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# 🔎 Spans & Distributed Tracing Fundamentals

> **Series:** SPANS | **Notebook:** 1 of 8 | **Created:** December 2025

## Understanding the Building Blocks of Observability

This notebook introduces distributed tracing concepts and demonstrates how to query span data in Dynatrace using DQL. You'll learn what spans are, how they form traces, and how to explore your distributed systems.

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## Prerequisites

Before starting this notebook, ensure you have:

-  Access to a Dynatrace environment with span data
-  DQL query permissions (viewer role minimum)
-  Basic understanding of microservices architecture

## 1. What is Distributed Tracing?

In modern microservices architectures, a single user request often travels through dozens of services. **Distributed tracing** captures this journey, showing:



- The **path** a request takes through your system
- **Timing** of each operation along the way
- **Dependencies** between services
- Where **errors** and **latency** occur



![Diagram illustrating Distributed Tracing Flow](#)



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[Distributed Tracing Flow]
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RvcC1vcGFjaXR50jEiIC8+CiAgICA8L2xpbmVhckdyYWRpZW50PgogICAgPGxpbmVhckdyYWRpZW50IGlkPSJzZXJ2aWNlR3JhZCIgeDE9IjA1IiB5MT0iMCUiIHgyPSIxMDALIiB5Mj0iMTAwJSI+CiAgICAgIDxdG9wIG9mZnNldD0iMCUiIH0eWxlPSJzdG9wLWNVbG9y0iMxNDk2ZmY7c3RvcC1vcGFjaXR50jEiIC8+CiAgICAgIDxdG9wIG9mZnNldD0iMTAwJSIgc3R5bGU9InN0b3AtY29sb3I6IzBhNjRiYztzdG9wLW9wYWNPdHk6MSIgLz4KICAgIDwbvGluZWFnR3JhZG1lbnQ+CiAgICAgICA8bGluZWFnR3JhZGllbnQgaWQ9ImRiR3JhZCIgeDE9IjA1IiB5MT0iMCUiIHgyPSIxMDALIiB5Mj0iMTAwJSI+CiAgICAgIDxdG9wIG9mZnNldD0iMCUiIH0eWxlPSJzdG9wLWNVbG9y0iMyMmM1NWU7c3RvcC1vcGFjaXR50jEiIC8+CiAgICAgIDxdG9wIG9mZnNldD0iMTAwJSIgc3R5bGU9InN0b3AtY29sb3I6IzE2YT M0YTtzdG9wLW9wYWNPdHk6MSIgLz4KICAgIDwbvGluZWFnR3JhZG1lbnQ+CiAgICAgICA8ZmlsdGVyIGlkPSJzaGFkb3ciPgogICAgICA8ZmVEcm9wU2hhZG93IGR4PSIyIiBkeT0iMiIgc3RkRGV2aWF0aW9uPSIzIiBmbG9vZC1vcGFjaXR5PSIwLjE1Ii8+CiAgICA8L2ZpbHRlcj4KICAgIDxtYXJrZXIgaWQ9ImFycm93aGVhZCIgbWFya2VvY2lkdGg9IjEwIiBtYXJrZXJIZWlnaHQ9IjciIHJlZlg9IjkIiHJlZl k9IjMuNSIgb3JpZW50PSJhdXRvIj4KICAgICAgPHBvbHlnb24gcG9pbnRzPSIwIDAsIDEwIDMuNSw gMCA3IIbmaWxsPSIjNjQ3NDhiIi8+CiAgICA8L21hcmtlcj4KICA8L2R1ZnM+CgogIDwhLS0gQmFj a2dyb3VuZCATLT4KICA8cmVjdCB3aWR0aD0iODAwIiBoZWlnaHQ9IjMyMCigZmlsbD0iI2Y4ZjlmY SIgcn9IjEwIi8+CgogIDwhLS0gVG10bGUgLS0+CiAgPHRleHQgeD0iNDAwIiB5PSIzMCigZm9udC 1mYW1pbHk9IkFyaWFsLCBzYW5zLXNlcmIiBmb250LXNpemU9IjE4IiBmb250LXdlaWdodD0iYm9 