



# Getting Started with Amazon Redshift

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May 4th 2016



# Agenda

- Introduction
- Benefits
- Use cases
- Getting started
- Q&A

# AWS big data portfolio

## Collect



AWS Direct Connect



AWS Import/Export



Amazon Kinesis Streams



Amazon Kinesis Firehose



AWS Database Migration Service

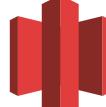
## Store



Amazon S3



Amazon RDS,  
Amazon Aurora



Amazon  
Glacier



Amazon  
DynamoDB



Amazon  
CloudSearch



Amazon  
Elasticsearch  
Service



AWS Data Pipeline

## Analyze



Amazon EMR



Amazon EC2



Amazon  
Redshift



Amazon  
Machine  
Learning



Amazon  
QuickSight



Amazon  
Redshift

Relational data warehouse

Massively parallel; petabyte scale

Fully managed

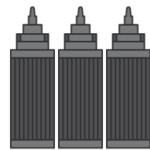
HDD and SSD platforms

\$1,000/TB/year; starts at \$0.25/hour

*a lot faster  
a lot simpler  
a lot cheaper*



# The Amazon Redshift view of data warehousing



## Enterprise

10x cheaper

Easy to provision

Higher DBA productivity



## Big data

10x faster

No programming

Easily leverage BI tools,  
Hadoop, machine learning,  
streaming



## SaaS

Analysis inline with process flows

Pay as you go, grow as you need

Managed availability and disaster recovery

# Forrester Wave™ Enterprise Data Warehouse Q4 '15

FIGURE 2 The Forrester Wave™: Enterprise Data Warehouse, Q4 '15



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# Selected Amazon Redshift customers



BEACHMINT.



NOKIA

foursquare®

Pinterest

FT.com  
FINANCIAL TIMES

sling®



latentview

Actionable Insights • Accurate Decisions

NTT docomo

NASDAQ OMX

FINRA

amazon

etix

scopely

has offers™

imshealth™  
INTELLIGENCE APPLIED.

euclid

SOUNDCLLOUD

4f

Sansan

Schumachergroup

Albert  
Optimization technology

spūul

peak  
GAMES

BookmyShow

vivaki

DataXU

MINICLIP

Z

UMUC

University of Maryland University College

# Amazon Redshift architecture

## Leader node

- Simple SQL endpoint
- Stores metadata
- Optimizes query plan
- Coordinates query execution

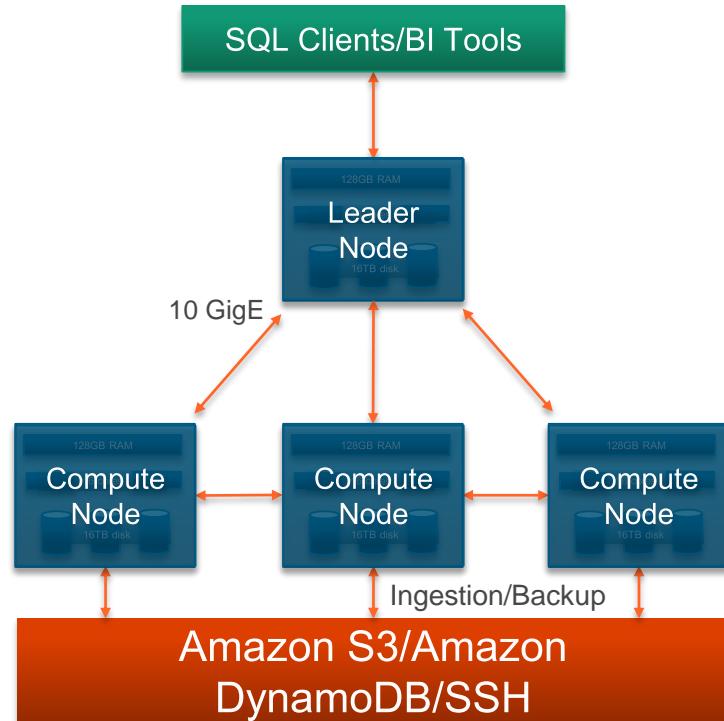
## Compute nodes

- Local columnar storage
- Parallel/distributed execution of all queries, loads, backups, restores, resizes

