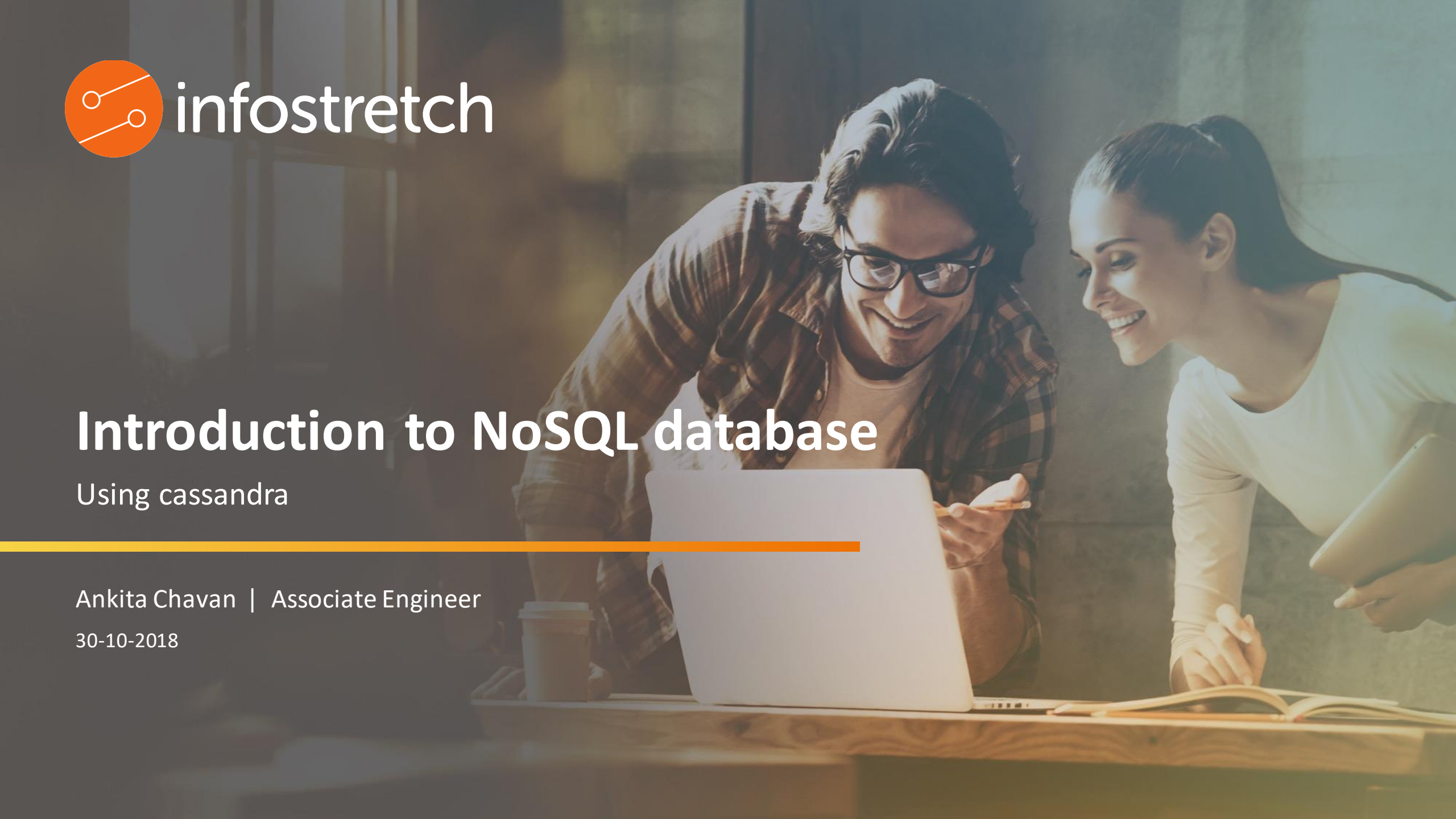

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Introduction to NoSQL database

Using cassandra

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Agenda

- Introduction to Cassandra
- Brief overview of SQL vs. NoSQL
- Design choices of Cassandra
- Architecture of Cassandra
- Data Model
- CQL Demo

