UDACITY

NANODEGREE PROGRAM SYLLABUS

Data Streaming

Overview

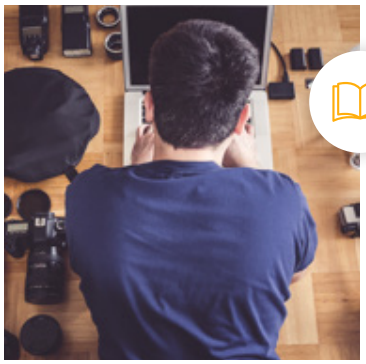
The ultimate goal of the Data Streaming Nanodegree program is to provide students with the latest skills to process data in real-time by building fluency in modern data engineering tools, such as Apache Spark,Kafka, Spark Streaming, and Kafka Streaming. A graduate of this program will be able to:

- Understand the components of data streaming systems. Ingest data in real-time using Apache Kafka and Spark and run analysis
- Use the Faust Stream Processing Python library to build a real-time stream-based application. Compile real-time data and run live analytics, as well as draw insights from reports generated by the streaming console.
- Learn about the Kafka ecosystem, and the types of problems each solution is designed to solve. Use the Confluent Kafka Python library for simple topic management, production, and consumption.
- Explain the components of Spark Streaming (architecture and API), integrate Apache Spark Structured Streaming and Apache Kafka, manipulate data using Spark, and understand the statistical report generated by the Structured Streaming console.

This program is comprised of 2 courses and 2 projects. Each project you build will be an opportunity to demonstrate what you've learned in the course, and will demonstrate to potential employers that you have skills in these areas.

Prerequisite Knowledge: Intermediate SQL, Python, and experience with ETL. Basic familiarity with traditional batch processing and traditional service architectures is desired, but not required.

Estimated Time: 2 Months at 5-10 hrs/week



Prerequisites: Intermediate SQL, Python, and experience with ETL

Flexible Learning: Self-paced, so you can learn on the schedule that works best for you.

Need Help? udacity.com/advisor Discuss this program with an enrollment advisor.

Course 1: Foundations of Data Streaming, and SQL & Data Modeling for the Web

The goal of this course is to demonstrate knowledge of the tools taught throughout, including Kafka Consumers, Producers, & Topics; Kafka Connect Sources and Sinks, Kafka REST Proxy for producing data over REST, Data Schemas with JSON and Apache Avro/Schema Registry, Stream Processing with the Faust Python Library, and Stream Processing with KSQL.

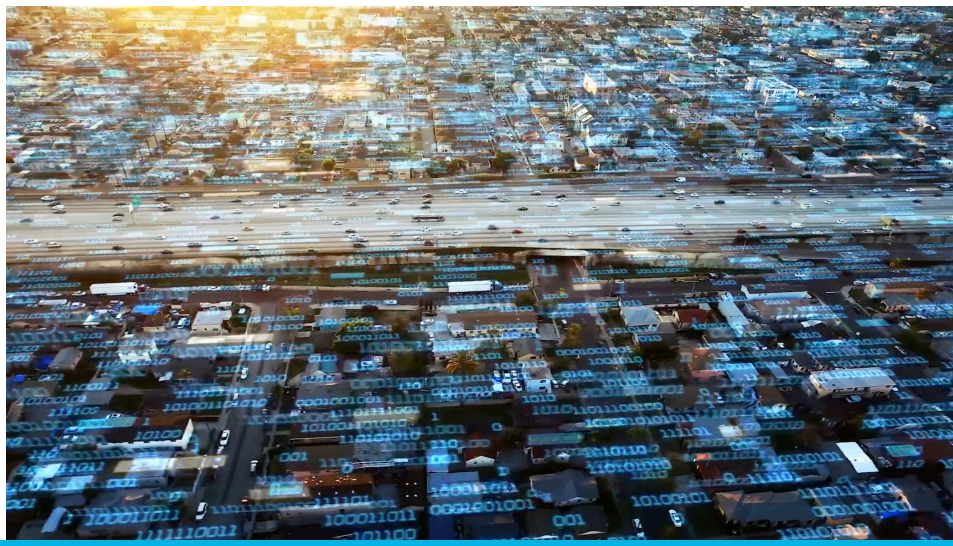
Course Project
Optimize Chicago Bus and Train Availability Using Kafka