**Start at just \$0.25/hour, grow to 2 PB (compressed)**

DC1: SSD; scale from 160 GB to 326 TB

DS2: HDD; scale from 2 TB to 2 PB



# Benefit #1: Amazon Redshift is fast

## Dramatically less I/O

Column storage

Data compression

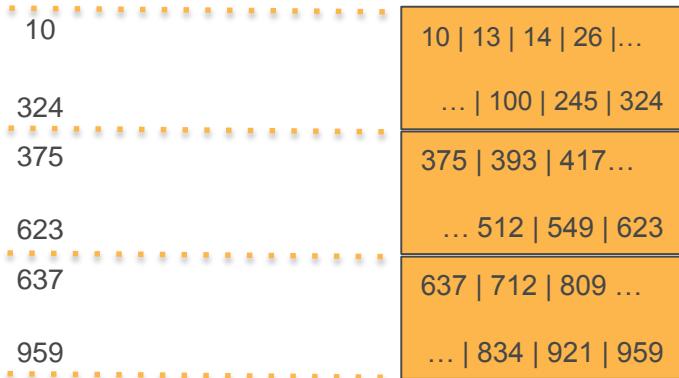
Zone maps

Direct-attached storage

Large data block sizes

```
analyze compression listing;
```

Table	Column	Encoding
listing	listid	delta
listing	sellerid	delta32k
listing	eventid	delta32k
listing	dateid	bytedict
listing	numtickets	bytedict
listing	priceticket	delta32k
listing	totalprice	mostly32
listing	listtime	raw