sZCIgZmlsbD0iIzMzMyIgdGV4dC1hbmnob3I9Im1pZGRsZSI+RGlzdHJpYnV0ZWQgVHJhY2luZyBG bG93PC90Zxh0PgoKICA8IS0tIEjb3dzZXIgLS0+CiAgPHJlY3QgeD0iMzAiIHk9IjcwIiB3aWR0a D0iMTAwIiBoZWlnaHQ9IjYwIiByeD0i0CigZmlsbD0idXjsKCNCicm93c2VYR3JhZCkiIGZpbHRlcj 0idXjsKCNCzaGFkb3cpIi8+CiAgPHRleHQgeD0i0DAiiHk9IjEwNSIgZm9udC1mYW1pbHk9IkFyaWF sLCBzYW5zLXNlcmIiBmb250LXNpemU9IjEzIiBmb250LXdlaWdodD0iYm9sZCIgZmlsbD0id2hp dGuIiHRLeHQtYW5jaG9yPSJtaWRkbGUipkJyb3dzZXI8L3RleHQ+CgogIDwhLS0gRnJvbnRlbnQgLS0+ CiAgPHJlY3QgeD0iMTgwIiB5PSI3MCigd21kdGg9IjEwMCigGaGVpZ2h0PSI2MCigcng9IjgiIG ZpbGw9InVybCgjc2VydmljZUdyYWQpIiBmaWx0Zxi9InVybCgjc2hhZG93KSiVPGogIDx0Zxh0IHg 9IjIzMCigeT0iMTA1IiBmb250LWZhbwlsT0iQXjpYwlsIHNhbnMtc2VyaWYiIGZvbnQtc2l6ZT0i MTMiIGZvbnQtd2VpZ2h0PSJib2xkIiBmaWxsPSJ3aG10ZSIgdGV4dC1hbmnob3I9Im1pZGRsZSI+R nJvbnRlbnQ8L3RleHQ+CgogIDwhLS0gQ2FydCBTZJ2aWNlIC0tPgogIDxyZWN0IHg9IjMzMCigeT 0iNzAiIHdpZHRoPSIxMDAiIGHlaWdodD0iNjAiIHJ4PSI4IiBmaWxsPSJ1cmwoI3NlcnZpY2VhcmF kKSIgZmlsdGVyPSJ1cmwoI3NoYWrvdykiLz4KICA8dGV4dCB4PSIz0DAiiHk9Ijk4IiBmb250LWzh bWlseT0iQXjpYwlsIHNhbnMtc2VyaWYiIGZvbnQtc2l6ZT0iMTIiIGZvbnQtd2VpZ2h0PSJib2xkI iBmaWxsPSJ3aG10ZSIgdGV4dC1hbmnob3I9Im1pZGRsZSI+Q2FydDwvdGV4dD4KICA8dGV4dCB4PS IZ0DAiiHk9IjExMyIgZm9udC1mYW1pbHk9IkFyaWFsLCBzYW5zLXNlcmIiBmb250LXNpemU9IjE yIiBmb250LXdlaWdodD0iYm9sZCIgZmlsbD0id2hpGUiiHRLeHQtYW5jaG9yPSJtaWRkbGUiplnl cnZpY2U8L3RleHQ+CgogIDwhLS0gRgf0YWJhc2UgLS0+CiAgPHJlY3QgeD0iNDgwIiB5PSI3MCigd 21kdGg9IjEwMCigGaGVpZ2h0PSI2MCigcng9IjgiIGZpbGw9InVybCgjc2hhZG93KSiVPGog IDx0Zxh0IHg9IjIzMCigeT0iMjA1IiBmb250LWZhbwlsT0iQXjpYwlsIHNhbnMtc2VyaWYiIGZv bnQtc2l6ZT0iMTIiIGZvbnQtd2VpZ2h0PSJib2xkIiBmaWxsPSJ3aG10ZSIgdGV4dC1hbmnob3I9Im1pZGRsZSI+UGF5bWVudDwvdGV4dD4KICA8dGV4dCB4PSIyMzAiIHk9IjIyMCigZm9udC1mYW1pbHk9IkFyaWFsLCBzYW5zLXNlcmIiBmb250LXNpemU9IjEyiBmb250LXdlaWdodD0iYm9sZCIgZmlsbD0id2hpGUiiHRLeHQtYW5jaG9yPSJtaWRkbGUiplnlcnZpY2U8L3RleHQ+CgogIDwhLS0gSw52ZW50b3J5IFNlcnZpY2UgLS0+CiAgPHJlY3QgeD0iMzMwIiB5PSIz0DAiiHdpZHRoPSIxMDAiIGHlaWdodD0iNjAiIHJ4PSI4IiBmaWxsPSJ1cmwoI3NlcnZpY2VhcmFkKSIgZmlsdGVyPSJ1cmwoI3NoYW

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Without distributed tracing, debugging issues in this flow would require correlating logs from each service manually—an error-prone and time-consuming process.

2. Understanding Spans

A **span** represents a single unit of work in a distributed system. Think of it as a timer that captures:

- **What** operation was performed
 - **When** it started and ended
 - **How long** it took

- **Whether** it succeeded or failed
 - **Context** about the operation (HTTP method, database query, etc.)