For your first project, you'll be streaming public transit status using Kafka and the Kafka ecosystem to build a stream processing application that shows the status of trains in real-time. Based on the skills you learn, you will be able to optimize the availability of buses and trains in Chicago based on streaming data. You will learn how to have your own Python code produce events, use REST Proxy to send events over HTTP, and use Kafka Connect to collect data from a Postgres database to produce streaming data from a number of sources into Kafka. Then, you will use KSQL to combine related data models into a single topic ready for consumption by the downstream Python applications, and complete a simple Python application that ingests data from the Kafka topics for analysis. Finally, you will use the Faust Python Stream Processing library to further transform train station data into a more streamlined representation: using stateful processing, this library will show whether passenger volume is increasing, decreasing, or staying steady.

		LEARNING OUTCOMES
LESSON ONE	**Introduction to Stream Processing**	• Describe and explain streaming data stores and stream processing • Describe and explain real-world usages of stream processing • Describe and explain append-only logs, events, and how stream processing differs from batch processing • Utilize Kafka CLI tools and the Confluent Kafka Python library for topic management, production, and consumption
LESSON TWO	**Apache Kafka**	• Understand Kafka architecture, topics, and configuration • Utilize Confluent Kafka Python to create topics and configuration • Understand Kafka producers, consumers, and configuration • Utilize Confluent Kafka Python to create producers and configuration

	LEARNING OUTCOMES	
LESSON TWO (CONTINUED)	**Apache Kafka**	• Utilize Confluent Kafka Python to create topics, configuration, and manage offsets • Describe and explain user privacy considerations • Describe and explain performance monitoring for consumers, producers, and the cluster itself
LESSON THREE	**Data Schemas and Apache Avro**	• Understand what a data schema is and the value it provides • Understand what Apache Avro is and what value it provides • Utilize AvroProducer and AvroConsumer in Confluent Kafka Python • Describe and explain schema evolution and data compatibility types • Utilize Schema Registry components in Confluent Kafka Python to manage compatibility
LESSON FOUR	**Kafka Connect and REST Proxy**	• Describe and explain what problem Kafka Connect solves for and where it would be more appropriate than a traditional consumer • Describe and explain common connectors and how they work • Utilize Kafka Connect FIleStream & JDBC Source and Sink • Describe and explain what problem Kafka REST Proxy solves for and where it would be more appropriate than alternatives • Describe, explain, and utilize the REST Proxy metadata and administrative APIs • Describe and explain the REST Proxy consumer APIs • Utilize the REST Proxy consumer, subscription, and offset APIs • Describe, explain, and utilize the REST Proxy producer APIs
LESSON FIVE	**Stream Processing Fundamentals**	• Describe and explain common scenarios for stream processing, and where you would use stream versus batch • Describe and explain common stream processing strategies • Describe and explain how time and windowing works in stream processing • Describe and explain what a stream versus a table is in stream processing, and where you would use on over the other • Describe and explain how data storage works in stream processing applications and why it is needed

		LEARNING OUTCOMES
LESSON SIX	**Stream Processing with Faust**	• Describe and explain the Faust Stream Processing Python library, and how it fits into the ecosystem relative to solutions like Kafka Streams • Describe and explain Faust stream-based processing • Utilize Faust to create a stream-based application • Describe and explain how Faust table-based processing works • Utilize Faust to create a table-based application • Describe and explain Faust processors and function usage • Utilize Faust processor and function • Describe and explain Faust serialization and deserialization • Utilize Faust serialization and deserialization
LESSON SEVEN	**KSQL**	• Describe and explain how KSQL fits into the Kafka ecosystem, and why you would choose it over a stream processing application built from scratch • Describe and explain KSQL architecture • Describe and explain how to create KSQL streams and tables from topics. Understand the importance of KEY and schema transformations • Utilize KSQL to create tables and streams • Describe and explain KSQL selection syntax • Utilize KSQL syntax to query tables and streams • Describe and explain KSQL windowing • Utilize KSQL windowing within the context of table analysis • Describe and explain KSQL grouping and aggregates • Utilize KSQL grouping and aggregates within queries



