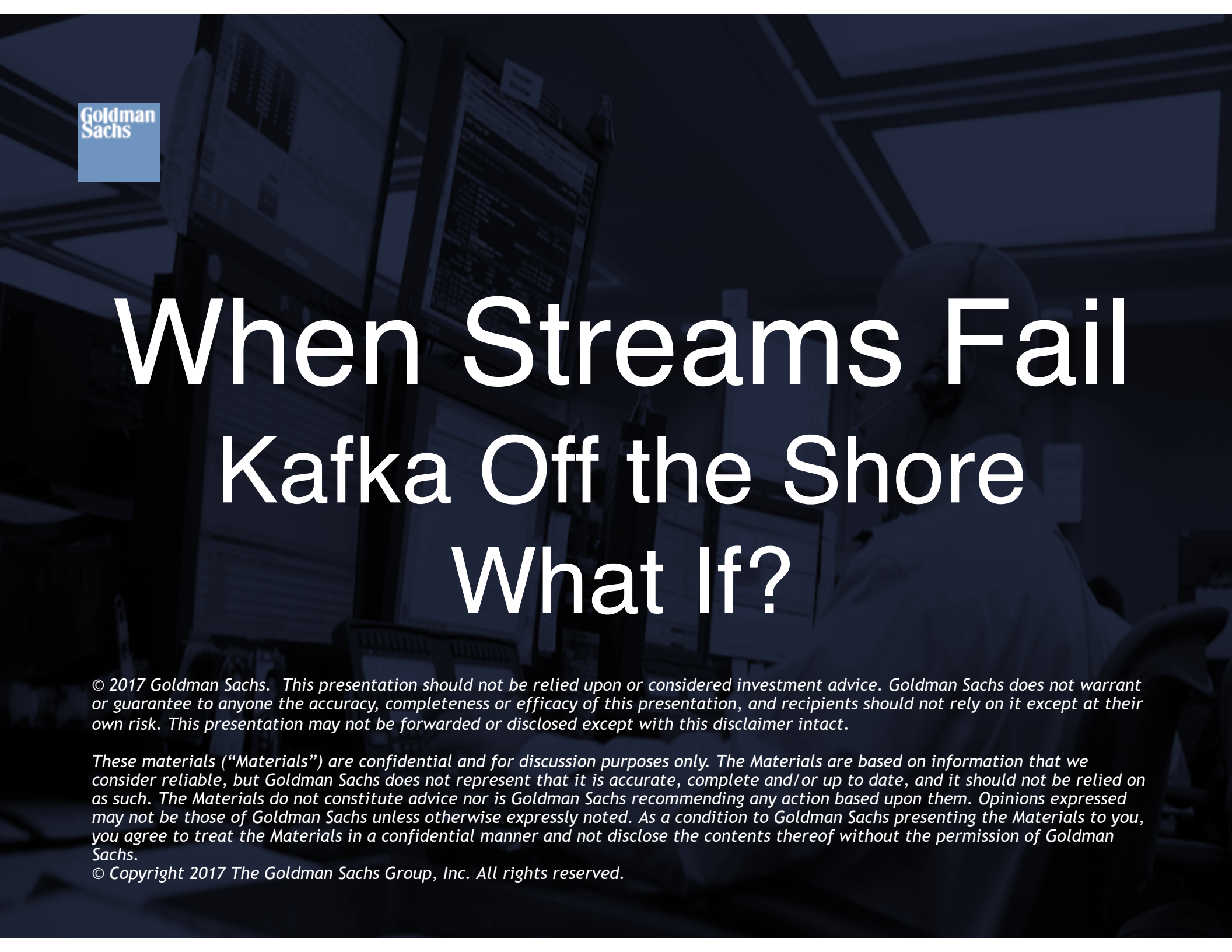


When Streams Fail
Kafka Off the Shore
What If?

ABOUT US

- Investment Management Division
- $1.4 Trillion Assets Under Management
- Core Front-Office Platform Team
- Interface with 15+ teams
- Kafka, Event Topology, Data Fabric, Akka, etc…
- Sounds fun? Talk to me!
- What if…

What If? This presentation is boring

- Topology Strategy, Context & Deployment Goals
- What If? Hosts / Network / DC Failures
- Deployment & Monitoring Strategy
- What If? Framework & Software Failure

KAFKA DEPLOYMENT USAGE PATTERNS

- Most used clusters serve ~1.5Tb a week to consumers
- However message count relatively low – order of millions per week; avg. several hundred a second
- At peak periods
  - ~1,500 messages produced/second
  - ~2.5Mb produced/second
  - ~12.5Mb consumed/second

DEPLOYMENT GOALS

- No data-loss even in case of DC outage
- No Primary/Back-Up notion
- No “failover” scenarios
- Minimize Outage time

DATALOSS 101

- Tape Backup
- Nightly Batch Replication
- Async Replication
- Sync Replication (ex: SRDF)