Key Span Concepts

Concept	Description	Example
Trace	Collection of spans forming a request flow	Checkout transaction
Span	Single operation within a trace	Database query
Root Span	First span in a trace (no parent)	HTTP request to frontend
Child Span	Span triggered by another span	Service calling database

3. Span Anatomy

Every span contains these essential fields:

zIIIGZvbnQtZmFtaWx5PSJBcmhbCwgc2Fucy1zZXJpZiIgZm9udC1zaXplPSIxMiIgZmlsbD0iIz
MzMyI+c3Bhb5pZDwvdGV4d4KICA8dGV4dCB4PSIxODAiIHk9IjE3MiIgZm9udC1mYW1pbHk9IkF
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XR0cmlidXRlczwvdGV4dD4KCiAgPCEtLSBEtXJhdGlvbIB2aXN1YWwgLS0+CiAgPHJ1Y3QgeD0iNz
AiIHk9IjMyMCiGd2lkGg9IjIwMCiGaGVpZ2h0PSIyNSIgcn9IjQiIGZpbGw9IiNmZWYzYzciIHn
0cm9rZT0iI2Y10WUwYiIgc3Ryb2tlLXdpZHRoPSIxIi8+CiAgPHRleHQgeD0iMTcwIiB5PSIzMzci
IGZvbnQtZmFtaWx5PSJBcmhbCwgc2Fucy1zZXJpZiIgZm9udC1zaXplPSIxMSIgZmlsbD0iIzkyN
DAwZSIgdGV4dC1hbmNob3I9Im1pZGRsZSI+ZHvYXRpb24gPSB1bmRfdGltZSAtiHN0YXJ0X3RpbW
U8L3RleHQ+Cjwvc3ZnPgo=)
```

Core Span Attributes

Attribute	Type	Description
`trace.id`	string	Unique identifier linking all spans in a trace
`span.id`	string	Unique identifier for this specific span
`span.parent_id`	string	ID of parent span (null for root spans)
`span.name`	string	Operation name (e.g., "GET /api/products")
`start_time`	timestamp	When the span started
`end_time`	timestamp	When the span ended
`duration`	long	Duration in nanoseconds

Service Context Attributes

Attribute	Type	Description
`service.name`	string	Name of the service
`dt.entity.service`	string	Dynatrace entity ID (reliable for joins)
`service.namespace`	string	Namespace or environment

Status Attributes

Attribute	Type	Description
`span.status_code`	string	Status: `ok`, `error`, or `unset`
`span.status_message`	string	Error message when status is error

4. Span Kinds

The `span.kind` attribute indicates the span's role in the distributed transaction:

! [Span Kinds]

data: image/svg+xml;base64,PHN2ZyB4bwXucz0iaHR0cDovL3d3dy53My5vcmcvMjAwMC9zdmcIHZpZXdCb3g9IjAgMCA3NTAgMzAwIj4KICA8ZGVmcz4KICAgIDxsaw51YXJHcmFkaWVudCBpZD0ic2VydmyR3jhZC1geDE9IjA1IiB5MT0iMCUiIHgyPSIxMDA1IiB5Mj0iMTAwJSI+CiAgICAgIDxzG9wIG9mZnNldD0iMCUiIH0eWx1PSJzdG9wLWNVbG9y0iMyMmM1NWU7c3RvcC1vcGFjaXR50jEiIC8+CiAgICAgIDxdG9wIG9mZnNldD0iMTAwJSIgc3R5bGU9InN0b3AtY29sb3I6IzE2YTM0YTtzdG9wLW9wYWNPdHk6MSigLz4KICAgIDwvbGluzWFyR3jhZGllbnQ+CiAgICA8bGluzWFyR3jhZGllbnQgaWQ9ImNsawWvdEdyYWQiIHgxPSIwJSIgeTE9IjA1IiB4Mj0iMTAwJSIgeTI9IjEwMCUiPgogICAgICA8c3RvcCBvZmZzZXQ9IjA1IiBzdHlsZT0ic3RvcC1jb2xvcjojMTQ5NmZm03N0b3Atb3BhY2l0eToxIiAvPgogICAgICA8c3RvcCBvZmZzZXQ9IjEwMCUiIH0eWx1PSJzdG9wLWNVbG9y0iMwYTY0YmM7c3RvcC1vcGFjaXR50jEiIC8+CiAgICA8L2xpbmVhckdyYWRpZW50PgogICAgPGxpbmVhckdyYWRpZW50IGlkPSJpbnRlcmb5hbEdyYWQiIHgxPSIwJSIgeTE9IjA1IiB4Mj0iMTAwJSIgeTI9IjEwMCUiPgogICAgICA8c3RvcCBvZmZzZXQ9IjA1IiBzdHlsZT0ic3RvcC1jb2xvcjojOGI1Y2Y203N0b3Atb3BhY2l0eToxIiAvPgogICAgICA8c3RvcCBvZmZzZXQ9IjEwMCUiIH0eWx1PSJzdG9wLWNVbG9y0iM3YzNhZWQ7c3RvcC1vcGFjaXR50jEiIC8+CiAgICA8L2xpbmVhckdyYWRpZW50PgogICAgPGxpbmVhckdyYWRpZW50IGlkPSJwcm9kdWNLckdyYWQiIHgxPSIwJSIgeTE9IjA1IiB4Mj0iMTAwJSIgeTI9IjEwMCUiPgogICAgICA8c3RvcCBvZmZzZXQ9IjA1IiBzdHlsZT0ic3RvcC1jb2xvcjojZjk3MzE203N0b3Atb3BhY2l0eToxIiAvPgogICAgICA8c3RvcCBvZmZzZXQ9IjEwMCUiIH0eWx1PSJzdG9wLWNvbG9y0iNlYTU4MGM7c3RvcC1vcGFjaXR50jEiIC8+CiAgICA8L2xpbmVhckdyYWRpZW50PgogICAgPGxpbmVhckdyYWRpZW50IGlkPSJjb25zdW1lckdyYWQiIHgxPSIwJSIgeTE9IjA1IiB4Mj0iMTAwJSIgeTI9IjEwMCUiPgogICAgICA8c3RvcCBvZmZzZXQ9IjA1IiBzdHlsZT0ic3RvcC1jb2xvcjojM DZiNmQ003N0b3Atb3BhY2l0eToxIiAvPgogICAgICA8c3RvcCBvZmZzZXQ9IjEwMCUiIH0eWx1PSJzdG9wLWNvbG9y0iMw0DkxYjI7c3RvcC1vcGFjaXR50jEiIC8+CiAgICA8L2xpbmVhckdyYWRpZW50PgogICAgPGZpbHrlciBpZD0ia2luZFNoYWRvdyI+CiAgICAgIDxmZURyb3BTaGFkb3cgZHg9IjIIiIGR5PSIyIiBzdGREZXZpYXRpb249IjMiIGZsb29kLw9wYWNPdHk9IjAuMTUiLz4KICAgIDwvZmlsdGVyPgogICAgPG1hcmtlcBpZD0iYXJyb3ciIG1hcmtlcldpZHRoPSIxMCiGbWFya2VySGVpZ2h0PSI3IiByZWZYPSI5IiByZWZPSIzLjUiIG9yalWvdD0iYXV0byI+CiAgICAgIDxwb2x5Z29uIHbvaW50cz0iMCawLCAxMCazLjUsIDAgnYIgZmlsbD0iIzY0NzQ4YiIvPgogICAgPC9tYXJrZXI+CiAgPC9kZWZzPgoKICA8IS0tIEjhY2tncm91bmQgLs0+CiAgPHJLY30gd21kdGg9Ijic1MCiGaGVpZ2h0PSIzMADaiIGZpbGw9IiNm0GY5ZmEiIHJ4PSIxMCiVPGoKICA8IS0tIFRpdxLIC0tPgogIDx0ZXh0IHg9IjM3NSIgeT0iMjgiIGZvbnQtZmFtaWx5PSJBcmhbCwgc2Fucy1zZXjpZiIgZm9udC1zaXplPSIxOCIgZm9udC13ZwlnaHQ9ImJvbGQIIGZpbGw9IiMzMzMiIHRleHQtYW5jaG9yPSJtaWRkbGUipLnwYw4gS2luZHM8L3RleHQ+CgogIDwhLS0gU2VydmljZSBbieJveCatLT4KICA8cmVjdCB4PSI0MCiGeT0iNTUiIHdpZHRoPSIy0DAiIGHlaWdodD0iMTYwIiByeD0iOCigZmlsbD0iI2ZmZiIgc3Ryb2tlPSIjZTJl0GYwIiBzdHJva2Utd21kdGg9IjIiIGZpbHrlcJ0idXjsKCnraW5kU2hhZG93KSiVPgogIDx0ZXh0IHg9IjE4MCiGeT0iNzgiIGZvbnQtZmFtaWx5PSJBcmhbCwgc2Fucy1zZXjpZiIgZm9udC1zaXplPSIxNCiGZm9udC13ZwlnaHQ9ImJvbGQIIGZpbGw9IiMzMzMiIHRleHQtYW5jaG9yPSJtaWRkbGUipLnlnZpY2UgQTwvdGV4dD4KCiAgPCETLSDBbGllbnQgU3BhbiAtLT4KICA8cmVjdCB4PSI2MCiGeT0i0TUiiIHdpZHRoPSIxMDAiIGHlaWdodD0iNDUiIHJ4PSI2IiBmaWxsPSJ1cmwoI2NsawVudEdyYWQpIi8+CiAgPHRleHqgeD0iMTEwIiB5PSIxMTUiIGZvbnQtZmFtaWx5PSJBcmhbCwgc2Fucy1zZXjpZiIgZm9udC1zaXplPSIxMSigZm9udC13ZwlnaHQ9ImJvbGQIIGZpbGw9IndoaXRlIiB0ZXh0LWFuY2hvcj0ibWlkZGxlj5DTE1FTlQ8L3RleHQ+CiAgPHRleHqgeD0iMTEwIiB5PSIxMzAiiGZvbnQtZmFtaWx5PSJBcmhbCwgc2Fucy1zZXjpZiIgZm9udC1zaXplPSIxMCiGZmlsbD0icmdiYSgyNTUsMju1LDI1NSwwLjkpIiB0ZXh0LWFuY2hvcj0ibWlkZGxlj5PdXrb3VuZdwdGV4dD4KCiAgPCETLSBJbnRlcmb5hbCBTcGFuIc0tPgogIDxyZwN0IHg9IjE4MCiGeT0i0TUiiIHdpZHRoPSIxMDAiIGHlaWdodD0iNDUiIHJ4PSI2IiBmaWxsPSJ1cmwoI2ludGVybmFsR3jhZCkiLz4KICA8dGV4dCB4PSIyMzAiiHK9IjExNSiGZm9udC1mYW1pbhk9IkFyaWfsLCBzYW5zLXN1cmIiBmb250LXNpemU9IjExIiBmb25

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QiIGZpbGw9IndoaXRlIiB0ZXh0LWFuY2hvcj0ibWlkZGxlij5QUk9EVUNFUjwvdGV4dD4KICA8dGV