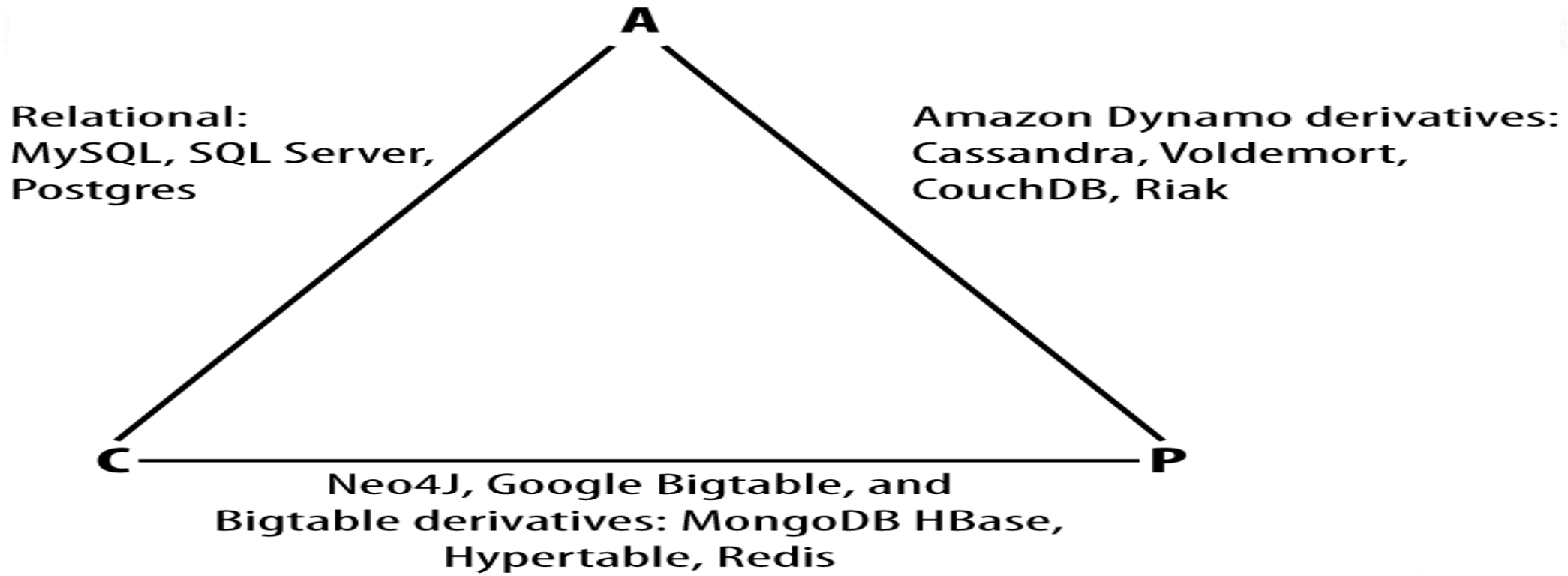
Introduction to Cassandra

- Facebook developed Cassandra in 2008 for solving inbox search problem
- Some of the companies which largely uses Cassandra are Facebook, Netflix, Instagram, eBay, Twitter, Reddit and Apple etc.
- It is based on Google's Bigtable and amazon's dynamo.

SQL vs NoSQL

- Structured Query Language (SQL) happens to be the more structured, rigid way of storing data, like a phone book. For a relational database to be effective, data needs to be stored in a very organized fashion.
- NoSQL is used when you are dealing with massive amount of data and your data requirements aren’t clear at the outset.You get much more flexibility than its traditional counterparts, with non-relational databases

Design choices of Cassandra (CAP theorem)



Architecture

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Topology of a cluster

- Cassandra provides two levels of grouping that are used to describe the topology of a cluster: data center and rack.
- A rack is a logical set of nodes in close proximity to each other.
- A data center is a logical set of racks, perhaps located in the same building and connected by reliable network.

Gossip and Failure Detection

- To support decentralization and partition tolerance, Cassandra uses a gossip protocol that allows each node to keep track of state information about the other nodes in the cluster.
- The gossiper runs every second on a timer.
- The gossip protocol in Cassandra is primarily implemented by the org.apache.cassandra.gms.Gossiper class.

