
AWS
re:Invent
NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

OPN301

Jump-start graph projects with Apache TinkerPop & Jupyter notebooks

Kelvin Lawrence

Sr. Principal Graph Architect
Amazon Neptune, AWS

Taylor Riggan

Sr. Graph Architect
Amazon Neptune, AWS

aws

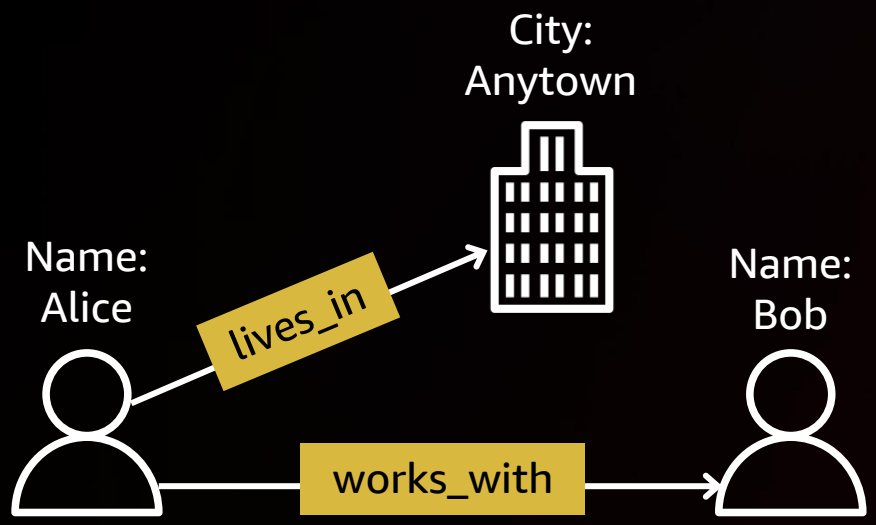
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Agenda

- Graph databases and use cases
- What is Apache TinkerPop and Jupyter?
- Gremlin query language
- Demo: Graph Notebook + Gremlin Server + Jupyter

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Graphs



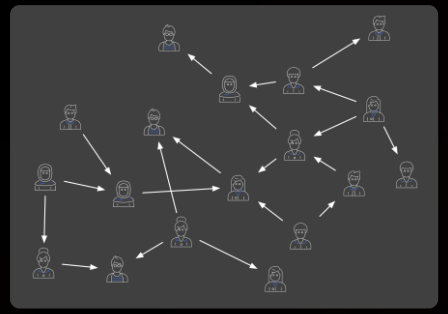
Graphs model data based on **relationships**

Graphs explore relationships and patterns in **connected data**

aws
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

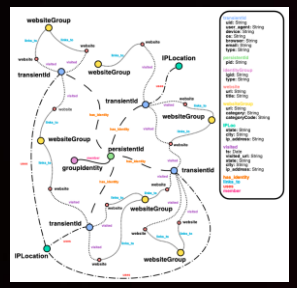
Graph use cases

Social networks



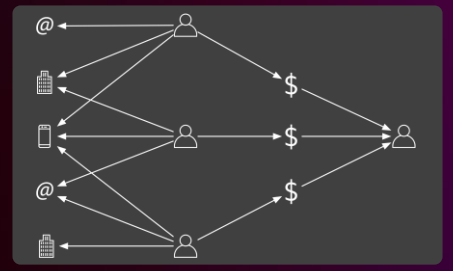
Social connections between friends and colleagues

Identity graphs



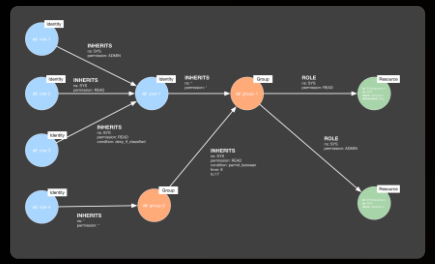
Unified view by linking devices, IP addresses, and browsing behaviors

Fraud detection



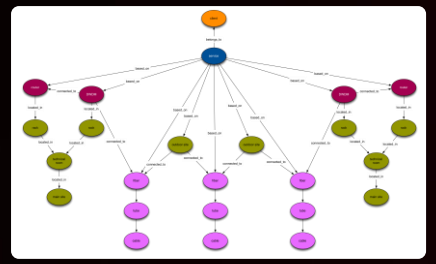
Patterns of connected transactions, senders, receivers, and identity info