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emU9IjEwIiBmaWxsPSJyZ2JhKDI1NSwyNTUsMjU1LDAuOSkiIHRleHQtYW5jaG9yPSJtaWRkbGUiP
lNlbmQgTWVzc2FnZTwvdGV4dD4KCiAgPCEtLSBTZXJ2aWNlIEIgQm94IC0tPgogIDxyZWN0IHg9Ij
QzMCiGeT0iNTUiiHdpZHRoPSIyODAiIGHlaWdodD0iMTYwIiByeD0iOCiIgZmlsbD0iI2ZmZiIgc3R
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JtaWRkbGUiPlNlcnPzY2UgQjwvdGV4dD4KCiAgPCEtLSBTZXJ2ZXiG3BhbiAtLT4KICA8cmVjdCB
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ZXJ2ZJXHcmFkKSiVpgogIDx0ZXh0IHg9IjUwMCiGeT0iMTE1IiBmb250LWZhbWlseT0iQXJpYWwsI
HNhbnMtc2VyaWYiIGZvbnQtc2l6ZT0iMTEiIGZvbnQtd2VpZ2h0PSJib2xkIiBmaWxsPSJ3aG10ZS
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YmEoMjU1LDI1NSwyNTUsMC45KSIgdGV4dC1hbmnob3I9Im1pZGRsZSI+SW5ib3VuZDwvdGV4dD4KC
iAgPCEtLSBD25zdW1lciBTcGFuIC0tPgogIDxyZWN0IHg9IjQ1MCiGeT0iMTU1IiB3aWR0aD0iMT
AwIiBoZWlnaHQ9IjQ1IiByeD0iNiIgZmlsbD0idXjsKCnjb25zdW1lckdyYWQpIi8+CiAgPHRleHQ
geD0iNTAwIiB5PSIxNzUiIGZvbnQtZmFtaWx5PSJBcmlhbCwgc2Fucy1zZXJpZiIgZm9udC1zaXpl
PSIxMSIgZm9udC13ZWlnaHQ9IjvBQIiIGZpbGw9IndoaXRlIiB0ZXh0LWFuY2hvcj0ibWlkZGxli
j5DT05TVU1FUjwvdGV4dD4KICA8dGV4dCB4PSI1MDAiIHK9IjE5MCiGeZm9udC1mYW1pbHk9IkFyaW
FsLCBzYW5zLXNlcmlmIiBmb250LXNpemU9IjEwIiBmaWxsPSJyZ2JhKDI1NSwyNTUsMjU1LDAuOSk
iIHRleHQtYW5jaG9yPSJtaWRkbGUiPlJlY2VpdUmugTWVzc2FnZTwvdGV4dD4KCiAgPCEtLSBBcnJv
d3MgLS0+CiAgPGxpbmUgeDE9IjE2MCiGeTE9IjExNyIgeDI9IjQ0NSIgeTI9IjExNyIgc3Ryb2tlP
SIjNjQ3NDhiIiBzdHJva2Utd2lkGg9IjIiIG1hcmtlcilbmq9InVybCgjYXJyb3cpIi8+CiAgPH
RleHQgeD0iMzMwIiB5PSIxMDgiIGZvbnQtZmFtaWx5PSJBcmlhbCwgc2Fucy1zZXJpZiIgZm9udC1
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PC90ZXh0PgokICA8bGluZSB4MT0iMTYwIiB5MT0iMTC3IiB4Mj0iNDQ1IiB5Mj0iMTC3IiBzdHJva
2U9IiM2NDc00GIiIHN0cm9rZS13aWR0aD0iMiIgbWFya2VylWVuZD0idXjsKCnrcnJvdykiLz4KIC
A8dGV4dCB4PSIxMzAiIHK9IjE20CigZm9udC1mYW1pbHk9IkFyaWFsLCBzYW5zLXNlcmlmIiBmb25
0LXNpemU9IjExIiBmaWxsPSIjNjQ3NDhiIiB0ZXh0LWFuY2hvcj0ibWlkZGxlij5LYWZrYS9RdWV1
ZTwvdGV4dD4KCiAgPCEtLSBMZWdlbmQgLS0+CiAgPHJlY3QgeD0iNDAiiHK9IjIzNSIgd2lkGg9I
jY3MCiGaGVpZ2h0PSI1MCiGng9IjYiIGZpbGw9IiNmMwY1ZjkiIHN0cm9rZT0iI2UyZThmMCiGc3
Ryb2tlLXdpZHRoPSIxIi8+CiAgPGNpcmNsZSBjeD0iNzAiIGN5PSIyNjAiIHI9IjgiIGZpbGw9InV
ybCgjc2VydVYR3JhZCKiLz4KICA8dGV4dCB4PSI4NSIgeT0iMjY0IiBmb250LWZhbWlseT0iQXJp
YWwsIHnhbnMtc2VyaWYiIGZvbnQtc2l6ZT0iMTEiIGZpbGw9IiM2NDc00GIiPlNlcZlcjwvdGV4d
D4KICA8Y2lyY2xLIGN4PSIxNTAiIGN5PSIyNjAiIHI9IjgiIGZpbGw9InVybCgjY2xpZW50R3JhZC
kiLz4KICA8dGV4dCB4PSIxNjUiIHK9IjI2NCiGZm9udC1mYW1pbHk9IkFyaWFsLCBzYW5zLXNlcml
mIiBmb250LXNpemU9IjExIiBmaWxsPSIjNjQ3NDhiIj5DbGllbnQ8L3RleHQ+CiAgPGNpcmNsZSBj
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CB4PSIyNDUiIHK9IjI2NCiGZm9udC1mYW1pbHk9IkFyaWFsLCBzYW5zLXNlcmlmIiBmb250LXNpem
U9IjExIiBmaWxsPSIjNjQ3NDhiIj5JbnRlc5hbDwvdGV4dD4KICA8Y2lyY2xLIGN4PSIxMjAiIGN