# Benefit #1: Amazon Redshift is fast

Parallel and distributed

Query

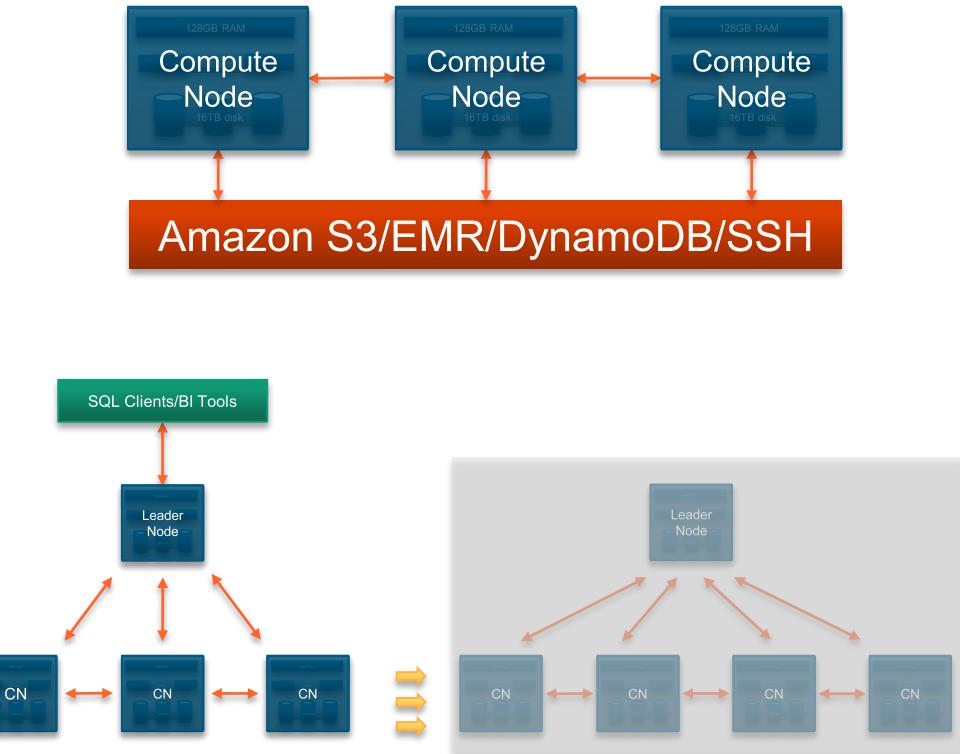
Load

Export

Backup

Restore

Resize



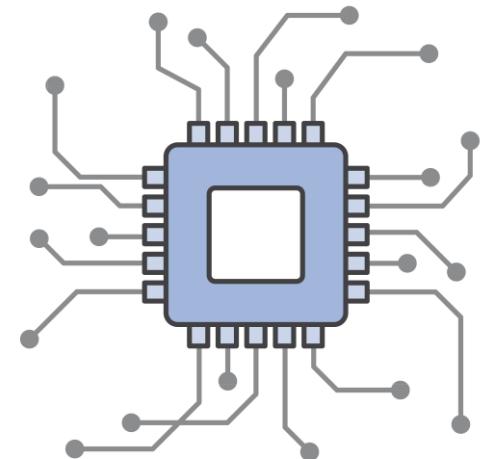
# Benefit #1: Amazon Redshift is fast

Hardware optimized for I/O intensive workloads, 4 GB/sec/node

Enhanced networking, over 1 million packets/sec/node

Choice of storage type, instance size

Regular cadence of autopatched improvements



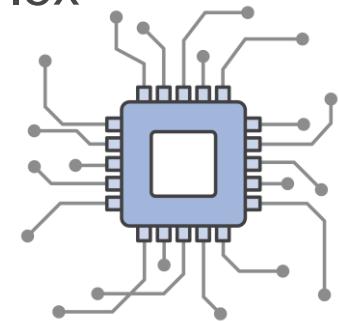
# Benefit #1: Amazon Redshift is fast

New Dense Storage (HDD) instance type

Improved memory 2x, compute 2x, disk throughput 1.5x

Cost: Same as our prior generation!

Performance improvement: 50%



Enhanced I/O and commit improvements (Jan '16)

Reduce amount of time to commit data

Performance improvement: 35%

# Benefit #2: Amazon Redshift is inexpensive

Ds2 (HDD)	Price per hour for DW1.XL single node	Effective annual price per TB compressed
On-demand	\$ 0.850	\$ 3,725
1 year reservation	\$ 0.500	\$ 2,190
3 year reservation	\$ 0.228	\$ 999

Dc1 (SSD)	Price per hour for DW2.L single node	Effective annual price per TB compressed
On-demand	\$ 0.250	\$ 13,690
1 year reservation	\$ 0.161	\$ 8,795
3 year reservation	\$ 0.100	\$ 5,500