Entitlements



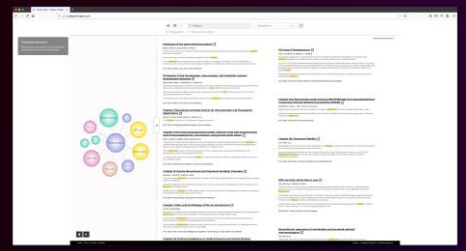
Conditional path from identities to resources

Network analysis



Top-down and bottom-up parent-child traversals

Knowledge graphs



Context created by linked datasets and concepts

aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Apache TinkerPop

- Started in 2009; Apache submission 2015
- A reference implementation for labeled property graph (LPG) databases
- Five active committers from Amazon (2 x PMC)
- Ongoing contributions from the Amazon Neptune team



TinkerPop image licensed under Apache License 2.0.

aws
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

TinkerPop components



TinkerPop image licensed under Apache License 2.0.

- Gremlin Server: OLTP processor
- TinkerGraph: In-memory graph data store
- Gremlin Console: Groovy-based REPL
- Gremlin query language
- Gremlin drivers and language variants (SDKs)
- GraphComputer: OLAP graph analytics engine
- OLAP plug-ins: Hadoop-Gremlin, Spark-Gremlin

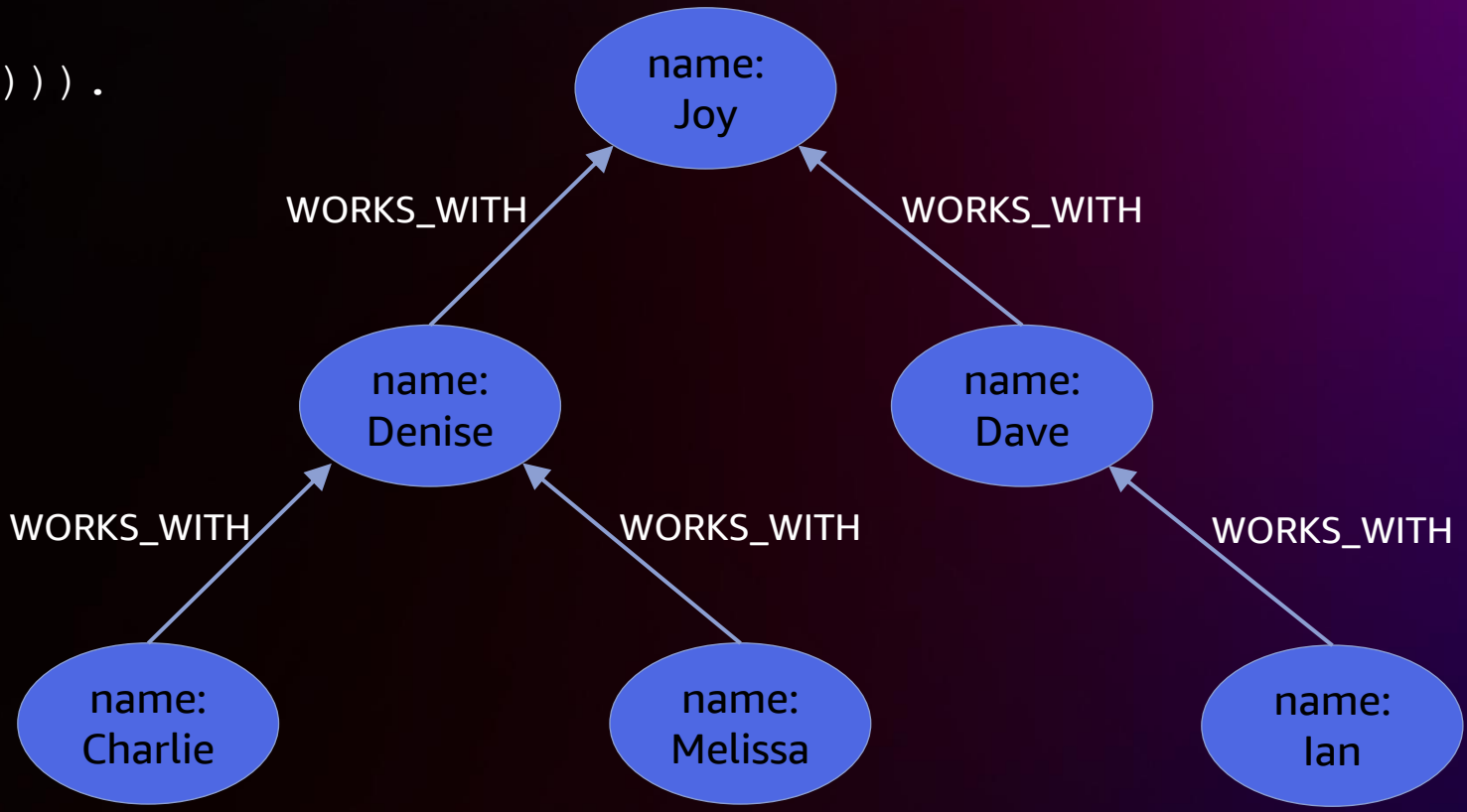
aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Gremlin query language

```
g.V().has('name','Joy').
    repeat(in('WORKS_WITH')).
    until(not(in('WORKS_WITH'))).
    path().by('name')
```