```
5PSIyNjAiIHl9IjgiIGZpbGw9InVybCgjcHJvZHvjZXJhcmFkKSIvPgogIDx0ZXh0IHg9IjMzNSIg
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Gw9IiM2NDc00GIiPlByb2R1Y2VyPC90ZXh0PgogIDxjaXjbGUgY3g9IjQyMCigY3k9IjI2MCIgcj
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mlhbCwgc2Fucy1zZXJpZiIgZm9udC1zaXplPSIxMSIgZmlsbD0iIzY0NzQ4YiI+Qm90aCBzaGFyZS
BzYW1lIHRyYwNlLmlkPC90ZXh0Pgo8L3N2Zz4K)
```

>  **Tip:** When a service calls another service, you'll see a `CLIENT` span on the caller and a `SERVER` span on the receiver. Both spans share the same `'trace.id'`.

5. Trace Structure

A `**trace**` is a tree of spans connected by parent-child relationships:

```
![Trace Tree]
(
ciIHZpZXdCb3g9IjAgMCA4MDAgMzgwIj4KICA8ZGVmcz4KICAgIDxsaw5lYXJHcmFkaWVudCBpZD0
icm9vdEdyYWQiIHgxPSIwJSIgeTE9IjAlIiB4Mj0iMTAwJSIgeTI9IjAlIj4KICAgICAgPHN0b3Ag
b2Zmc2V0PSIwJSIgc3R5bGU9InN0b3AtY29sb3I6IzYzNjZmMTtzdG9wLW9wYWNPdHk6MSIgLz4KI
CAgICAgPHN0b3Agb2Zmc2V0PSIxMDAIIiBzdHlsZT0ic3RvcC1jb2xvcjojNGY0NmU103N0b3Atb3
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b2Zmc2V0PSIwJSIgc3R5bGU9InN0b3AtY29sb3I6IzE00TzmtzdG9wLW9wYWNPdHk6MSIgLz4KI
CAgICAgPHN0b3Agb2Zmc2V0PSIxMDAIIiBzdHlsZT0ic3RvcC1jb2xvcjojMGE2NGJj03N0b3Atb3
BhY2l0eToxiAvPgogICAgPC9saW5lYXJHcmFkaWVudD4KICAgIDxsaw5lYXJHcmFkaWVudCBpZD0
ibGVhZkdyYWQiIHgxPSIwJSIgeTE9IjAlIiB4Mj0iMTAwJSIgeTI9IjAlIj4KICAgICAgPHN0b3Ag
b2Zmc2V0PSIwJSIgc3R5bGU9InN0b3AtY29sb3I6IzIyYzU1ZtzdG9wLW9wYWNPdHk6MSIgLz4KI
CAgICAgPHN0b3Agb2Zmc2V0PSIxMDAIIiBzdHlsZT0ic3RvcC1jb2xvcjojMTZhMzRh03N0b3Atb3
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ZCIgZmlsbD0iIzMzMyIgdGV4dC1hbmNob3I9Im1pZGRsZSI+VHJhY2UgVHJlZSAoQ2hLY2tvdXQgR
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A8IS0tIFJvb3QgU3BhbiAtLT4KICA8cmVjdCB4PSI1MCiGeT0i0DAiIHdpZHRoPSI10DAiIGhlaWd
odD0iMzAiIHJ4PSI1IiBmaWxsPSJ1cmwoI3Jvb3RHcmFkKSIgZmlsdGVyPSJ1cmwoI3RyZWVTaGFk
b3cpIi8+CiAgPHRleHQgeD0iNjUiIHk9IjEwMCigZm9udC1mYW1pbHk9IkFyaWFsLCBzYW5zLXNlC
```



