in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=327.6818666666668) [plan this is where the other bulk of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=330.27806666666703) [time is spent, a second and a half. So I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=332.89106666666663) [love the additional information we get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=336.0401538461538) [here, and if you compare the operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=338.50661538461526) [level information that we get against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=341.53200000000004) [information that we get from the Messages](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=344.92700000000013) [tab it roughly adds up to be about the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=346.76439999999985) [same, but it's great because in the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=348.793) [those operator level statistics really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=351.8140909090911) [help us understand where the majority of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=353.7531818181818) [work is occurring, and it's another good](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=356.57481818181816) [way to determine where to focus your](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=359.4664166666666) [efforts in terms of tuning. So I see this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=362.386) [Nested Loop and my first thought isn't, I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=365.5842142857143) [need to change the Nested Loop, my first](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=368.1834615384616) [thought is, why do I have so much data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=370.3766923076925) [coming into the Nested Loop and maybe I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=372.81873333333334) [need to address that first. So again, how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=374.983) [you approach tuning is something that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=377.48100000000005) [going to come to you over time, but that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=379.36866666666674) [information tells us where we're spending](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=382.242666666667) [the most amount of time in the query, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=383.89353846153847) [gives us an idea of what direction to go next.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=7&mode=live&start=387.024)

[Parallelism](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live)

[One item that we've seen pop-up in a few](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=2.428) [of our plans is parallelism, and if MAXDOP](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=5.1440714285714275) [is not set to one for an instance or for a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=7.7547999999999995) [database, depending on what version you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=11.794733333333342) [running, then the optimizer can generate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=13.527499999999998) [either a serial or a parallel plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=15.292875) [Remember that the optimizer is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=18.092) [cost-based optimizer, and so if the cost](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=20.448) [of a plan exceeds the cost threshold for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=23.1874) [parallelism, then SQL Server can consider](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=26.254600000000014) [running the plan in parallel. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=28.622499999999995)[ultimately only caches one of those plans,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=30.992916666666666) [either the serial or the parallel plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=33.69433333333333) [Not every single plan can run in parallel.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=36.68072727272728) [There are certain factors that inhibit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=40.528) [parallelism, such as user-defined](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=43.39085714285715) [functions, and table value functions, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=45.324875) [certain built-in functions, so if you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=48.1255) [expecting a plan to run in parallel, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=50.360500000000016) [you don't see that it is, it's quite](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=53.08746153846154) [possible that it has an inhibitor, which](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=55.392692307692315) [prevents that parallel plan. Now the thing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=58.702888888888886) [about a parallel plan means that it costs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=61.742) [more, right? It exceeds that threshold](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=64.014) [that you have set for the instance, but it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=66.08345454545452) [doesn't necessarily mean that a query is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=69.19585714285715)[bad, you just need to be aware that it's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=70.89285714285718) [more expensive query that you're running.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=75.0827272727273) [Now when we've seen the parallelism before](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=78.656) [in the plans I haven't really pointed out](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=80.59850000000003) [the different operators, but there are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=82.95990909090908) [three that you will see, and the first is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=84.90772727272723) [a Distribute Streams. This operator takes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=87.88030000000003) [one input, as you can see, the single](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=89.90842857142857) [block on the right, and it outputs](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=92.66157142857142) [multiple threads. It can be two or more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=95.59066666666665) [depending on what is set for the max](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=99.384)[degree of parallelism and the number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=101.61784615384612) [processors that are used. The second](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=103.74381818181818) [operator you might see is Repartition](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=105.93327272727275) [Streams where multiple streams of data are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=108.37936363636365) [pulled in, and then multiple streams are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=111.53254545454548) [pushed back out. You can sometimes see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=114.71566666666664) [this when there's a rebalance of threads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=117.30266666666665) [that has to occur, and then the third one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=119.4388333333333) [is the Gather Streams operator. And with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=123.04430769230768) [the Gather Streams this operator takes in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=125.83554545454547) [multiple streams and then produces a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=128.3854545454546) [single stream as output. And then the last](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=131.1915) [thing to pay attention to is what we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=134.19642857142856) [seen before, where we've got an operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=136.05128571428565) [that is running in parallel, so when we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=137.80923076923074) [have something like a Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=139.88) [Scan, and you see the circle with the two](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=141.96149999999994) [arrows, then that scan is running across](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=145.918) [multiple threads. Now when we talk about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=150.293) [parallelism one of the things that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=153.01383333333328) [sometimes confuses people is that things](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=154.7788333333332) [can happen concurrently within a plan, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=157.71209090909096) [there can be multiple zones of execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=161.29741666666666) [happening at the same time, as shown in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=164.22633333333337) [this image. Here we've got three different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=167.69700000000003) [zones where the Clustered Index Scan from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=170.84175000000008) [zone two can be happening at the same time](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=173.46438461538457) [as the Index Scan in zone three. The](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=177.07355555555557) [MAXDOP setting limits the number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=181.28714285714284) [threads that can be used per operator. It](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=184.02399999999994) [is not the total number of threads for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=187.60764285714288) [query, so if MAXDOP, for example, were set](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=191.12342857142866) [to four, then of the Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=194.21338461538457) [in zone two there could be four threads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=197.2681538461537) [scanning that Clustered Index. There could](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=201.28872727272727) [also be four threads for the index scan in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=204.38784615384617) [zone three. So the MAXDOP doesn't limit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=208.97715384615395) [the total threads for the plan. In the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=212.00654545454552) [example that I just gave we could have at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=215.00386666666668) [least eight, potentially more. It simply limits the number of threads per operator.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=8&mode=live&start=217.64026666666672)

[Demo: Parallelism in Plans](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live)