- Imperative query language
- Recursive / path-finding semantics
- Turing complete



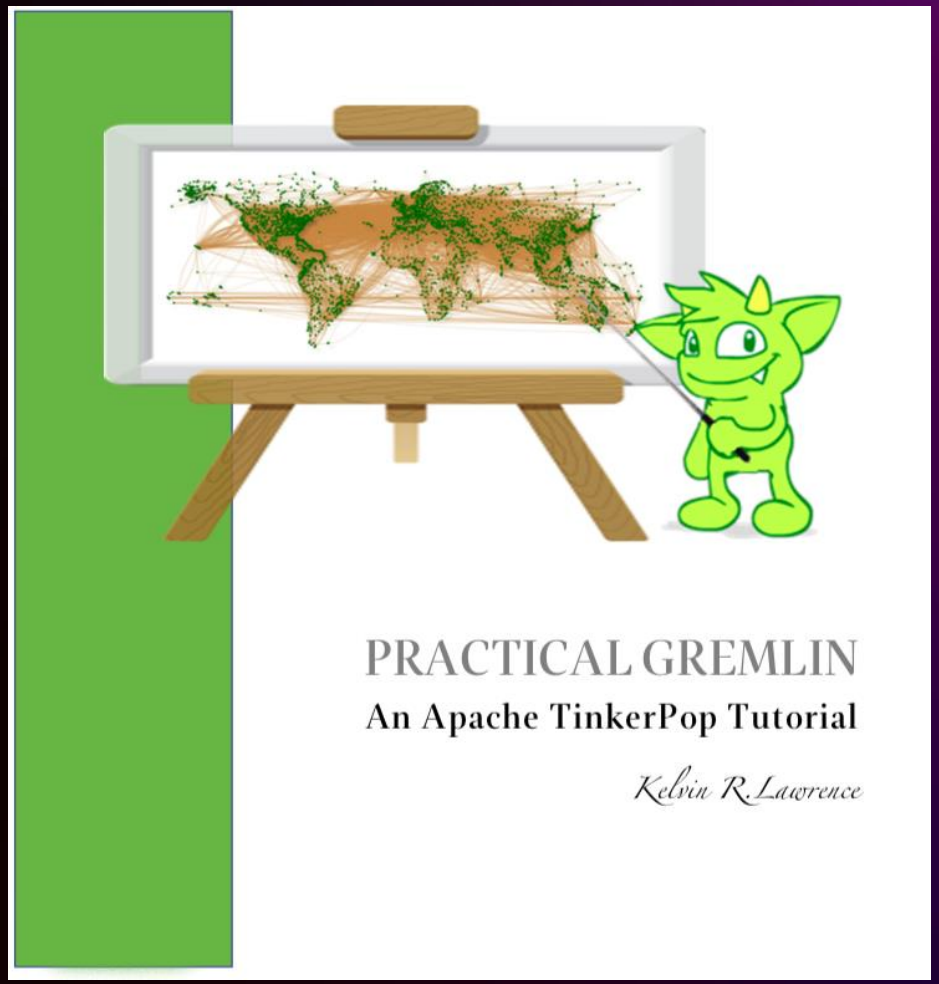
aws
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Practical Gremlin