```

SBDaGFyZ2U8L3RleHQ+CiAgPHRleHQgeD0iNzAwIiB5PSIyNjQiIGZvbnQtZmFtaWx5PSJBcmlhbC
wgc2Fucy1zZXJpZiIgZm9udC1zaXplPSIxMCigZmlsbD0iIzIyYzU1ZSIgdGV4dC1hbhNob3I9ImV
uZCI+MTUwbXM8L3RleHQ+CgogIDwhLS0gSW52ZW50b3J5IC0tPgogIDxsaw5lIHgxPSI3MCiGeTE9
IjE5NSIgeDI9IjcwIiB5Mj0iMjk1IiBzdHJva2U9IiNjYmQ1ZTEiIHn0cm9rZs13aWR0aD0iMiIvP
gogIDxsaw5lIHgxPSI3MCiGeTE9IjI5NSIgeDI9IjkwIiB5Mj0iMjk1IiBzdHJva2U9IiNjYmQ1ZT
EiIHn0cm9rZs13aWR0aD0iMiIvPgogIDxyZWN0IHg9IjkwIiB5PSIyODUiIHdpZHRoPSIxODAiIGH
laWdodD0iMjYiIHJ4PSI0iIbmaWxsPSJ1cmwoI3NwYW5HcmFkKSiGZmlsdGVyPSJ1cmwoI3RyZwVT
aGFkb3cpIi8+CiAgPHRleHQgeD0iMTA1IiB5PSIzMDMIIGZvbnQtZmFtaWx5PSJBcmlhbCwgc2Fuc
y1zZXJpZiIgZm9udC1zaXplPSIxMSIgZm9udC13ZWlnaHQ9ImJvbGQiIGZpbGw9IndoaXR1Ij5bSw
52ZW50b3J5XSBSZXNlcnZlSXrlbXM8L3RleHQ+CiAgPHRleHQgeD0iNzAwIiB5PSIzMDMIIGZvbnQ
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dGV4dC1hbhNob3I9ImVuZCI+MzVtczwvdGV4dD4KCiAgPCETLSBQb3N0Z3JlU1FMIC0tPgogIDxsaw
W5lIHgxPSIxMTAiIHkxPSIzMTCiIHKyPSIzMjciIHn0cm9rZT0iI2NiZDvlMSIgc3
Ryb2tLXdpxZHRoPSIyIi8+CiAgPGxpbmUgeDE9IjExMCiGeTE9IjMyNyIgeDI9IjEzMCiGeTI9IjM
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IjMx0CIgd2lkdGg9IjEzMCiGaGVpZ2h0PSIyMiIgcng9IjQiIGZpbGw9InVybCgjbGVhZkdyYwQpI
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IiB5PSIzMzMiIGZvbnQtZmFtaWx5PSJBcmlhbCwgc2Fucy1zZXJpZiIgZm9udC1zaXplPSIxMCiGz
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QgLS0+CiAgPHJlY3QgeD0iNTAiIHk9IjM1MiIgd2lkdGg9IjcwMCiGaGVpZ2h0PSIyMiIgcng9IjQ
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CNyb290R3jhZCkilz4KICA8dGV4dCB4PSI30CIgeT0iMzY3IiBmb250LWZhbWlseT0iQXJpYwlsIH
NhbnMtc2VyaWYiIGZvbnQtc2l6ZT0iMTAiIGZpbGw9IiM2NDc00GIiPlJvb3QgU3BhbjwvdGV4d4
KICA8cmVjdCB4PSIxNTAiIHk9IjM1NyIgd2lkdGg9IjEyIiBoZwlnaHQ9IjEyIiByeD0iMiIgZmls
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kFyaWFsLCBzYW5zLXNlcmlmIiBmb250LXNpemU9IjEwIiBmaWxsPSIjNjQ3NDhiIj5TZXJ2aWNlIF
NwYw48L3RleHQ+CiAgPHJlY3QgeD0iMjYwIiB5PSIzNTciIHdpZHRoPSIxMiIgaGVpZ2h0PSIxMii
gcng9IjIiIGZpbGw9InVybCgjbGVhZkdyYwQpIi8+CiAgPHRleHQgeD0iMjc4IiB5PSIzNjciIGZv
bnQtZmFtaWx5PSJBcmlhbCwgc2Fucy1zZXJpZiIgZm9udC1zaXplPSIxMCiGZmlsbD0iIzY0NzQ4Y
iI+RGF0YWJhc2UvRXh0ZXJuYw8L3RleHQ+CiAgPHRleHQgeD0iNDIwIiB5PSIzNjciIGZvbnQtZm
FtaWx5PSJBcmlhbCwgc2Fucy1zZXJpZiIgZm9udC1zaXplPSIxMCiGZmlsbD0iIzY0NzQ4YiI+UGF
yZw50LwNoaWxkIGxpbt1ZCB2aWEgc3Bhbi5wYXJlbnRfaWQ8L3RleHQ+Cjwvc3ZnPgo=)

```

Parent-Child Relationships

- Each span (except root) has a `span.parent_id` pointing to its parent
- Root spans have `span.parent_id = null`
- All spans in a trace share the same `trace.id`
- Child span's `start_time` is always \geq parent's `start_time`

6. Your First Span Query

Let's explore span data using DQL. We'll start with the most basic query and