[Let's take a look at a couple of queries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=2.466) [that run in parallel, so that you know](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=4.951384615384615) [what to look for when you see this in your](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=7.5360000000000005) [plans. So for this demo that looks at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=11.235999999999994) [parallelism we're going to work with one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=13.024307692307692) [query, some variations of it that returns](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=14.589) [a lot of data, as I've noted here, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=17.032) [let's make sure we're in the right](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=19.70338461538462) [database, and let's enable our actual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=21.48892307692309) [execution plan. So you'll start to see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=24.48614285714285) [queries go parallel when they become more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=26.80549999999999) [expensive, and remember that in order for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=28.517) [a query to run in Parallel the cost of it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=30.930923076923065) [has to exceed the cost threshold for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=34.18153846153845) [parallelism that's set for the instance.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=36.24923076923074) [Now the default for that setting is five,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=37.879333333333335) [and I've left it set at that for this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=39.958) [instance. So this query joins four tables,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=43.61290000000002) [Orders, OrderLines, StockItems, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=47.61366666666668)[StockItemTransactions, and our predicate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=50.024625) [is on the TransactionOccuredWhen column](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=52.479124999999996) [from StockItemTransactions and Quantity](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=56.105250000000005) [for OrderLines. So we'll go ahead and kick](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=59.675750000000015) [this off, and this query takes about 30](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=62.775000000000006) [seconds to run. As I said in the notes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=64.527) [here, it returns a lot of data, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=67.42560000000005) [because of that, because the query is more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=70.1170909090909) [complex, and because it moves a lot of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=73.15345454545451) [data through the plan it's more expensive,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=75.11015384615386) [and thus, we're going to see that it ends](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=76.75042857142857) [up running in parallel. It returns about 2](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=79.34628571428568) [million rows, and again, takes about 30](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=81.82914285714287) [seconds to complete. One of the things](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=84.15514285714289) [that you can play with is this date range](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=86.18613333333333) [that we have here, as well as the quantity](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=88.51293333333332) [because the plan will change based upon](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=90.91138461538466) [the amount of data that it has to return,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=92.76323076923077) [so that's sometimes just a fun exercise,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=94.91630769230773) [but here's the plan that we get, and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=96.73542857142859) [can immediately see that it's a parallel](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=99.2136428571429) [plan because we have some of those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=101.39000000000001) [parallel operators that we talked about.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=103.74057142857143) [So here we've got a Distribute Streams](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=106.438) [operator. Here we've got a GatherStreams,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=109.61512499999998) [and here we don't have a Redistribute](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=111.75775) [anywhere, but that's okay. We don't have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=114.122) [to, and we notice that some of these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=116.7071538461538) [operators are running in parallel, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=119.89245454545454) [something like our Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=122.80081818181816) [over here, I keep hovering on that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=125.09709999999998) [interestingly enough, isn't running in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=127.062) [parallel, but this Clustered Index Scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=129.40755555555558) [against OrderLines is, and if we, we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=132.22276923076925) [going to use F4 because hovering over](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=135.50846153846163) [these icons just gets a little bit much](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=138.21999999999997) [sometimes in terms of trying to read, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=140.444) [if we look at our Clustered Index Scan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=142.68742857142848) [and we look at the number of rows one of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=145.06333333333333) [the things that you'll see because this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=148.52999999999997) [a parallel, this query is running in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=151.0429166666666) [parallel, is how many rows are coming](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=153.105) [across the different threads. So one of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=155.9221818181819) [the things that you might start to look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=157.9655) [for when you're looking at your parallel](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=159.12149999999994) [queries is what this distribution of data](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=160.93318181818182) [looks like across the threads, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=163.345) [sometimes if there's an uneven](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=165.13081818181823) [distribution across however many threads](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=166.619) [you've got, you'll see that redistribute](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=169.14100000000002) [operator that I had mentioned in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=172.066) [slides because it will rebalance the rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=174.88699999999994) [on the threads before it moves on to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=177.52026666666666) [next operator. So that's one thing to look](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=180.72486666666663) [for in the plan when you've got a parallel](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=183.25049999999993)[query. And then as we continue to move](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=185.9707499999998) [through, and we look at the different](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=187.54550000000006) [threats here you'll see that those numbers](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=188.818) [change, and we're expecting or we're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=191.28900000000007) [hoping that the rows are close to the same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=193.4699230769231) [across the different threads, otherwise,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=196.93007692307705) [you can sometimes end up waiting a little](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=198.53960000000004)[bit longer because one thread is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=200.8723) [processing more rows potentially than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=203.10009999999994) [another. So we just tend to look at that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=204.6775714285714) [as we move through the plan, and it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=206.76364285714277) [looking, for the most part, pretty good](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=209.00130769230765) [here. Now if I want to understand more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=211.16053846153835) [about the parallelism in a little bit more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=214.3130000000001) [detail, from here I can right-click, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=217.49528571428573) [can look in the XML, and if I look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=220.20157142857147) [DegreeOfParallelism attribute here I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=224.5708461538462) [see that it was set to 4. In terms of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=226.80238461538468) [branches that we talked about in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=231.07562500000012) [slide, I can see that I've got one here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=233.705) [and in terms of the threads that were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=236.9792) [reserved for this query, I can see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=239.79476923076922) [there were six. So this information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=242.32584615384607) [coupled with what I see at the operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=244.72775000000001) [level helps me understand to what degree](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=248.60175000000004) [the parallelism occurred, and how many](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=251.04266666666672) [different branches I had within this plan.