Speed of Light Network Roundtrips

NYC to SF	~60ms
Virginia to Ohio	~12ms
NYC to NJ	~4ms

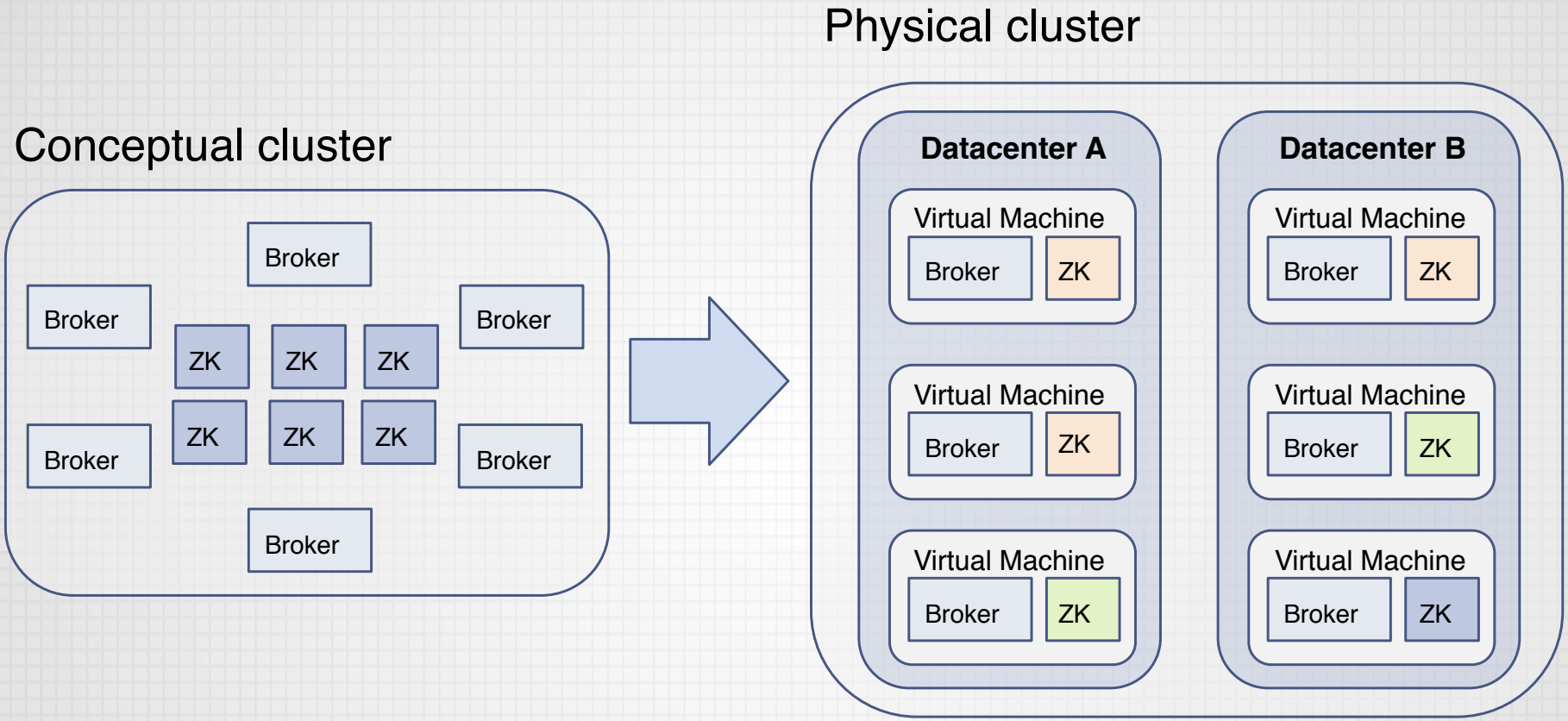
What If? Datacenters were near…

Treat multi-DC environment as

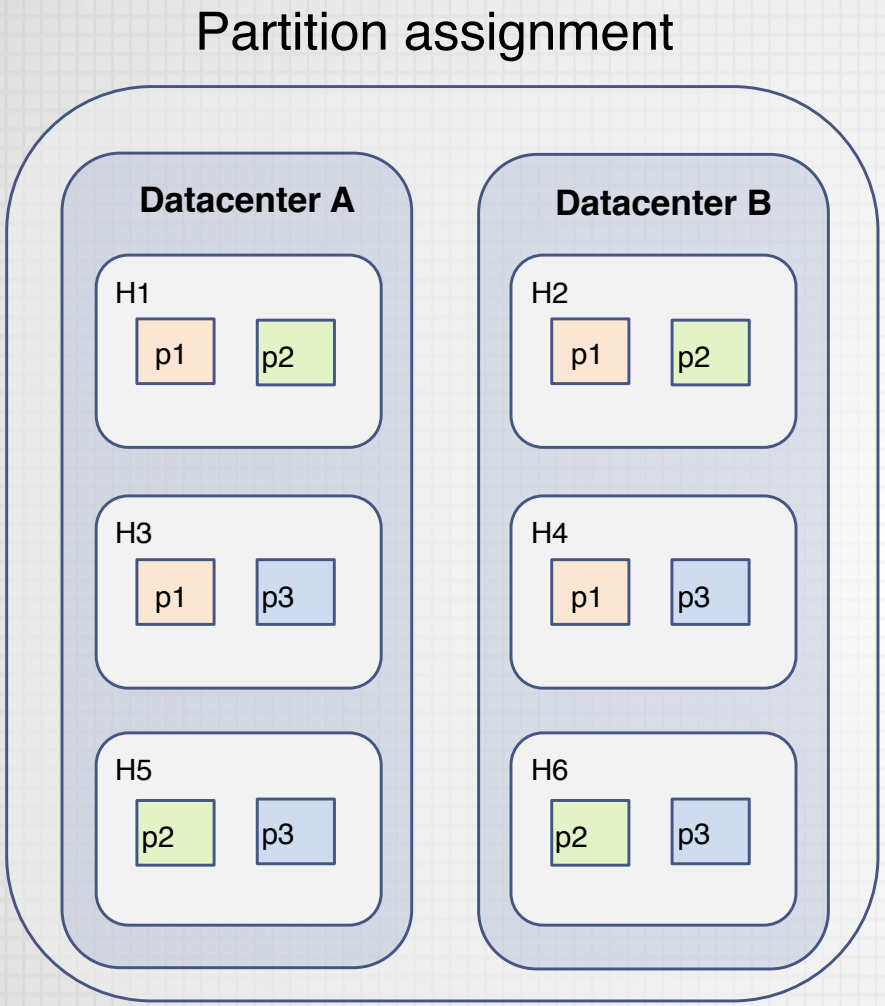
a single redundant data-center

where half could go down