Open-source documentation covering the Gremlin query language:

https://github.com/krlawrence/graph

Includes examples using a freely available dataset of commercial air routes



https://www.kelvinlawrence.net/book/PracticalGremlin.html

aws
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

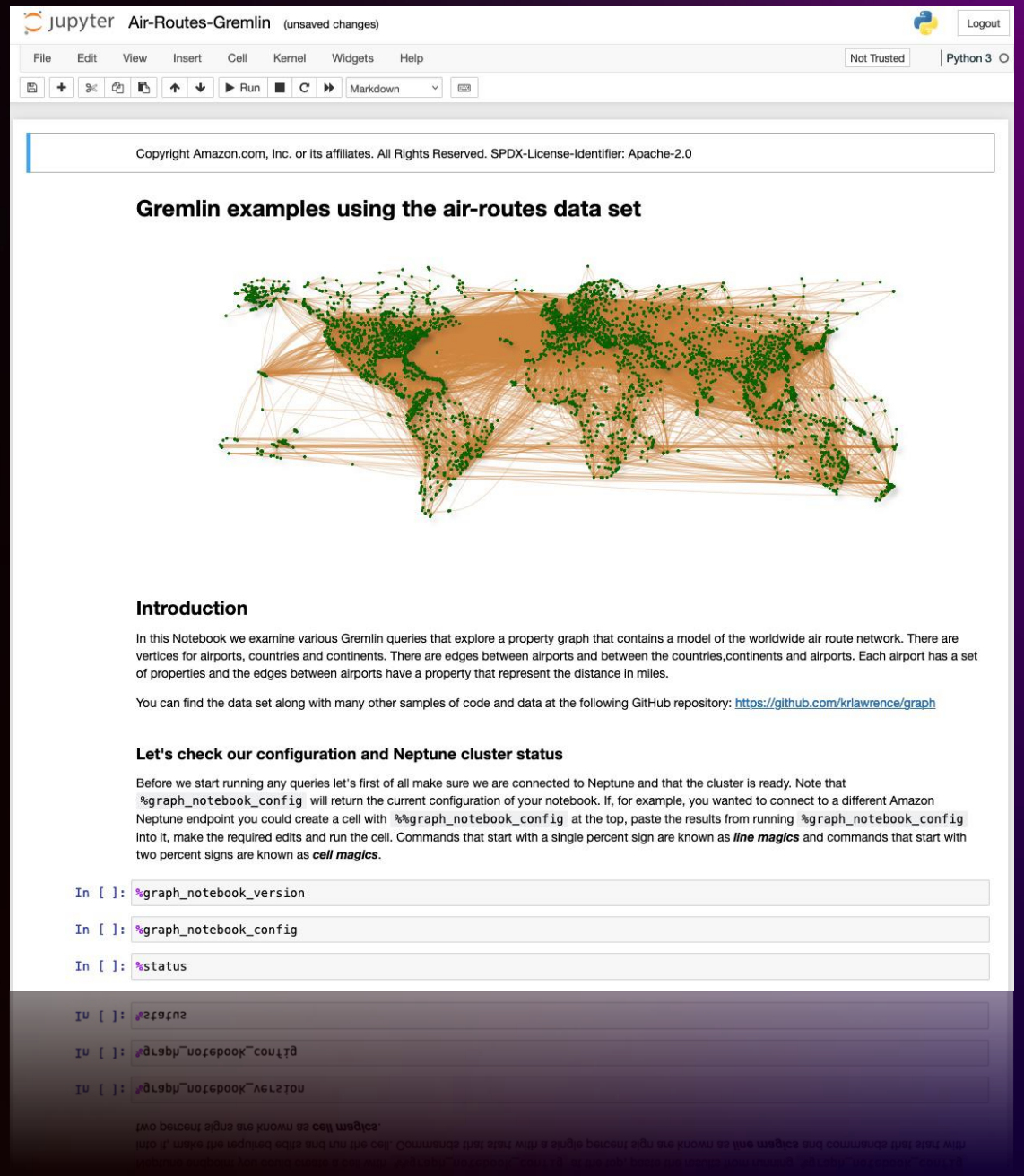
Databases implementing TinkerPop

- Alibaba Graph Database
- **Amazon Neptune**
- ArangoDB
- ArcadeDB
- Bitsy
- Blazegraph
- ChronoGraph
- CosmosDB
- DSEGraph
- Hadoop
- HGraphDB
- Huawei Graph Engine Service
- HugeGraph (Apache incubator)
- IBM Db2 Graph
- JanusGraph (Titan fork)
- Neo4j