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=253.2981) [Now one of the things that you might have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=256.278) [noticed about this query is that I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=259.0548461538459) [asked for, I've don't his calculation in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=261.1336363636363) [here, and I'm going to close the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=263.10445454545436) [Properties window for the moment, and I've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=264.72945454545464) [done a calculation to determine](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=266.87425) [TotalItemCost. Now I could put this into a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=269.4373750000001) [function. Let's say that this is something](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=271.3516153846153) [that I calculate quite frequently, and so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=272.9666363636364) [one of my developers, or maybe it's me,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=275.8620909090911)[decides to put this into a function. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=278.6246666666666) [we're just passing in those three columns,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=281.142) [Quantity, UnitPrice, and TaxRate, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=283.851) [we're going to output the total cost.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=285.5550909090909) [We're going to do the math here in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=287.86) [function. So we'll create that function,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=289.81030000000004) [and then I'm going to put that into the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=291.3446666666666) [query. So rather than inline the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=293.7164666666666) [calculation we're going to drop this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=295.34416666666664) [function in, and we'll rerun this query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=296.9811666666666) [here, and again, it's still going to take](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=299.3923076923078) [the same amount of time, but what you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=302.1560666666667) [going to see is that the plan changes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=304.30860000000007) [slightly, and if you remember, when I was](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=306.76683333333335) [talking about parallelism I stated that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=310.14216666666675) [there were some objects that inhibit them,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=312.6801818181817) [and one of them is functions, and this is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=315.645) [what we're going to see in the plan is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=318.03299999999996) [that rather than have this query run in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=320.42074999999994) [parallel, as we did previously, it's now](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=322.5427499999998) [going to run serially because that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=325.5564999999999) [function inhibits the ability, and when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=328.305) [you see a query that you expect to run in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=330.6264999999999) [parallel there's a couple things that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=334.07657142857136) [can do to try to figure out what the issue](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=336.05157142857126) [is if it's not immediately evident. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=339.25915384615405) [when we look at this plan we see none of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=341.58014285714285) [those parallel operators. We see the same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=344.55157142857115) [shape that we saw before. We've got our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=346.8371538461538) [Clustered Index Scans over here that feed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=349.6254615384614) [into a Hash Match, and our other index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=351.8022857142857) [scans, and we had Hash Matches all over](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=354.24) [the place, and we ended with a Sort. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=356.41599999999994) [is the same shape that we saw before, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=358.9358461538461) [now everything is running serially, and if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=362.0304615384613) [you look into the properties here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=364.794) [actually let me close this one that we had](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=367.392) [open earlier, just so we don't have any](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=369.245357142857) [mistakes. If I look at this you can see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=371.09121428571433) [that my DegreeOfParallelism is 0, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=373.5398571428574) [there's this other entry here,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=375.9542222222223) [NonParallelPlanReason, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=378.292) [CouldNotGenerateValidParallelPlan. Well,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=382.8565) [that's not extremely helpful. It doesn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=384.74727272727273) [tell us exactly why, but it's a start.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=386.9629090909092) [This is more information than we used to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=389.3630769230769) [get, and this is available in SQL Server](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=391.2092307692307) [2012 and higher. object from here one of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=395.1409000000001) [the other things that I could do is I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=398.1170000000001) [could come back to my query, and I could](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=400.61900000000026) [add this trace flag, so let me kick off](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=403.6324666666665) [the query here, and you'll notice at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=407.2554285714286) [bottom I have 8649, and I've noted up](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=412.17314285714286) [here, this is an undocumented trace flag.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=415.7894545454546) [It's one of these that you should only use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=417.815) [for testing. I would not recommend using](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=419.79009090909085) [it in a production environment, but the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=421.9219999999999) [purpose of that trace flag is to force a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=424.3563333333334) [parallel query to be generated, even if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=427.69233333333364) [it's serial initially, and you add that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=430.46975) [trace flag, it will run it as a parallel](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=433.4908333333332) [query, but what's interesting here is that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=436.65107692307686) [it won't because we have this function in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=439.1701538461538)[place, and even using the trace flag, it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=443.5713846153844) [will not override that, so there's some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=447.1516666666667) [limitations in the optimizer that you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=449.56608333333344) [can't force your way around with a hint or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=451.69207142857135) [with a trace flag. You see that this still](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=454.898) [runs serial. It doesn't run in parallel](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=458.3908181818183) [even with that trace flag in place. If I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=460.65450000000004) [were to comment this out or remove this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=463.36976923076924) [entire line entirely, and run it again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=465.9008461538461) [you would see that it would run in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=467.8866153846153) [parallel. We'll go ahead and clean up, and then head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=9&mode=live&start=469.9598461538459)

[Seek Predicate and Residual Predicate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live)

[Hopefully the majority of queries that run](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=1.909) [against your system have a predicate or a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=3.8544166666666664) [where clause, and when you're looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=6.317999999999999) [queries, and you're looking to understand](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=8.823999999999998) [more details about the operator,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=11.223500000000003) [particularly those seeks and scans, one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=13.265) [thing to pay attention to is the predicate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=15.4405)[information. So here you can see we've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=18.281166666666664) [a Clustered Index Seek, and we've expanded](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=20.94183333333332) [the information related to the seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=23.918666666666667) [predicate. Now a seek predicate, if you're](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=26.692666666666668) [not familiar with that term, means that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=28.59936363636364) [the predicate or the where clause could](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=30.573153846153847) [leverage the index key. So, in this case,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=33.268692307692305) [we're looking for ContactID against the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=37.14063636363636) [Contact table or the Clustered Index on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=40.638090909090906) [the Contact table, and the Clustered Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=43.980499999999985) [Key is ContactID, so we could seek that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=47.173375) [and therefore we have a seek predicate.