Course 2: Streaming API Development and Documentation

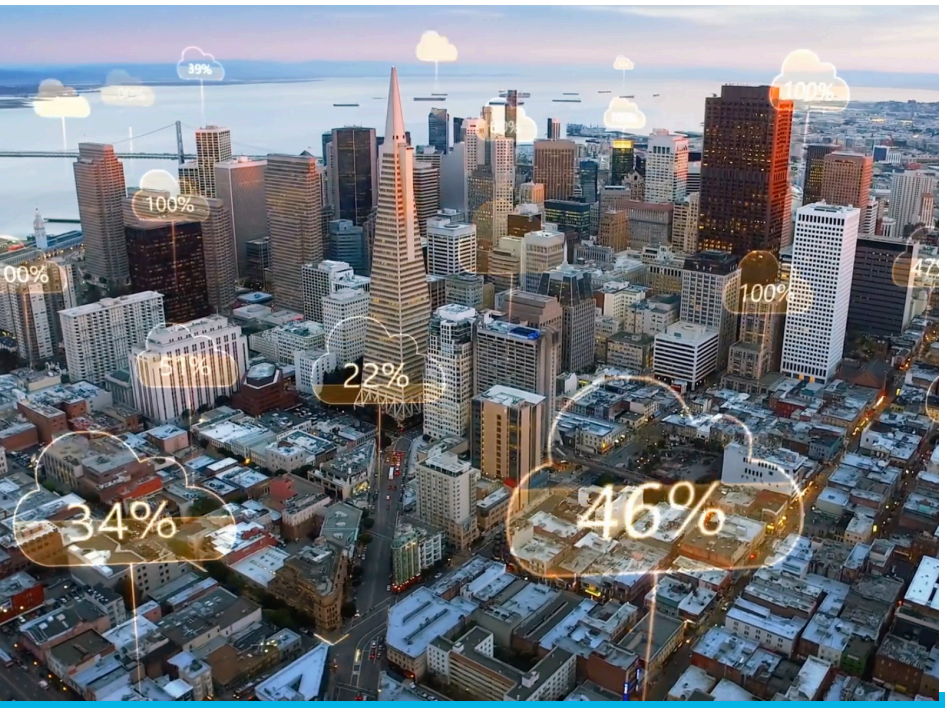
The goal of this course is to grow your expertise in the components of streaming data systems, and build a real-time analytics application. Specifically, you will be able to: explain components of Spark Streaming (architecture and API), ingest streaming data to Apache Spark Structured Streaming and perform analysis, integrate Apache Spark Structured Streaming and Apache Kafka, and understand the statistical report generated by the Structured Streaming console.

Course Project
Analyze San Francisco Crime Rate with Apache Spark Streaming

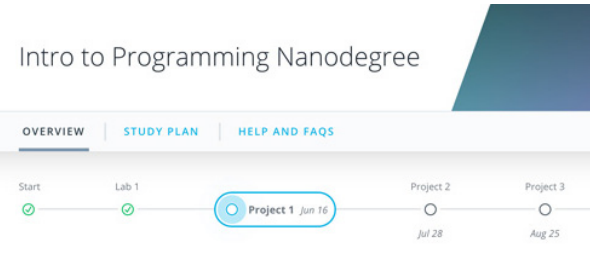
In this project, you will analyze a real-world dataset of the SF Crime Rate, extracted from kaggle, to provide statistical analysis using Apache Spark Structured Streaming. You will be provided with dataset, and use a Kafka server locally to produce and ingest data through Spark Structured Streaming. Then, you will use various APIs to create and execute logics. You will create an ETL pipeline that produces Kafka data and ingests the data through Spark. Finally, you will generate a meaningful statistical report from the data.