DEPLOYMENT STRATEGY

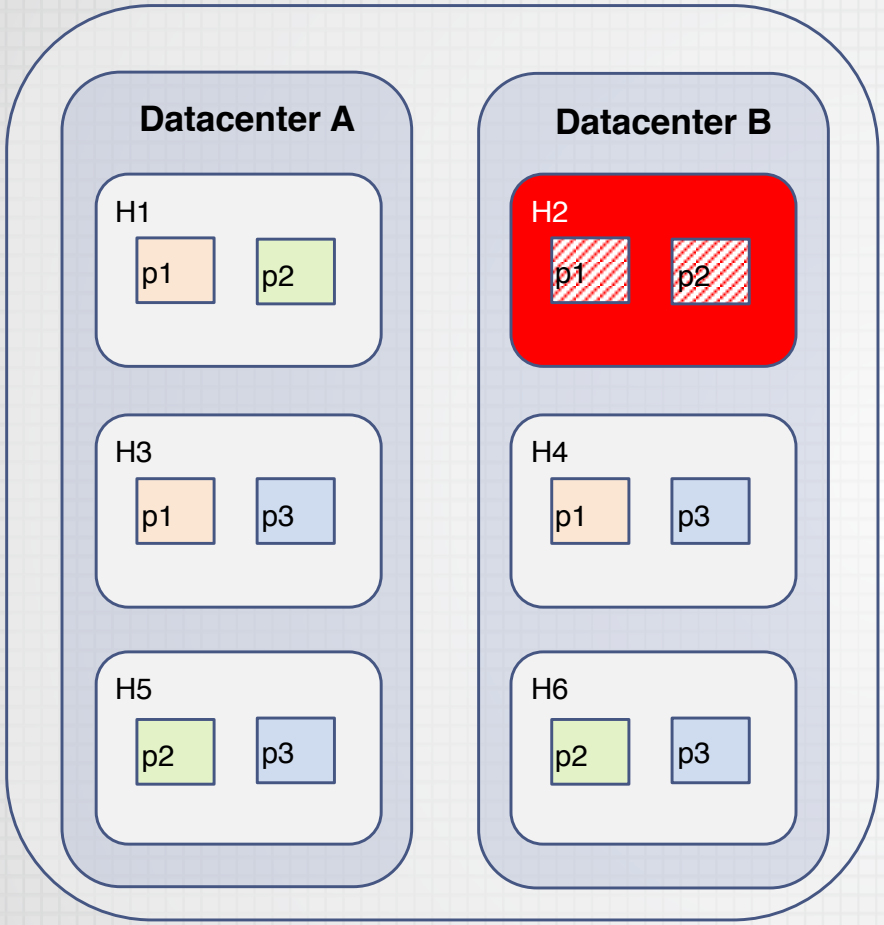


EXAMPLE Single Topic Setup



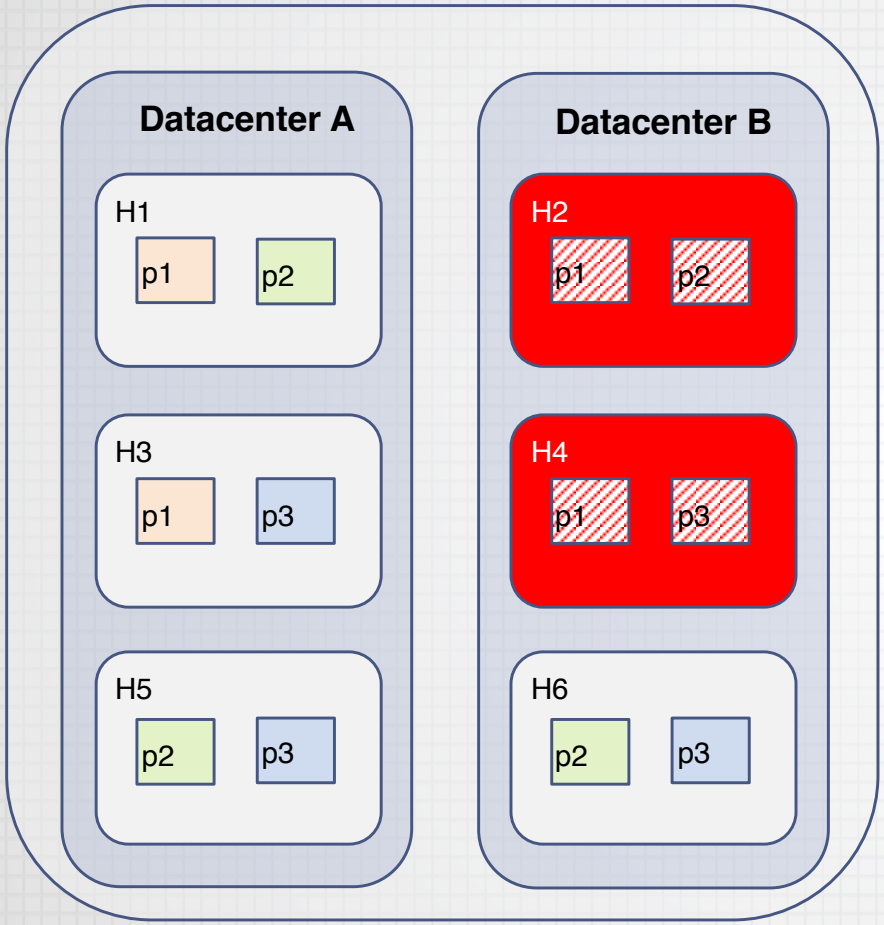
- 1 topic
- 3 partitions (p1-p3)
- Replication factor of 4
- Ensure even replicas between DCs
- Min.Insync.Replicas 3
- Cross-DC latency is low!