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=50.640374999999985) [This is in contrast to what we call a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=53.674) [residual predicate. So in this case, in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=57.53909090909092) [the contact table, in addition to looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=59.842642857142856) [at the ContactID as part of the predicate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=61.86514285714285) [we're also looking at LastName, and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=65.96554545454543) [LastName isn't part of that index key, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=69.6775) [it can't leverage a seek there. What it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=72.78349999999999) [has to do instead is after it checks the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=76.04566666666668) [ContactID it goes to check the LastName,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=80.24266666666672) [so we call that a predicate here in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=83.25785714285716) [view or in this window, but you'll hear](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=86.70742857142864) [the term also, residual predicate. It's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=89.81290909090912) [additional work that the optimizer has to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=92.088) [do that's part of the WHERE clause, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=94.36999999999995) [the overhead for this can sometimes be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=97.15009090909092) [very significant, and it's not easily](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=99.8336363636364) [identifiable in the plan. You really have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=102.45811111111114) [to look at the operator information to understand when it occurs.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=10&mode=live&start=107.251)

[Demo: Seek and Residual Predicates](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live)

[We're going to run through a few queries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=1.889) [that have different WHERE clauses,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=3.773) [different indexes, so that we can see what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=5.14675) [seek and residual predicates look like](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=8.600750000000001) [within a plan. Time to take a look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=11.755000000000003) [predicates in more detail. We'll set the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=15.072000000000003) [database context to WideWorldImporters,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=17.422499999999996) [and before I start we're just going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=19.26049999999999) [take a quick review of the orders indexes.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=22.492461538461544) [So just as a reminder, we've got our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=25.458) [primary key on OrderID, and then we've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=29.02066666666667) [our four NonClustered indexes. None of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=32.163500000000006) [them have included columns. They are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=34.222454545454546) [single column indexes only, and none of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=36.31481818181819) [them are defined as unique. So CustomerID,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=38.42011111111112) [SalespersonPersonID, PickedByPersonID, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=42.010000000000005) [ContactPersonID. So let's enable the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=44.809000000000005) [actual plan, and here's the query that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=47.47400000000001)[we're going to work with, CustomerID,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=51.04833333333334) [OrderDate, ExpectedDeliveryDate, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=53.77633333333335) [SalespersonID from the Orders table WHERE](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=55.464999999999996) [CustomerID equals a specific value, in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=59.167) [this case, 890, so we know that we have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=61.31130769230771) [NonClustered index that leads on](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=64.97333333333334) [CustomerID, and assuming this is pretty](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=66.90722222222225) [selective you can try to guess what the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=69.0109230769231) [optimizer is going to do. It's a game I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=71.758) [like to play, right? Here we have an Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=74.05853846153843) [Seek against that NonClustered Index,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=76.697)[which outputs the OrderID and the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=78.313) [CustomerID, and then there's a key lookup](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=80.72009090909087) [against the Clustered Index using the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=83.61133333333333) [OrderID to pull back the SalesPersonID,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=86.26733333333334) [the OrderDate, and ExpectedDeliveryDate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=88.97333333333333) [and this is done through a Nested Loop,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=90.844) [and our output is the SELECT. So we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=93.31485714285719) [seen this type of query plan before. This](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=95.6588888888889) [is actually a query from an earlier demo,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=97.59393333333333) [and if you look in this Index Seek you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=99.32939999999996) [see at the bottom of the operator details](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=101.64453846153847) [that we have a seek predicate, and that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=104.34730769230774) [seek predicate is the CustomerID equals](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=107.09299999999999) [890. So we have a NonClustered Index that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=109.16299999999998)[leads on CustomerID. We can leverage that,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=111.74799999999996) [thus we have a seek predicate. Now let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=114.81039999999999) [edit our existing index to make it a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=118.74353846153846) [little bit more friendly for this query,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=121.86169230769232) [so we're going to leave CustomerID as the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=124.41166666666669) [leading column, and if we're going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=127.173) [include those other three columns,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=128.811) [OrderDate, ExpectedDeliveryDate, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=130.6638) [SalespersonPersonID, as included columns,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=133.4142) [so that ideally we can have an index seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=135.4705714285714) [and not have to use that lookup at all.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=138.8892857142856) [I'll rerun my query, and if I look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=142.30725) [plan I do have that Index Seek against](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=146.13116666666667) [that edited NonClustered index, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=149.3805000000001) [still have my Seek Predicate of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=152.40860000000004) [CustomerID. Now what happens if someone](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=156.02780000000013) [changes the WHERE clause? Right? They edit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=159.03155555555557) [the predicate. I didn't mean for that to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=161.89599999999996)[rhyme, but it did, and it was kind of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=164.41333333333318) [funny, right? But this will happen, right?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=167.02719999999994) [People will come along and they'll change](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=168.8647272727272) [your code or maybe your code has the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=170.74992307692307) [flexibility to allow the predicate to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=173.70930769230765) [change. So we were great with CustomerID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=176.00845454545455) [equals 890, and now we've got OrderDate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=178.87654545454552) [between May 1st 2016 and May 31st. So if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=182.12766666666667) [we run that query and we look at the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=186.0392222222222) [it looks exactly the same, right? We have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=188.5753333333332) [an Index Seek, and if I look here what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=190.8100666666667) [you're going to notice is the seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=194.0188666666668) [predicate is the same, but now we also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=196.44935714285714) [have a predicate. So remember, Customer is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=199.12764285714286) [the index key, OrderDate is an included](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=201.70945454545455) [column, so it can leverage the index key](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=204.47) [of CustomerID, it can seek that, so that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=207.25953846153854) [our seek predicate, but in order to check](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=209.96099999999998) [the OrderDate it has to look at that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=212.51566666666665) [included column, so that's a residual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=216.36676923076922) [predicate, and we see this here in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=219.394) [properties of the operator as a predicate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=222.31857142857143) [so predicate residual predicate while](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=224.8371111111111) [we're looking at the operator properties](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=226.46266666666668) [are the same thing. The additional](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=228.66414285714288) [information that we look for here is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=231.08084615384618) [Number of Rows Read and the Actual Number](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=234.20823076923088) [of Rows because what can sometimes be a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=236.98638461538465) [little misleading, when we look at the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=239.555) [output here you'll see Actual Number of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=241.92974999999996) [Rows, 6, and you'll see Estimated Number](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=244.22366666666667) [of Rows 20, and you're like, well, it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=246.31550000000001) [estimated higher. It only actually read](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=248.81557142857136) [six rows, and that's incorrect. It output](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=251.48633333333328) [six rows, but it read 130, so that's some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=254.93361538461536) [really good additional information in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=259.0313846153847) [plan that you'll want to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=260.8823636363636) [particularly when you have a residual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=262.528) [predicate, not just a seek predicate. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=265.1874999999999) [if we see this one of the things that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=268.07599999999996) [could do to further highlight this is use](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=270.3659999999998) [trace flag 9130, which I mentioned before](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=272.7096666666667) [is undocumented, and what this trace flag](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=275.20808333333343) [does is it pushes that residual predicate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=277.8346363636362) [out to a filter operator, and again, I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=280.4808888888889) [wouldn't recommend using this in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=283.4630909090909) [production, but the plan changes slightly.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=285.1635454545455) [We still have our Index Seek, and notice](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=287.18253846153846) [now that we just have a seek predicate,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=289.7308461538463) [and our Actual Number of Rows and our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=292.2792857142857) [Number of Rows Read now match. We read 130](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=294.82785714285717)[rows, and that's the number of rows that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=297.671076923077) [came out of the operator, but now we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=300.07523076923076) [this filter operator, which still is a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=302.3847692307691) [residual predicate. It's an additional](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=305.24728571428585) [step in the plan, and it's really a red](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=307.15960000000007) [flag if I see a filter operator in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=310.07740000000024) [plan because I want filtering to occur as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=313.0304285714287) [early as possible, but with this trace](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=315.671) [flag we've pushed this out on purpose to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=317.5448461538461) [that filter operator. It's just a good way](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=319.78284615384615) [to look into those details with a little](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=322.3102307692307) [bit more structure around them in that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=325.4469285714286) [filter operator. To address this, right,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=328.51142857142867) [if it's going to be common that users are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=330.6636153846153) [going to look for both CustomerID and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=333.536)[OrderDate, then maybe I want to change the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=335.6516153846155) [index. Maybe we put OrderDate into the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=338.3583333333333) [index key along with CustomerID, so let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=341.4849999999999) [change that. We'll leave](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=344.5356666666666) [ExpectedDeliveryDate and SalesPersonID as](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=346.3412857142857) [included columns, and if I run my query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=348.241857142857) [one more time and I look at the plan it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=351.43711764705864) [goes back to what we had in terms of just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=355.323) [the Index Seek, and now I can see that I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=357.95299999999975) [just have a seek predicate. That residual](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=360.7047777777778) [is gone. My seek predicate uses CustomerID](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=363.0975000000001) [and it also uses my date range, so the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=366.3367500000003) [index key can be leveraged for a seek for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=369.9046000000001) [both of those predicates that I have in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=373.174) [the query, but if I change it just a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=376.49879999999985) [little bit, rather than have an equality](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=380.10450000000003) [for CustomerID I'm going to change it to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=382.5422500000001) [be between 800 and 900. So this just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=385.96599999999995) [changes slightly. It looks exactly the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=389.82040000000006) [same, but you'll notice when I hover over](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=392.77120000000014) [it that now I've come back to a seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=394.77453333333335) [predicate and a predicate. Because I have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=396.8716153846154) [a range for the first column rather than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=399.458923076923) [an equality, it seeks through the index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=402.54425000000003) [looking for the CustomerIDs within that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=405.43116666666674) [range, and then as it's doing that it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=407.7213333333333) [also looking at the OrderDate as part of a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=410.652) [residual, so you'll see this here, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=414.3863076923075) [again, Actual Number of Rows, 301, but the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=417.0856153846153) [Number of Rows Read, 13, 000. So great](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=419.8579230769229) [information that's exposed in the plan. So](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=424.6069999999999) [you're aware, these residuals can also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=428.9302) [appear in lookup, so we're going to take a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=430.53340000000003) [query, that looks pretty good, it's our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=433.28063636363635) [standard Nested Loop with a Key Lookup,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=435.38679999999994) [and if we look in our Index Seek here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=437.08359999999976) [we've got a seek predicate based on a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=439.78425) [ContactPersonID and then our Key Lookup is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=443.10758333333325) [to pull out a couple additional columns](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=444.8919230769229) [here, OrderDate, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=446.489)[CustomerPurchaseNumber. If I add-on to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=448.8545) [that predicate, in addition to looking for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=450.6371818181819) [ContactPersonID equals 1179, I've also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=452.377) [said I want an OrderDate greater than](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=454.4555000000001) [January 1, 2016. When we see this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=457.6771666666666) [execution plan it looks the same, again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=461.67824999999976) [and our seek predicate here for the Index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=464.64776923076914) [Seek is the same, but in our lookup](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=467.1573076923075) [operator, in addition to that seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=469.5187692307693) [predicate we had before, I also have a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=471.274) [residual on that OrderDate. So as it goes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=474.3113333333332) [into the Clustered Index to find the row](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=477.1499999999999) [based on the OrderID it's also then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=479.7899999999998) [checking the OrderDate to see what that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=482.24266666666676) [is, and if the row matches then it pushes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=484.80233333333365) [it out to the Nested Loop. So again, here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=487.6554285714286) [in this Key Lookup if I look at the output](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=490.0778000000001) [it looks like Number of Rows, 36, not so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=491.9338000000003) [bad, but if I look at the Number of Rows](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=494.29343750000004) [Read it's actually 170, and it only pushed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=497.20876923076924) [out 36 that matched based on that. And](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=500.07892307692293) [again, I can use the trace flag of 9130 to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=503.3156)[see that residual predicate even better.