```
progressively add complexity.
```

> **⚠ **Important:**** Always use `limit` when exploring data to avoid processing millions of spans.

```
```dql
// Basic span query - fetch all spans from the last 2 hours
fetch spans
| limit 100
```

```

Selecting Specific Fields

Instead of retrieving all span attributes, select only the fields you need for better performance and readability:

```
```dql
// Select specific span fields for analysis
fetch spans
| fields start_time,
 trace.id,
 span.id,
 span.name,
 span.kind,
 service.name,
 duration,
 span.status_code
| sort start_time desc
| limit 50
```

```

Understanding Duration

Span duration in Dynatrace is stored in **nanoseconds**. Here's how to convert to more readable formats:

> **💡 **Tip:**** 1 millisecond = 1,000,000 nanoseconds

```
```dql
// Convert duration from nanoseconds to milliseconds and seconds
fetch spans
| fields start_time,
 span.name,
 service.name,
 duration,
 duration_ms = duration / 1000000.0, // Convert to milliseconds
 duration_sec = duration / 1000000000.0 // Convert to seconds
| sort duration desc
```

```

```
| limit 20
```

```
````
```

### ### Filtering Spans

Use filters to focus on specific spans. Filter early in your query for better performance:

```
```dql
// Filter spans by service and span kind
fetch spans
| filter span.kind == "server"
| filter duration > 100ms
| fields start_time,
    service.name,
    span.name,
    duration_ms = duration / 1000000.0,
    span.status_code
| sort duration_ms desc
| limit 50
````
```

### ### Discovering Services in Your Environment

Find all services that are generating span data:

```
```dql
// Discover all services with span data
fetch spans
| filter span.kind == "server"
| summarize {span_count = count()}, by:{service.name}
| sort span_count desc
| limit 50
````
```

```

```

## ## Summary

In this notebook, you learned:

- ✓ \*\*What distributed tracing is\*\* and why it's essential for modern architectures
- ✓ \*\*What spans are\*\* and their core attributes
- ✓ \*\*Span anatomy\*\* including trace.id, span.id, duration, and status
- ✓ \*\*Span kinds\*\* (server, client, internal, producer, consumer)
- ✓ \*\*Trace structure\*\* with parent-child relationships
- ✓ \*\*Basic DQL queries\*\* to fetch and explore span data

**Duration conversion** from nanoseconds to human-readable formats

---

## ## Next Steps

Continue to **SPANS-02: Querying Spans with DQL** to learn:

- Filtering spans by service, operation, and attributes
- Finding specific traces by trace.id
- Querying HTTP and database spans
- Combining multiple filters for precise analysis