What If? A host fails



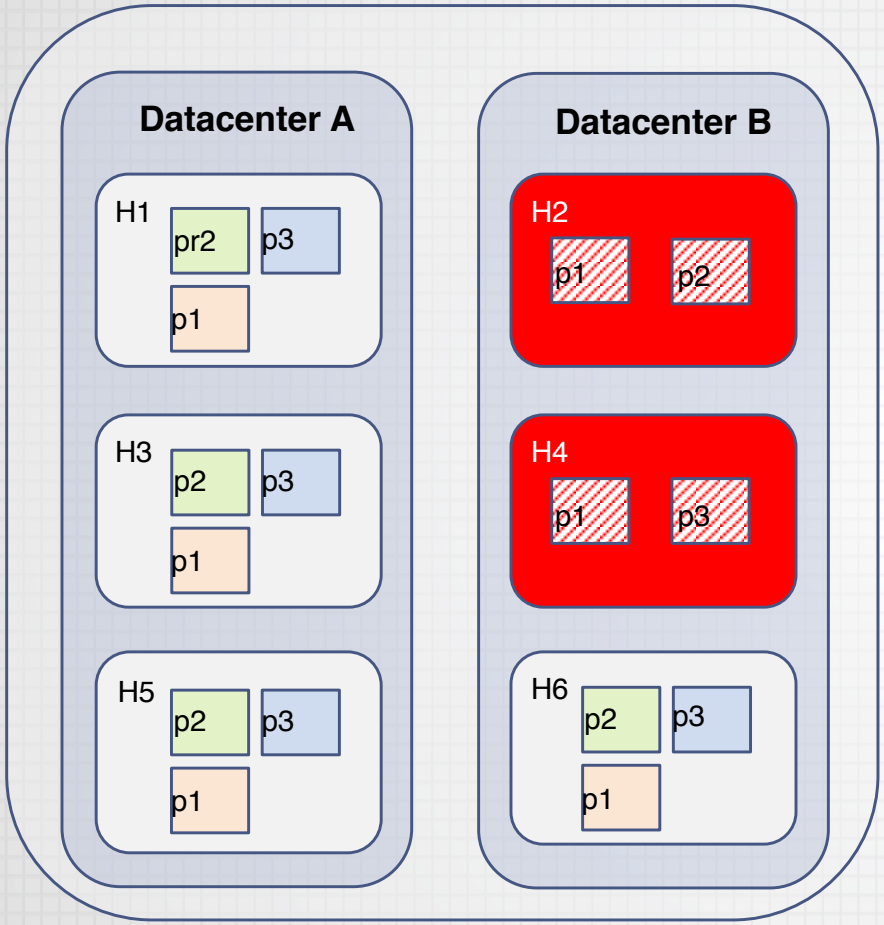
- 1-5 times / year
- No impact to producers/consumers (still able to satisfy 3 ISR)
- No manual recovery beyond replacing host

What If? Two hosts fail



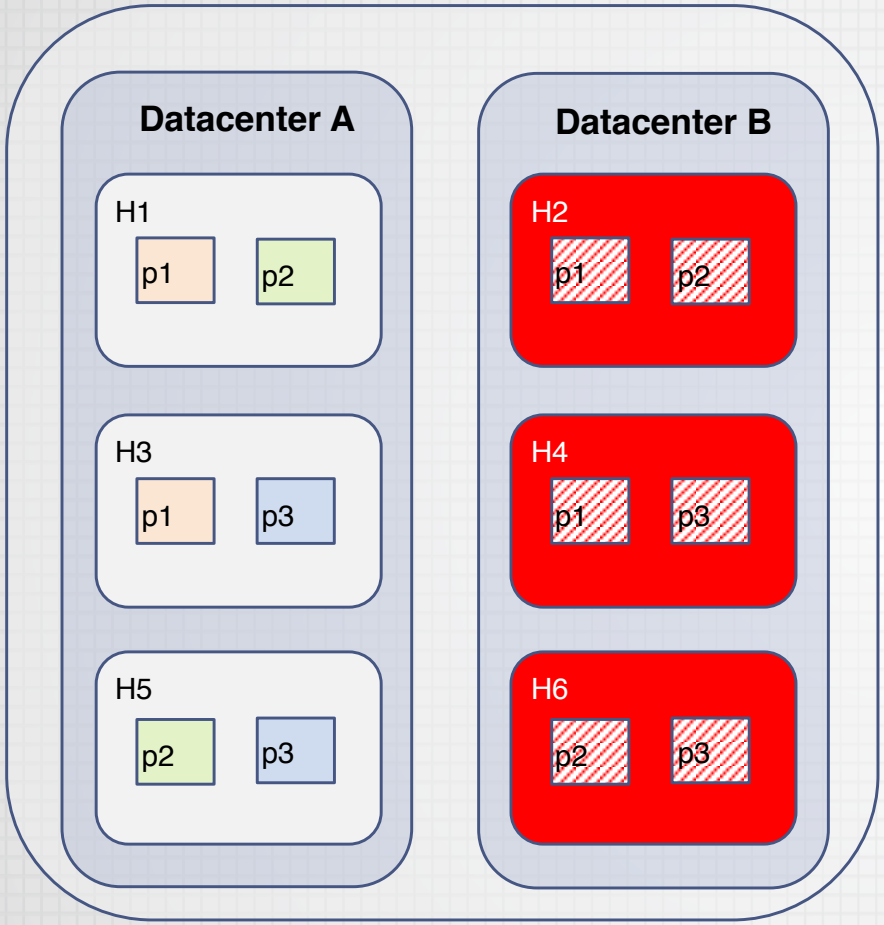
- 1/year depending where hosts are (e.g. bad hypervisor)
- Processing for some topics will be halted
- Short-term: Add replicas for affected partitions on remaining hosts
- ASAP: Replace bad hosts
- GS Dynamic Compute allows seamless VM replace with no need to re-point dns aliases/change kafka config