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=507.81960000000004) [Again, not for production, and what's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=510.9766666666667) [interesting here is that it pushes that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=513.5918333333334) [filter out after the Nested Loop, so we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=515.1662500000001) [have our Index Seek with the seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=517.3079230769232) [predicate, it does the lookup over to the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=519.3616153846157) [Clustered Index based on the OrderID. That](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=521.8713076923076) [data flows through the Nested Loop, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=524.0814615384616) [then the 170 rows that match there come](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=526.2546923076927) [out and drop into that filter, and only 36](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=528.9015714285713) [rows come out of that. It's pushed that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=532.1852857142851)[predicate out to the filter operator](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=534.5684999999999) [rather than having that in the lookup](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=536.222) [operator. Last thing to note is that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=540.1393749999999) [residuals can exist in hash joins, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=543.0870769230767)[this is the same query that we used when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=545.3574285714286) [we were looking at Cardinality Estimate](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=547.368285714286) [issues, so I'm not going to go through it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=548.6469999999999) [in great detail, but you may have noticed](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=550.3794999999999) [this when we looked at this query and we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=553.0570000000001) [looked at the plan that it had something](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=556.2655000000001) [rather interesting in it, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=559.1415000000003) [purposefully just kind of glossed over it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=560.9280833333336) [earlier, in that we have this table scan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=562.926) [against our table variable, and after that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=566.2019999999999) [we have a filter, and we come in to this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=568.7207999999999) [Hash Match and you'll see that there's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=571.6567999999996) [Probe Residual here where it's checking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=574.5750000000002) [the StockItemID value. So this would be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=576.906) [additional information that I would be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=580.6468) [interested in seeing in my plan, but you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=583.4075714285715) [don't see these as frequently, but it's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=586.4944285714288) [definitely something to take note of when](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=588.7890000000002) [you see a Probe Residual within a Hash](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=590.7787500000005) [Match. Alright, let's reset our](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=595.2151666666666) [NonClustered Index to just have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=598.181) [CustomerID, and we'll head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=11&mode=live&start=603.181)

[Warnings](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live)

[When we looked at some plans in the very](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=2.435) [beginning of the course I pointed out](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=4.683071428571429) [warnings and there are multiple warnings](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=6.753818181818183) [that can appear in a plan. Some of them](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=9.219272727272728) [can be related to spills to tempdb, such](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=12.396461538461539) [as hash warnings and sort warnings. We can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=15.022833333333333) [also see warnings related to implicit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=17.885499999999993)[conversions, where we have joins or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=20.494400000000002) [predicates between data types that don't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=23.565200000000008) [match. Sometimes you'll see warnings if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=26.049727272727274) [you've got no statistics. Now, hopefully](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=28.417) [everybody has that auto create statistics](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=30.95499999999999) [enabled and everyone is updating](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=33.394) [statistics on a regular basis. But if not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=35.2615) [you'll sometimes see that no stats](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=38.10053846153846) [warning, and if there's no index or an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=40.04361538461539) [index that doesn't help the query enough](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=42.84042857142856) [you'll see a missing index warning that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=45.467928571428544) [shows up with the green text. It doesn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=47.836400000000005) [show up with the triangle, but with a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=50.36261538461538) [green text instead. And finally, if you've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=53.013076923076895) [got some old code out there you may](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=55.11746153846155)[sometimes run into a case where you've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=57.33838461538465) [a missing join predicate. Hopefully these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=60.16845454545455) [are not very common nowadays, but I have seen them in the wild from time to time.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=12&mode=live&start=62.289461538461545)

[Demo: Generating Plan Warnings](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live)

[In this demo we'll take a look at some of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=1.982) [the typical warnings that you might see in](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=4.1577142857142855) [a plan and how you could track those down.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=6.4852307692307685) [Final demo of the course friends. Let's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=9.764) [set the context for the database to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=12.428083333333337) [WideWorldImporters. Let's make sure also](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=15.182400000000001) [that we will include our actual execution](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=17.3109) [plan. So this goes query against Sales](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=20.412) [Orders. We're pulling back four columns;](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=23.603999999999996) [CustomerID, OrderID, OrderDate and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=26.11928571428572) [ExpectedDeliveryDate. Our predicate is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=28.1285) [WHERE OrderDate between January 1st, 2012](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=30.499499999999994) [and December 31st, 2013, and we're going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=33.62800000000001) [to order by OrderDate. I do have an OPTION](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=37.02825000000003)[RECOMPILE here. It is because I don't want](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=41.476400000000005) [to worry about freeing the procedure cache](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=45.0566923076923) [as I'm making some changes, so I'm putting](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=48.078) [that on there to make my life easier, to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=50.11171428571427) [make the demos easier. It's not something](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=52.58250000000001) [that you want to just throw on code to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=54.7886666666667) [resolve any kind of problem. There's a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=57.89466666666668)[specific time and place for using that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=60.2556) [option. Here it's just so the demos flow a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=62.32970000000002) [little bit easier. So go ahead and execute](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=65.25945454545455) [the query, and when I look at the plan](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=67.34399999999997) [I've got a Clustered Index Scan. Remember,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=69.3185999999999) [I asked for data based upon a particular](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=72.10092307692305) [range of OrderDate, so you'll see I've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=75.44209090909091) [a residual predicate here, bonus points if](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=78.25081818181822) [you picked that up from the last demo, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=80.72338461538459) [I've pulled out those four columns that I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=83.76453846153846) [asked for and then again, I had asked for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=85.4328461538462) [that data ordered by OrderDate, so we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=87.65628571428572) [got a sort in here, so that we see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=89.60128571428572) [data in that order. I have a missing index](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=93.21633333333337)[recommendation. There's definitely an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=96.11900000000003) [index that I could create to help this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=97.21740000000005) [query, but we're going to stick with this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=98.89699999999999) [for the moment, and we're going to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=100.6718) [what we have for Page and RowCount for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=103.99999999999999) [Clustered Index in particular because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=107.51663636363635) [that's the index that we were scanning.