- OrientDB
- OverflowDB
- Apache S2Graph
- Sqlg
- Stardog
- Tibco Graph Database
- TinkerGraph
- Unipop

aws
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Jupyter

- Name derived from “Julia,” ”Python,” and “R”
- In-browser iPython console
- Write code + Markdown
- Shareable via .ipynb files
- Extensible via Jupyter “magics”
- New support for other languages (javascript, Java, Scala, and 40 other languages)

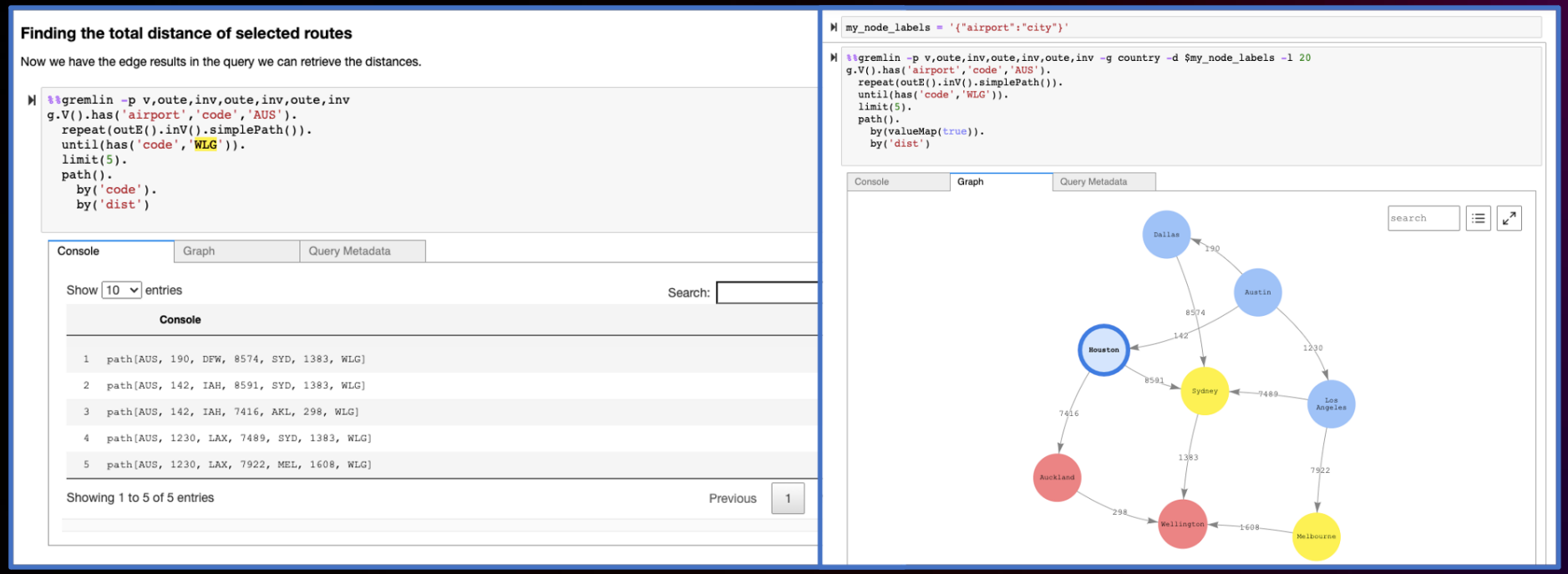


© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Graph notebook

- Developed at AWS
- Apache 2 licensed
- Growing community
- Support for multiple graph databases