Working of gossiper

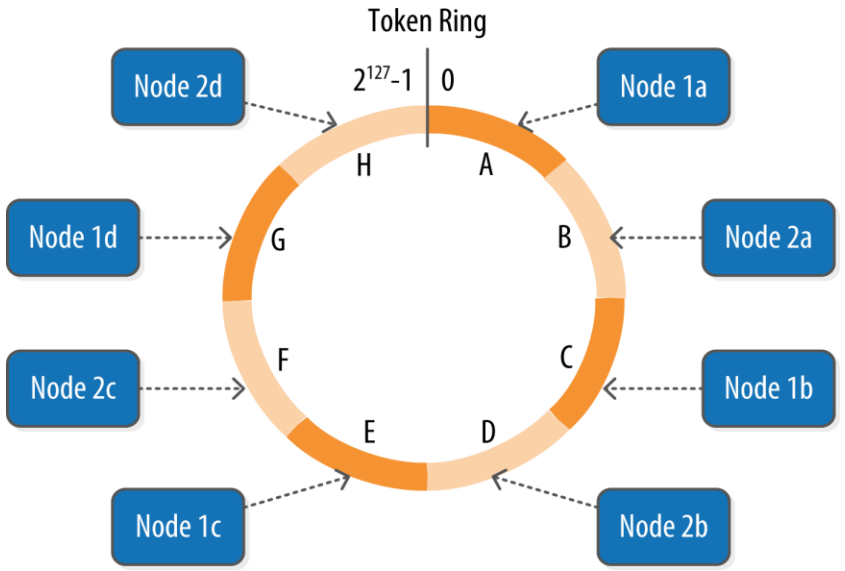
- Once per second, the gossiper will choose a random node in the cluster and initialize a gossip session with it. Each round of gossip requires three messages.
- The gossip initiator sends its chosen friend a GossipDigestSynMessage.
- When the friend receives this message, it returns a GossipDigestAckMessage.
- When the initiator receives the ack message from the friend, it sends the friend a GossipDigestAck2Message to complete the round of gossip.

Failure Detection

- Failure detection is implemented in Cassandra by the org.apache.cassandra.gms. FailureDetector class.
- isAlive(InetAddress) : What the detector will report about a given node's alive-ness.
- interpret(InetAddress) : Used by the gossiper to help it decide whether a node is alive or not based on suspicion level reached by calculating Phi (as described in the Hayashibara paper).
- report(InetAddress) : When a node receives a heartbeat, it invokes this method.

Rings and Tokens

- Cassandra represents the data managed by a cluster as a ring.
- A token is a 64-bit integer ID used to identify each partition.



Snitches

- Snitches gather information about your network topology so that Cassandra can efficiently route requests.
- The role of the snitch is to help identify the replica that will return the fastest, and this is the replica which is queried for the full data.

Virtual nodes

- Virtual nodes have been enabled by default since 2.0
- Instead of assigning a single token to a node, the token range is broken up into multiple smaller ranges. Each physical node is then assigned multiple tokens

Partitioners

- A Partitioner determines how data is distributed across the nodes in the cluster.
- Each row has a partition key that is used to identify the partition.

Replication Strategies

- Cassandra stores replicas on multiple nodes to ensure reliability and fault tolerance.
- A replication strategy determines the nodes where replicas are placed.
- Two replication strategies are available:
  1. SimpleStrategy
  2. NetworkTopologyStrategy

Tunable Consistency

- Consistency refers to how up-to-date and synchronized a row of Cassandra data is on all of its replicas.
- Cassandra extends the concept of eventual consistency by offering tunable consistency for any given read or write operation, the client application decides how consistent the requested data should be.

Data Model

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Data Model

- The Cassandra data model consists of keyspaces, column families, keys and columns.

Relational Model	Cassandra Model
Database	Keyspace
Table	Column Family (CF)
Primary key	Row key
Column name	Column name/key
Column value	Column value

Demo

References & Further study

- https://www.safaribooksonline.com/library/view/cassandra-the-definitive
- https://app.pluralsight.com/player?course=cassandra-developers&author=paul-ofallon&name=cassandra-developers-m1&clip=0&mode=live
- http://cassandra.apache.org/

Thank You

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