Pricing is simple

Number of nodes x price/hour

No charge for leader node

No upfront costs

Pay as you go

# Benefit #3: Amazon Redshift is fully managed

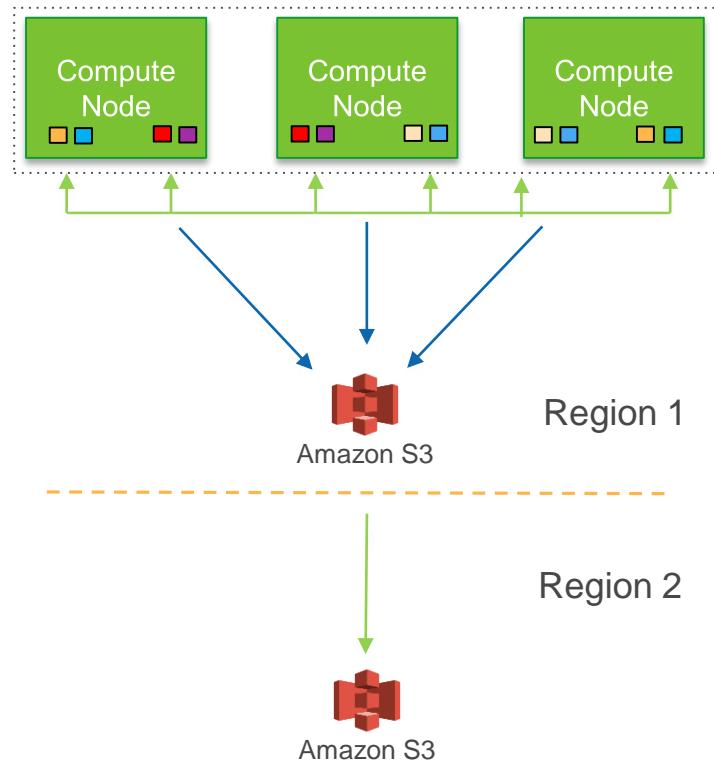
## Continuous/incremental backups

Multiple copies within cluster

Continuous and incremental backups to Amazon S3

Continuous and incremental backups across regions

Streaming restore



# Benefit #3: Amazon Redshift is fully managed

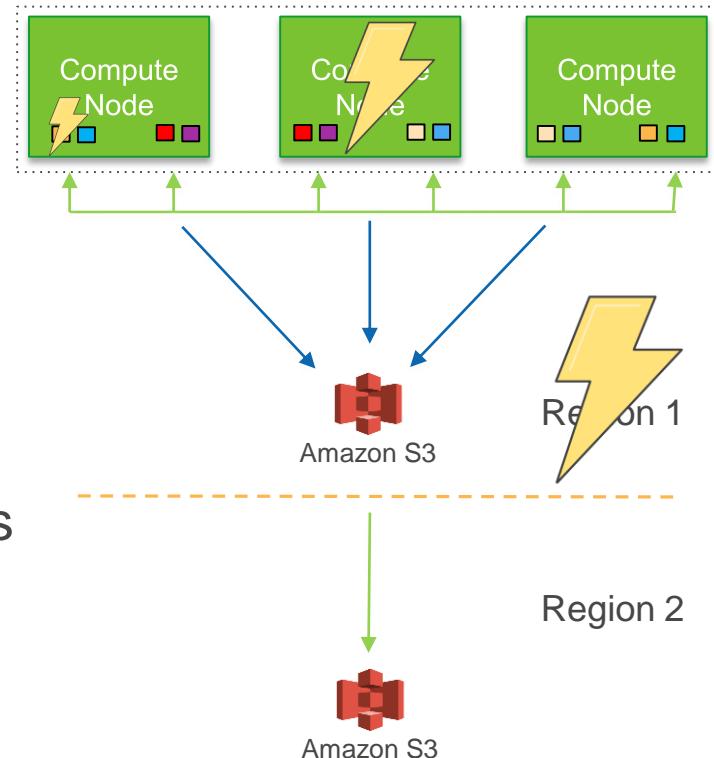
## Fault tolerance

Disk failures

Node failures

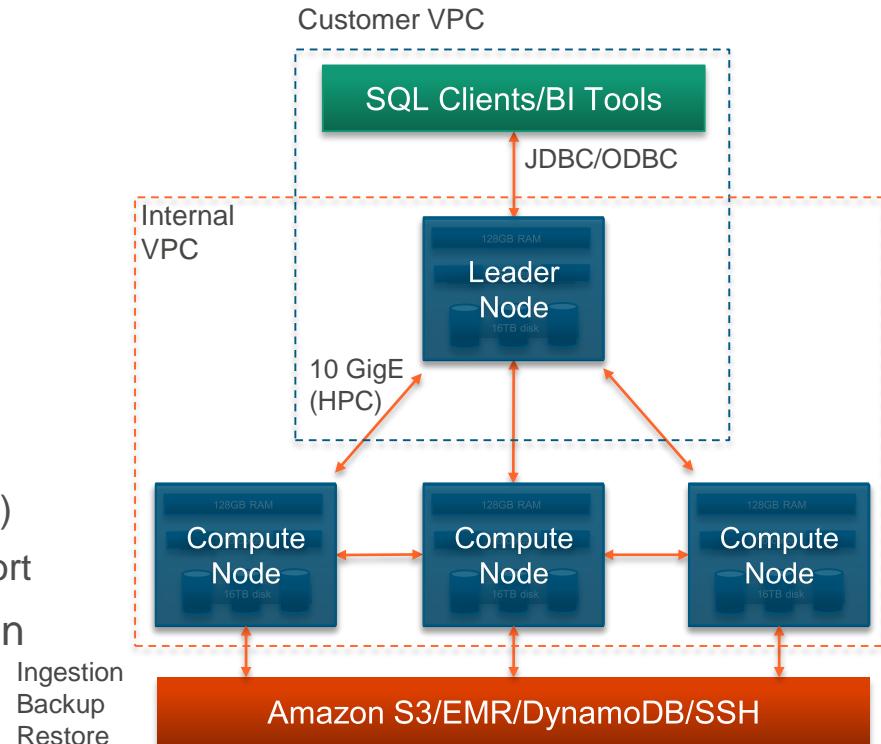