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=109.60118181818179) [So, for the Clustered Index we've got some](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=112.1354166666667) [IN\_ROW\_DATA, some LOB\_DATA, and for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=115.031) [IN\_ROW\_DATA we're at 84, 000 rows and 801](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=118.12100000000001) [pages. So I'm going to do something that's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=122.08028571428571) [really not very nice. I'm going to trick](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=125.94314285714285) [the optimizer. This is not recommended for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=128.40933333333334) [a production environment. I have don't try](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=130.41037500000004) [this at home with exclamation marks, but](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=132.4177692307692) [we're going to tell SQL Server that the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=134.42461538461535) [Orders table has still 801 pages, but it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=137.675) [only has 100 rows. So we're going from 84,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=140.97666666666666) [000 rows to 100. Not very nice to mislead](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=143.7876666666666) [the optimizer in this way. If I rerun that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=147.45200000000003) [same query we're going to have the same](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=151.22976923076922) [plan, but you'll notice that I have a Sort](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=153.95530769230768) [warning. So the warnings that we've](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=155.94755555555565) [mentioned, were looking for that triangle](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=157.8999090909091) [with an exclamation mark. That means I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=159.995) [need to dig into something in a little bit](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=162.10253846153844) [more detail, and what we see here for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=164.57079999999996) [sort is we actually have warning text:](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=166.55619999999988)[Operator used tempdb to spill, and we have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=168.8713333333333) [information about how many pages were](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=172.178) [written to and read from tempdb, and what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=174.73499999999996) [we have in terms of memory. So this Memory](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=177.68546666666666) [Grant that we see here, 1024, was not](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=179.4560666666666) [enough for the rows that came into the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=181.9614615384615) [sort. It was expecting 23 rows and there](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=185.3983846153845) [were actually 19, 000, so could not handle](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=188.55600000000004) [19, 000 rows, sorting all of those in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=191.5866923076923) [memory that was allocated, which is why it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=194.31092307692296) [spilled out to tempdb. This information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=197.29344444444448) [shows up in the actual plan, it doesn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=199.45284615384614) [show up in the estimated plan, so when you](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=201.45223076923068) [try to mine the plan cache and look for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=203.9145714285715) [this type of information you're not going](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=206.47442857142858) [to see it, which is why we need to turn to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=208.40942857142855) [something else, like Trace or Extended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=212.18175000000005) [Events. So this information is in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=214.7182500000001) [default trace. Let me just grab this path](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=217.658) [here because I want to show you. If we go](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=220.34084615384614) [into Profiler, which I already have open,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=223.656)[and we'll go right to this Log folder. If](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=226.37200000000004) [I just copied this in here you'll see that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=229.18499999999995) [we drop right to the same location. I take](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=231.45479999999984) [the most recent log file that we have, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=234.32185714285708) [if I scroll all the way down you'll see](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=237.29283333333336) [that I've got a sort warning. This just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=240.3223333333335) [occurred. This is the sort warning we just](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=242.8730909090909) [generated, but I don't have any](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=244.99745454545447) [information about the actual query text.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=246.97300000000007) [TextData is empty. Very sad. I can get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=249.025) [better information through Extended](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=253.33453846153853) [Events. So this is the code to create an](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=255.4893076923078) [event session that captures the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=258.27046153846163) [hash\_warning event, the sort\_warning](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=259.672) [event, and sql\_batch\_completed, and for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=262.38342857142857) [the two warning events we're also going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=265.0953333333333) [capture sql\_text and tsql\_text. Now these](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=267.80866666666645) [are expensive actions, and I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=270.1560000000001) [talk about a couple alternatives in a](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=273.0767500000003) [second here, but let's create this EVENT](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=275.41600000000005) [SESSION, and then we'll start it up, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=277.8943571428572) [we'll run our query one more time to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=282.3452142857145) [generate that Sort warning. Again,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=286.5097272727272) [confirmed that we've generated it here.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=288.81427272727257) [We'll stop our EVENT SESSION, just so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=291.24275000000006) [that's not running in the background, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=293.6828333333335)[then let's take a look at our Temp folder,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=296.3803846153847) [and open up this. So, we've got one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=300.19) [sort\_warning right here, and if we click](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=305.06199999999984) [on the text and we show the column in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=307.9765000000001) [table it looks like this is the query that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=310.6952500000003) [we ran, and it is in our case, but I need](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=312.85553333333326) [to make the point that SQL text represents](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=315.85307142857147) [the last query that was executed, and it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=318.9199285714288) [may not be the query that generated the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=321.13678571428574) [sort warning, which is why I have the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=322.8436428571429) [batch completed. Now you'll see I've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=325.3327777777776) [batch\_text here, I can add that, and I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=327.53657142857156) [have other batch completed events in here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=330.02228571428606) [that don't relate to this sort, and this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=332.7529999999999) [is where we have to make some decisions](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=336.17114285714285) [about this event session. I have included](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=340.16371428571426) [the option to track causality for the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=343.0777500000001) [event session, which means I'm going to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=345.2191666666669) [drag this column over here, and widen it](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=347.36778571428573) [out a little bit, but the track causality](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=349.8266428571429) [option means that for every event there's](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=352.7654166666668) [a GUID that is attached to it, and for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=355.24457142857136) [those events that are related they'll have](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=357.9426428571426) [the same GUID. So I know that this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=360.1493333333334) [sql\_batch\_completed event relates to this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=362.764) [sort\_warning, and that's great, but you'll](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=366.2265) [see I've got all these other](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=368.1476363636363) [batch\_completed events because I didn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=369.622) [filter on anything for batch\_completed,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=371.1903333333334) [which means that every batch that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=372.891) [completes I'm going to have here in my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=375.5670000000002) [output, and that can be a lot of overhead.