What If? Two hosts fail



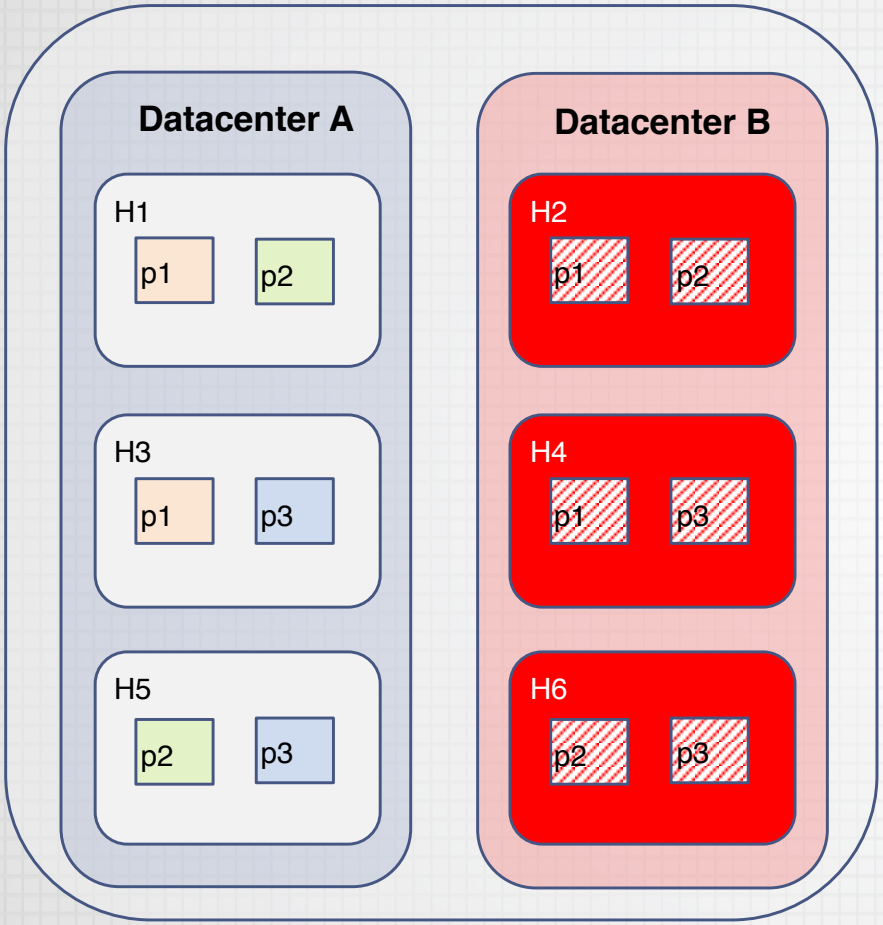
- 1/year depending where hosts are (e.g. bad hypervisor)
- Processing for some topics will be halted
- Short-term: Add replicas for affected partitions on remaining hosts
- ASAP: Replace bad hosts
- GS Dynamic Compute allows seamless VM replace with no need to re-point dns aliases/change kafka config

What If? Three hosts fail



- 1 / few years
- Cluster processing halted as cannot satisfy in-sync replica requirements
- Proceed with immediate host replacement

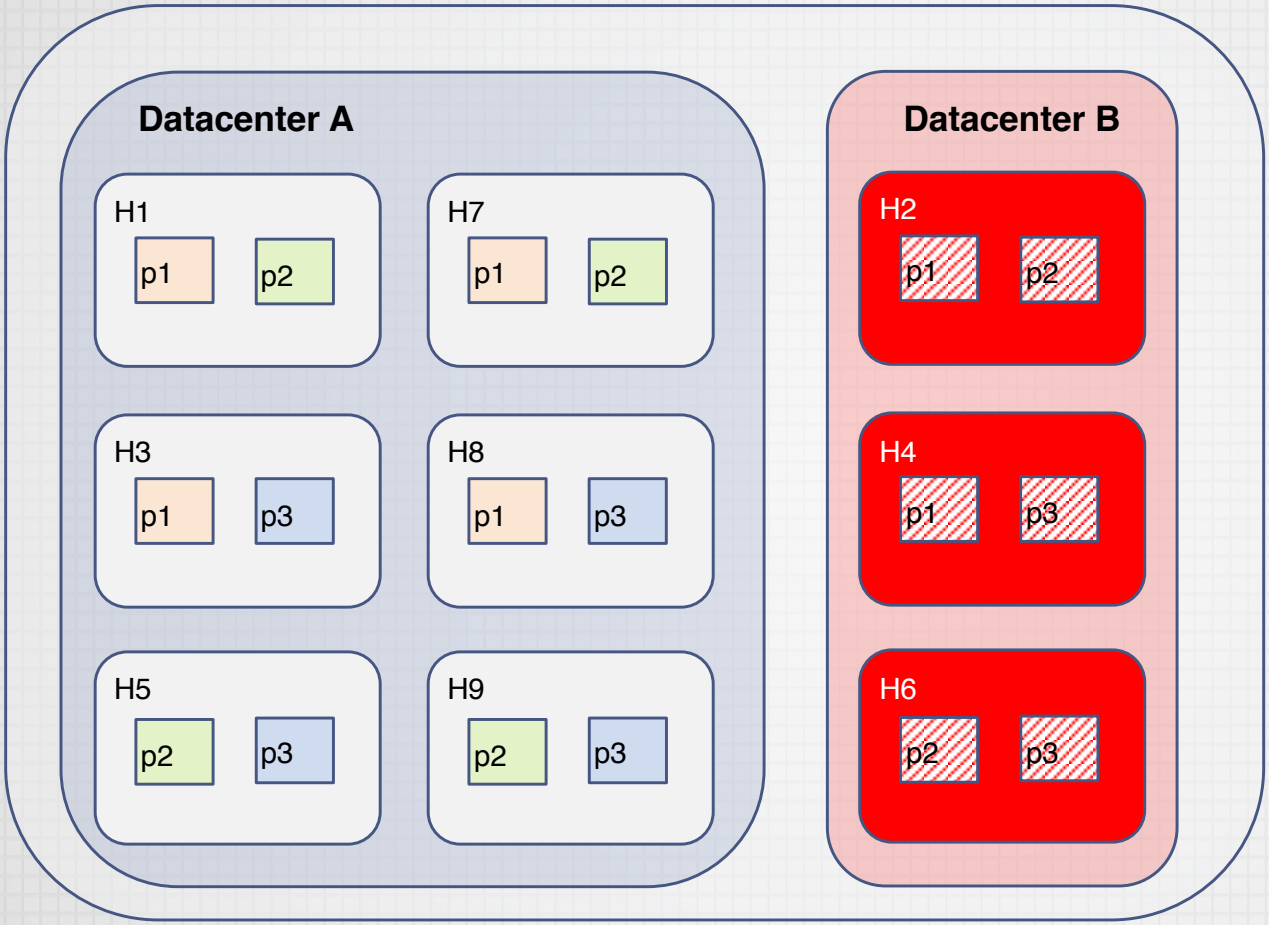
What If? Datacenter Failed / Network Partition



- Once a 20-year event
- Short-term strategy: add additional machines in Datacenter A
- Largest impact on recovery time is how long to get new hosts provisioned