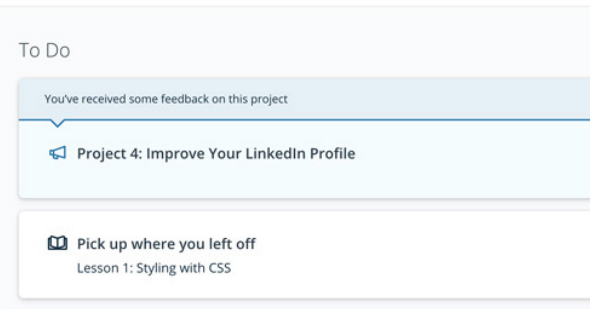
	LEARNING OUTCOMES	
LESSON ONE	**The Power of Spark**	• Describe and explain the big data ecosystem • Describe and explain the hardware behind big data • Describe and explain distributed systems • Understand when to use Spark and when not to use it
LESSON TWO	**Data Wrangling with Spark**	• Manipulate data using Functional Programming • Manipulate data using Maps and Lambda functions • Read and write data into SparkSQL and Spark dataframes • Manipulate data using Spark for ETL purposes
LESSON THREE	**Debugging and Optimization**	• Set up a Spark cluster on AWS (transition from local to distributed mode) • Upload and retrieve data on AWS Cloud using Jupyter Notebook • Submit data using Python notebook • Read and write data using distributed data storage, Amazon S3, and HDFS • Diagnose, correct errors, and optimize code using Spark WebUI and Accumulators

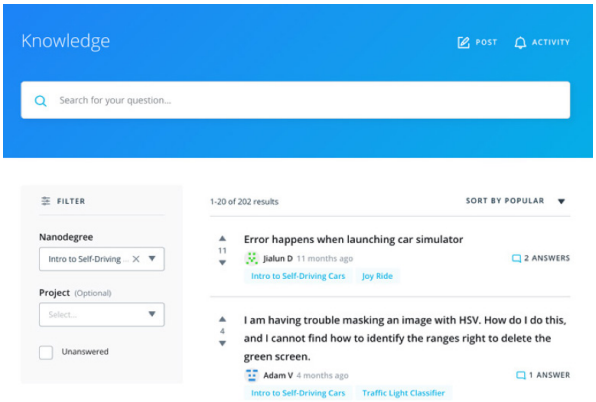
	LEARNING OUTCOMES	
LESSON FOUR	**Introduction to Spark Streaming**	• Learn Apache Fundamental's core building blocks (RDD/ Dataframe/Dataset) • Review Action/Transformation functions and learn how these concepts apply in streaming
LESSON FIVE	**Structured Streaming APIs**	• Understand the concept of lazy evaluation • Describe different join types between streaming and static dataframes
LESSON SIX	**Integration of Spark Streaming and Kafka**	• Describe Kafka Source Provider • Describe Kafka Offset Management • Describe Triggers in Spark Streaming • Describe Progress Report in Spark Console to analyze batches in Kafka • Understand sample business architectures and learn how to tune them for best performance from examples

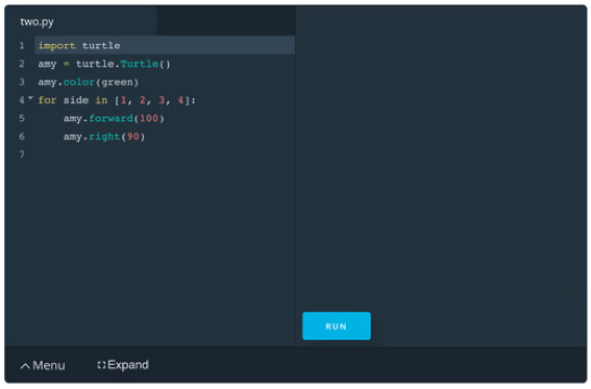


Our Classroom Experience









REAL-WORLD PROJECTS

Build your skills through industry-relevant projects. Get personalized feedback from our network of 900+ project reviewers. Our simple interface makes it easy to submit your projects as often as you need and receive unlimited feedback on your work.