https://github.com/aws/graph-notebook



© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

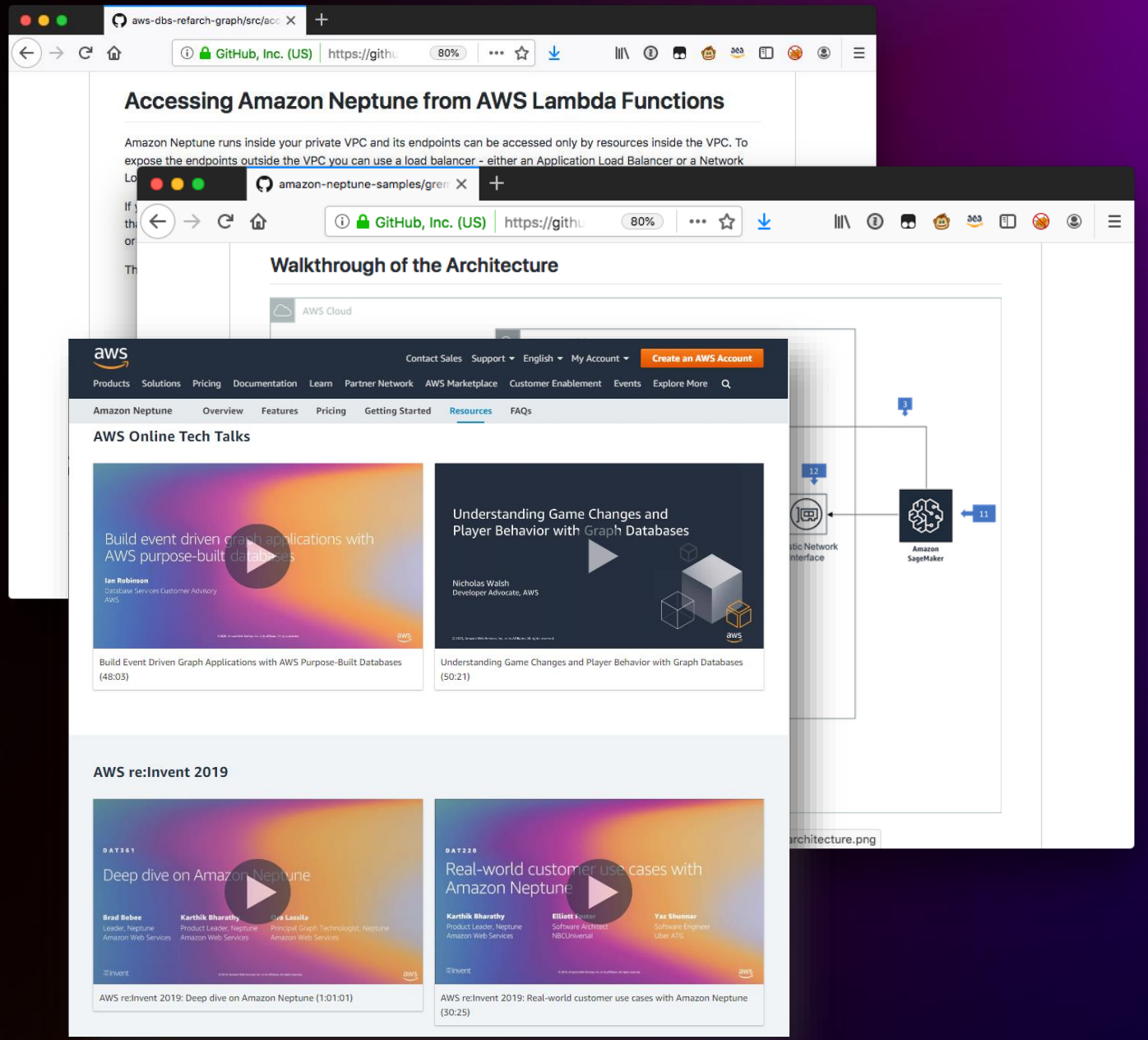
Additional resources

Neptune notebooks/graph notebook
go.aws/3LKM2xS

Neptune reference architectures
bit.ly/3OVRlfB

Neptune sample applications
bit.ly/3w2lwsU

Use cases, videos, blogs, and code
go.aws/3vTXHUa



© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Thank you!

Kelvin Lawrence
lakelvin@amazon.com
@gfxman

Taylor Riggan
triggan@amazon.com
@triggan



Please complete the session survey in the **mobile app**

aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.