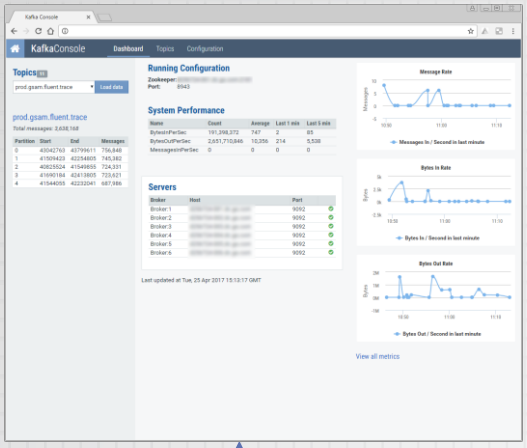
What If? Datacenter Failed / Network Partition

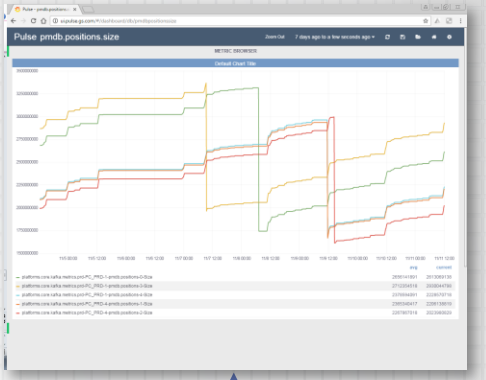
After adding additional hosts



- Short-term strategy: add additional machines in Datacenter A
- Largest impact on recovery time is how long to get new hosts provisioned
- Stand-by Hosts?

TOOLING OVERVIEW





Kafka Broker

Zookeeper

REST Service

Metrics Capture

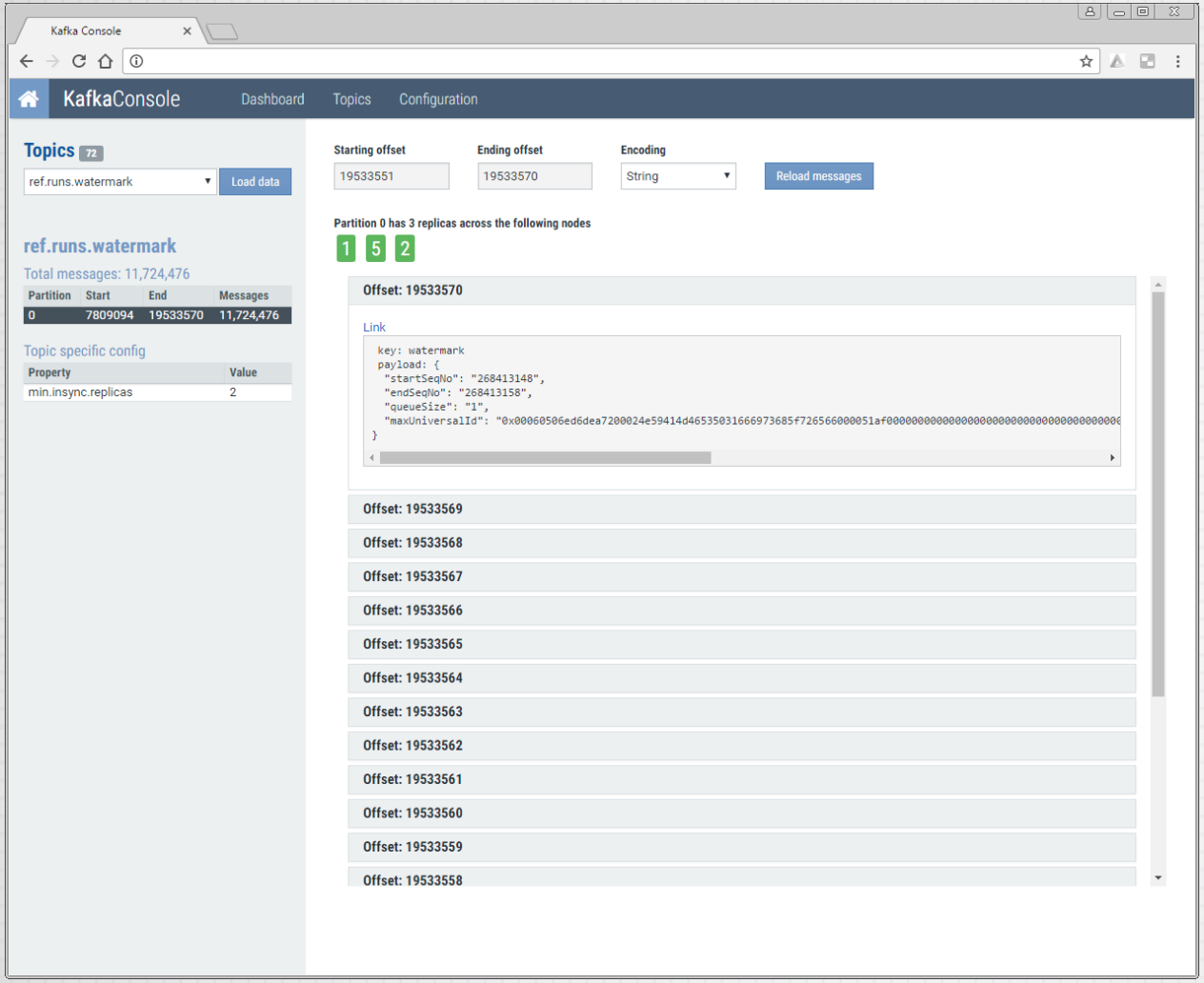
Time-Series DB

GS CENTRALIZED ALERTING INFRASTRUCTURE

Phone/e-mail/IM alerts to team

Images are shown for illustrative purposes only and should not be relied upon as representative of actual or future information for Goldman Sachs products and services.