KNOWLEDGE

Find answers to your questions with Knowledge, our proprietary wiki. Search questions asked by other students and discover in real-time how to solve the challenges that you encounter.

STUDENT HUB

Leverage the power of community through a simple, yet powerful chat interface built within the classroom. Use Student Hub to connect with your technical mentor and fellow students in your Nanodegree program.

WORKSPACES

See your code in action. Check the output and quality of your code by running them on workspaces that are a part of our classroom.

QUIZZES

Check your understanding of concepts learned in the program by answering simple and auto-graded quizzes. Easily go back to the lessons to brush up on concepts anytime you get an answer wrong.

CUSTOM STUDY PLANS

Work with a mentor to create a custom study plan to suit your personal needs. Use this plan to keep track of your progress toward your goal.

PROGRESS TRACKER

Stay on track to complete your Nanodegree program with useful milestone reminders.

Learn with the Best

Ben Goldberg

STAFF ENGINEER
AT SPOTHERO

In his career as an engineer, Ben Goldberg has worked in fields ranging from Computer Vision to Natural Language Processing. At SpotHero, he founded and built out their Data Engineering team, using Airflow as one of the key technologies.

Judit Lantos

SENIOR DATA ENGINEER
AT NETFLIX

Currently, Judit is a Senior Data Engineer at Netflix. Formerly a Data Engineer at Split, where she worked on the statistical engine of their full-stack experimentation platform, she has also been an instructor at Insight Data Science, helping software engineers and academic coders transition to DE roles.

David Drummond

VP OF ENGINEERING
AT INSIGHT

David is VP of Engineering at Insight where he enjoys breaking down difficult concepts and helping others learn data engineering. David has a PhD in Physics from UC Riverside.

Jillian Kim

SENIOR DATA ENGINEER
AT CHANGE HEALTHCARE

Jillian has worked in roles from building data analytics platforms to machine learning pipelines. Previously, she was a research engineer at Samsung focused on data analytics and ML, and now leads building pipelines at scale as a Senior Data Engineer at Change Healthcare.

All Our Nanodegree Programs Include:

EXPERIENCED PROJECT REVIEWERS

REVIEWER SERVICES

- Personalized feedback
- Unlimited submissions and feedback loops
- Practical tips and industry best practices
- Additional suggested resources to improve

INDIVIDUAL 1-ON-1 MENTORSHIP

MENTORSHIP SERVICES

- 6+ hrs of mentor support per month
- Weekly 1-on-1 personal mentor calls
- 1-on-1 mentor chats anytime
- Custom weekly learning plan focused on your progress, goals and availability
- Daily progress tracking
- Proactive check-ins with you
- Mentors are compensated based on your progress and success

PERSONAL CAREER SERVICES

CAREER COACHING

- Personal assistance in your job search
- Monthly 1-on-1 calls
- Personalized feedback and career guidance
- Access Udacity Talent Program used by our network of employers to source candidates
- Advice on negotiating job offers
- Interview preparation
- Resume services
- Github portfolio review
- LinkedIn profile optimization

Frequently Asked Questions

PROGRAM OVERVIEW

WHY SHOULD I ENROLL?

As businesses increasingly rely on applications that produce and process data in real-time, data streaming is an increasingly in-demand skill for data engineers. The Data Streaming Nanodegree program will prepare you for the cutting edge of data engineering as more and more companies look to derive live insights from data at scale.