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=378.15979999999985) [So I've got a note in here, which notes](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=380.711) [that this Extended Events session isn't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=383.5425384615383) [perfect. I cannot rely on sql\_text, so I](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=385.4286923076923) [need to either use tsql\_stack, and this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=387.93946153846156) [can be expensive as well, and there's more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=390.76166666666666) [information about how to walk through and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=394.523) [unwind the tsql\_stack in another](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=397.83654545454533) [Pluralsight course by Jonathan Kehayias,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=400.09345454545456) [so I could either use tsql\_stack and I can](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=401.9107272727273) [remove batch\_completed or I could remove](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=405.6843636363637) [both stack and text and just keep](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=408.6189090909092) [sql\_batch\_completed in there. A really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=411.5406666666668) [good starting point is to just create that](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=413.75761538461535) [event session with the two warnings to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=417.7600769230767) [understand how frequently these are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=420.74063636363627) [occurring or maybe just look in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=422.5901818181816) [default trace first, and then decide what](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=424.92461538461527) [you need to add based upon your workload.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=427.15707692307666) [When we're finished, after we've stopped](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=430.7065) [the EVENT SESSION we'll go ahead and drop](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=432.95675000000006) [it, although you can leave it there and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=435.26541666666685) [just start and stop it as needed. Because](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=437.46449999999993) [I made that edit to statistics to really](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=439.73607692307695) [properly reset them I need to restore the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=442.62469230769256) [database. You can try and run that update](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=445.05266666666677) [statistics to set it back, but there are](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=447.02) [cases where it doesn't set them back to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=449.70184615384596) [how they were originally, so my](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=452.14500000000004) [recommendation is to restore the database,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=453.67900000000014) [which is why we don't use that option in production. Let's head back to the slides.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=13&mode=live&start=455.5615384615385)

[Module and Course Summaries](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live)

[In this module we talked about some of the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=1.977) [additional valuable information that we](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=5.012454545454545) [can find in a plan, which includes, but is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=6.514307692307693) [not limited to estimates about the number](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=8.99623076923077) [of rows that will be returned compared to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=11.661) [the actuals, whether or not the query ran](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=15.001666666666669) [in parallel, whether there were seek](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=18.80833333333334) [and/or residual predicates in the plan,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=21.196000000000005) [and whether we had any warnings in the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=23.35) [plan, and we covered a lot of information](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=26.000666666666667) [in this course, and so what then are your](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=28.738833333333332) [next steps, right? I've created a ton more](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=32.58653846153845) [work for you, and so you might be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=36.09361538461536) [thinking, holy cow, where do I even start?](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=38.589999999999975) [Well, of course, I have ideas for that for](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=40.942) [you. The first is you have to practice.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=45.833500000000015) [You need to make sure that you've got](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=48.572999999999986) [scripts to capture the query data that is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=51.105230769230765) [of interest to you that's most relevant,](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=53.7950769230769) [and you really have to start simple here](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=55.9305) [and work your way up. It may be a little](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=58.038500000000006) [overwhelming at first, but if you start](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=61.910250000000005) [with something simple, like just capturing](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=64.21700000000001) [information from dm\_exec\_query\_stats, and](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=65.873) [then you build on that over time it won't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=67.18899999999998) [seem so overwhelming. You need to look at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=70.47871428571429) [the data that you capture from those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=73.98728571428578) [scripts, and you need to be looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=76.6452857142857) [execution plans. The only way you get](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=79.32985714285712) [better is to start to become familiar with](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=81.41457142857146) [the operators, understand what to expect](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=83.6762857142858) [and sometimes experiment with changing the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=86.10011111111109)[queries and seeing how the query](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=88.6876) [performance changes, and speaking of](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=91.31139999999996) [changing that performance, it's important](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=93.5177) [to make those changes in an organized](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=95.7372) [manner, right? I tend to change just one](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=99.65928571428569) [thing at a time, and then understand how](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=102.70599999999997) [overall query performance changes. If I do](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=105.15) [two things at the same time, then I don't](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=107.84150000000002) [know what provided the most benefit, so](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=111.32440000000001) [incrementally making modifications is the](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=114.15245454545455) [best way to work through a tuning](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=116.58972727272725) [exercise. So even though this course has](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=120.83566666666665) [ended, the entire process of looking at](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=124.23138461538464) [query performance and plans doesn't end](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=127.138) [here. You now know that information about](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=130.20485714285715) [query execution can be captured within SQL](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=132.69054545454554) [Server, and this is really very easy to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=135.02090909090913) [do. That data can be historical, which is](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=137.7605454545456) [probably what you're going to be looking](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=139.9159999999999) [at most of the time, but it can also be](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=141.83083333333335) [real-time, and your task is really to](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=145.4391666666668) [figure out and understand how to use this](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=147.7178571428572) [data to determine what you need to fix or](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=150.275) [what you might need to change, and then](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=153.07592857142868) [after you've made that change use those](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=155.81492307692312) [same tools to continue to monitor](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=158.57507692307706) [performance, and again, incrementally make](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=161.78733333333338) [improvements. I hope that this course has](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=165.16955555555566) [provided a good foundation for you from](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=167.4733846153847) [which you can start tuning and adjusting](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=169.372) [and improving your code. Until next time, thanks for watching.](https://app.pluralsight.com/player?course=sqlserver-query-performance-developers&author=erin-stellato&name=0480cc3a-2124-4eef-a48a-919d42f127a0&clip=14&mode=live&start=172.1790000000001)