TOOLING CLUSTER DASHBOARD



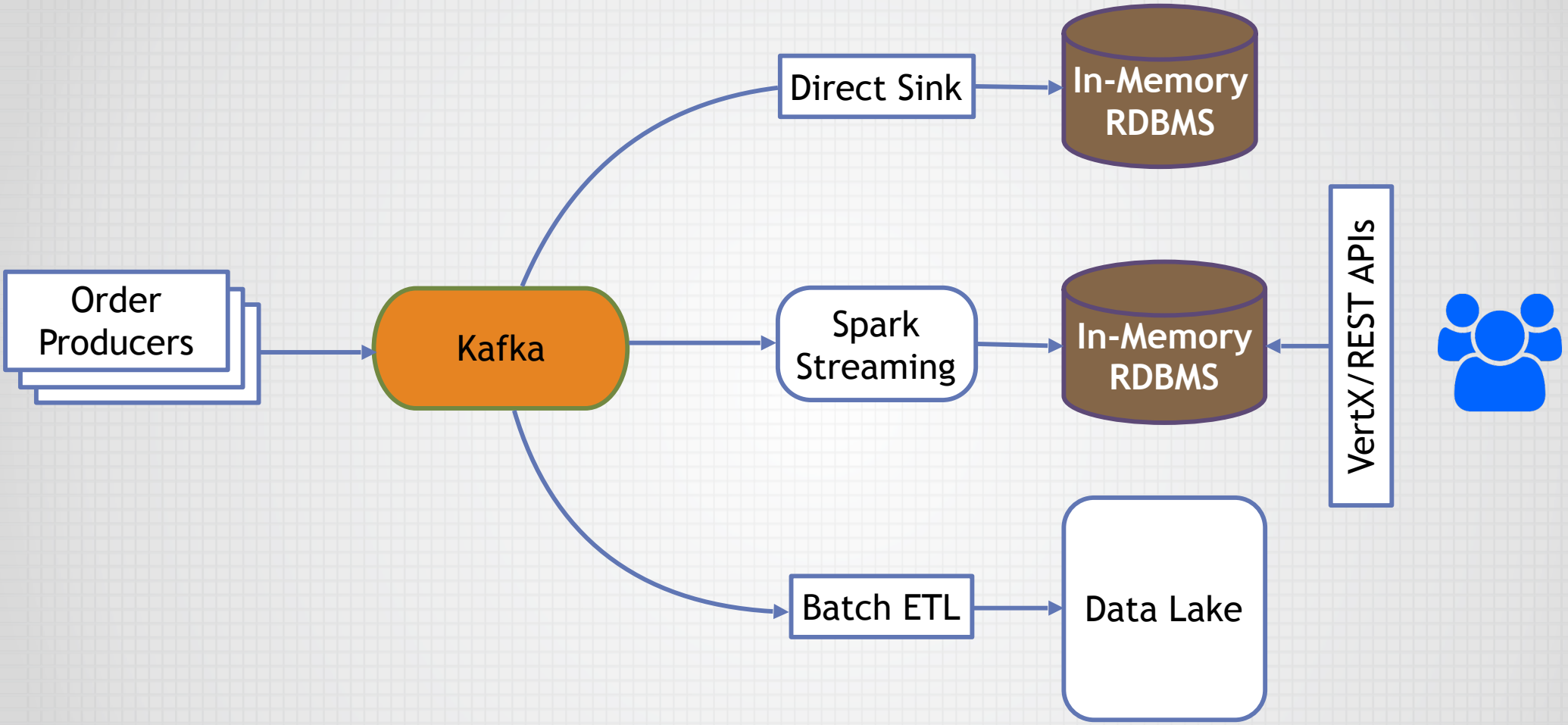
Endpoints include:

- View messages on topic
- Consumer lag
- Leader & ISRs for topic
- Highwatermark for topic
- Run-Time Broker & zookeeper configuration

TOOLING HEALTHCHECK

- Topic sizes monitoring
- Alert when at risk of losing data due to truncation
- If partitions breach threshold, escalate via GS alerting infrastructure