Students will learn how to process data in real-time by building fluency in modern data engineering tools, such as Apache Spark, Kafka, Spark Streaming, and Kafka Streaming.

You'll start by understanding the components of data streaming systems. You'll then build a real-time analytics application. You will also compile data and run analytics, as well as draw insights from reports generated by the streaming console.

WHAT JOBS WILL THIS PROGRAM PREPARE ME FOR?

This program is designed to upskill experienced Software Engineers and Data Engineers to learn the latest advancements in data processing, sending data records continuously to support live updating.

The projects in the Data Streaming Nanodegree program will prepare you to develop systems and applications capable of interpreting data in real-time, and position you for roles in all industries that require live data processing for functions including big data, cloud computing, web personalization, fraud detection, sensor monitoring, anomaly detection, supply chain maintenance, location-based services, and much more.

HOW DO I KNOW IF THIS PROGRAM IS RIGHT FOR ME?

This program is intended for software engineers looking to build real-time data processing proficiency, as well as data engineers looking to enhance their existing skill set with the next advancement in data engineering.

ENROLLMENT AND ADMISSION

DO I NEED TO APPLY? WHAT ARE THE ADMISSION CRITERIA?

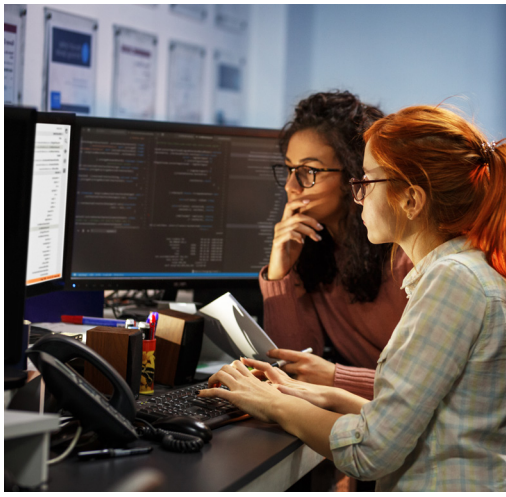
There is no application. This Nanodegree program accepts everyone, regardless of experience and specific background.

WHAT ARE THE PREREQUISITES FOR ENROLLMENT?

The Data Streaming Nanodegree program is designed for students with intermediate Python and SQL skills, as well as experience with ETL.

FAQs Continued

Basic familiarity with traditional batch processing and basic conceptual familiarity with traditional service architectures is desired, but not required.



IF I DO NOT MEET THE REQUIREMENTS TO ENROLL, WHAT SHOULD I DO?

Udacity's **Programming for Data Science with Python** Nanodegree program is great preparation for the Data Engineer Nanodegree program. You'll learn to code with Python and SQL.

Similarly, the **Data Engineering** Nanodegree program is great preparation for the Data Streaming Nanodegree program.

TUITION AND TERM OF PROGRAM

HOW IS THIS NANODEGREE PROGRAM STRUCTURED?

The Data Streaming Nanodegree program is comprised of content and curriculum to support two projects. We estimate that students can complete the program in two months, working five to ten hours per week.

Each project will be reviewed by the Udacity reviewer network. Feedback will be provided, and if you do not pass the project, you will be asked to resubmit the project until it passes.

HOW LONG IS THIS NANODEGREE PROGRAM?

Access to this Nanodegree program runs for the length of time specified in the payment card on the Nanodegree program overview page. If you do not graduate within that time period, you will continue learning with month to month payments. See the **Terms of Use** for other policies around the terms of access to our Nanodegree programs.

CAN I SWITCH MY START DATE? CAN I GET A REFUND?

Please see the Udacity Nanodegree program **FAQs** for policies on enrollment in our programs.

SOFTWARE AND HARDWARE

WHAT SOFTWARE AND VERSIONS WILL I NEED IN THIS PROGRAM?

There are no software and version requirements to complete this Nanodegree program. All coursework and projects can be completed via Student Workspaces in the Udacity online classroom.