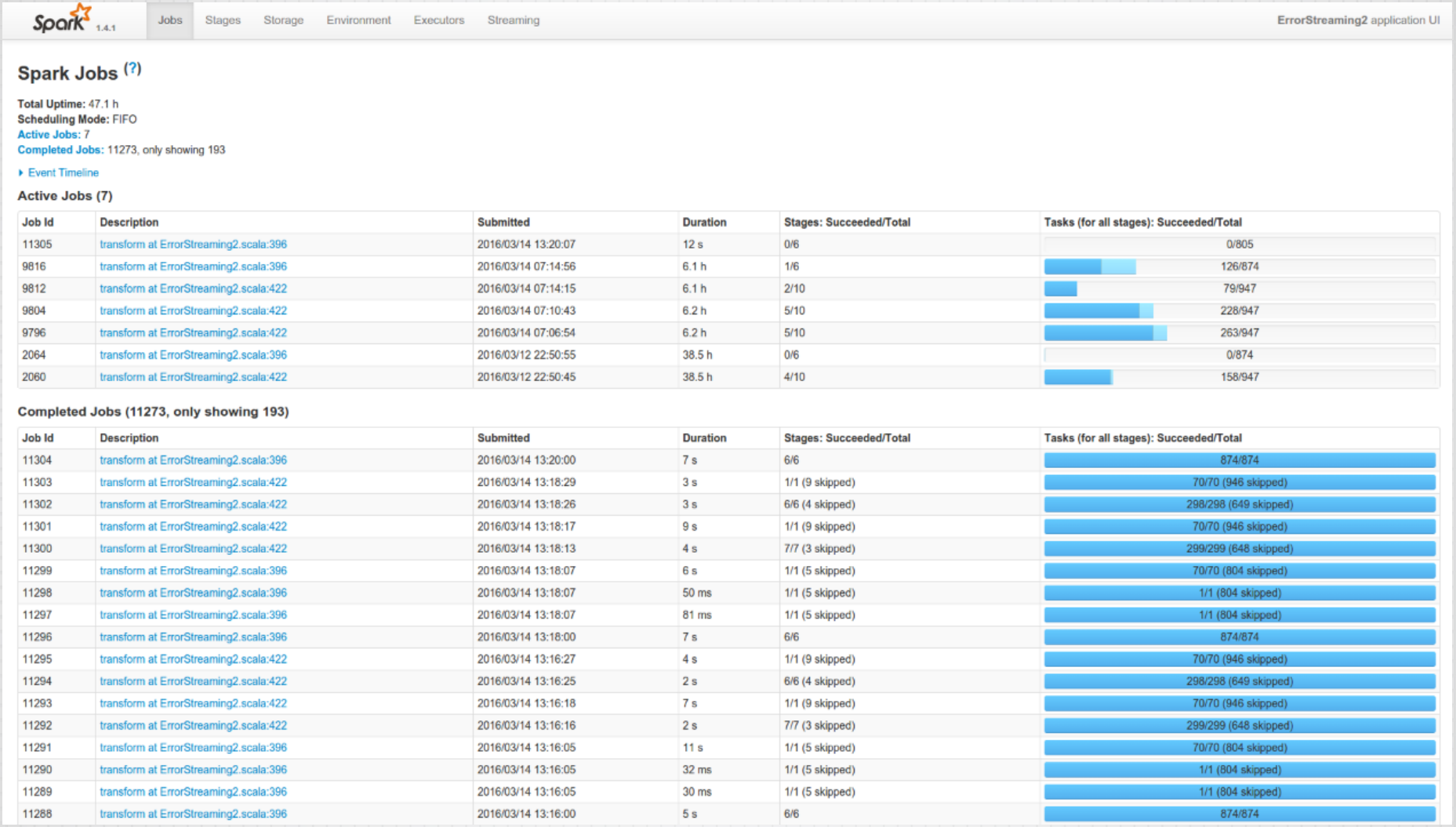
SAMPLE DEPLOYMENT



What If? I need to Replay

- Message Remains on Queue?
- Delivery Semantics
  - == 1
  - =< 1
  - >=1
- Unique ID on everything
- Making Replay Easy
- KIP-98

What If? Spark Streaming Fails



Spark 1.4.1 — Jobs | Stages | Storage | Environment | Executors | Streaming — ErrorStreaming2 application UI

Spark Jobs (?)

Total Uptime: 47.1 h
Scheduling Mode: FIFO
Active Jobs: 7
Completed Jobs: 11273, only showing 193

▸ Event Timeline

Active Jobs (7)

Job Id	Description	Submitted	Duration	Stages: Succeeded/Total	Tasks (for all stages): Succeeded/Total
11305	transform at ErrorStreaming2.scala:396	2016/03/14 13:20:07	12 s	0/6	0/805
9816	transform at ErrorStreaming2.scala:396	2016/03/14 07:14:56	6.1 h	1/6	126/874
9812	transform at ErrorStreaming2.scala:422	2016/03/14 07:14:15	6.1 h	2/10	79/947
9804	transform at ErrorStreaming2.scala:422	2016/03/14 07:10:43	6.2 h	5/10	228/947
9796	transform at ErrorStreaming2.scala:422	2016/03/14 07:06:54	6.2 h	5/10	263/947
2064	transform at ErrorStreaming2.scala:396	2016/03/12 22:50:55	38.5 h	0/6	0/874
2060	transform at ErrorStreaming2.scala:422	2016/03/12 22:50:45	38.5 h	4/10	158/947

Completed Jobs (11273, only showing 193)

Job Id	Description	Submitted	Duration	Stages: Succeeded/Total	Tasks (for all stages): Succeeded/Total
11304	transform at ErrorStreaming2.scala:396	2016/03/14 13:20:00	7 s	6/6	874/874
11303	transform at ErrorStreaming2.scala:422	2016/03/14 13:18:29	3 s	1/1 (9 skipped)	70/70 (946 skipped)
11302	transform at ErrorStreaming2.scala:422	2016/03/14 13:18:26	3 s	6/6 (4 skipped)	298/298 (649 skipped)
11301	transform at ErrorStreaming2.scala:422	2016/03/14 13:18:17	9 s	1/1 (9 skipped)	70/70 (946 skipped)
11300	transform at ErrorStreaming2.scala:422	2016/03/14 13:18:13	4 s	7/7 (3 skipped)	299/299 (648 skipped)
11299	transform at ErrorStreaming2.scala:396	2016/03/14 13:18:07	6 s	1/1 (5 skipped)	70/70 (804 skipped)
11298	transform at ErrorStreaming2.scala:396	2016/03/14 13:18:07	50 ms	1/1 (5 skipped)	1/1 (804 skipped)
11297	transform at ErrorStreaming2.scala:396	2016/03/14 13:18:07	81 ms	1/1 (5 skipped)	1/1 (804 skipped)
11296	transform at ErrorStreaming2.scala:396	2016/03/14 13:18:00	7 s	6/6	874/874
11295	transform at ErrorStreaming2.scala:422	2016/03/14 13:16:27	4 s	1/1 (9 skipped)	70/70 (946 skipped)
11294	transform at ErrorStreaming2.scala:422	2016/03/14 13:16:25	2 s	6/6 (4 skipped)	298/298 (649 skipped)
11293	transform at ErrorStreaming2.scala:422	2016/03/14 13:16:18	7 s	1/1 (9 skipped)	70/70 (946 skipped)
11292	transform at ErrorStreaming2.scala:422	2016/03/14 13:16:16	2 s	7/7 (3 skipped)	299/299 (648 skipped)
11291	transform at ErrorStreaming2.scala:396	2016/03/14 13:16:05	11 s	1/1 (5 skipped)	70/70 (804 skipped)
11290	transform at ErrorStreaming2.scala:396	2016/03/14 13:16:05	32 ms	1/1 (5 skipped)	1/1 (804 skipped)
11289	transform at ErrorStreaming2.scala:396	2016/03/14 13:16:05	30 ms	1/1 (5 skipped)	1/1 (804 skipped)
11288	transform at ErrorStreaming2.scala:396	2016/03/14 13:16:00	5 s	6/6	874/874

SUMMARY

- Failure will occur
- Belt & Suspenders for everything
- Ultimate Throughput vs Ultimate Reliability
- Kafka has many Knobs, perhaps too many, hide some
- Resilience through Transparency

Q&A

text time…