Network failures

Availability Zone/region level disasters



# Benefit #4: Security is built-in

- Load encrypted from S3
- SSL to secure data in transit
  - ECDHE perfect forward security
- Amazon VPC for network isolation
- Encryption to secure data at rest
  - All blocks on disks and in S3 encrypted
  - Block key, cluster key, master key (AES-256)
  - On-premises HSM & AWS CloudHSM support
- Audit logging and AWS CloudTrail integration
- SOC 1/2/3, PCI-DSS, FedRAMP, BAA

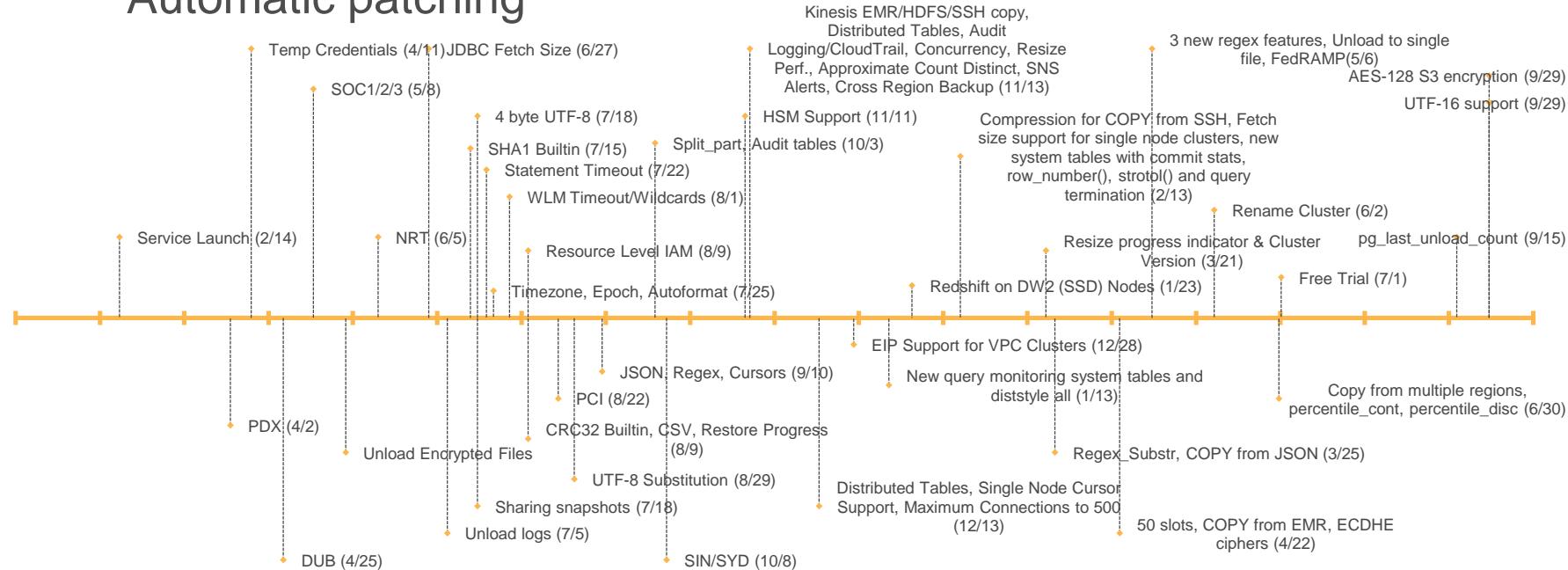


# Benefit #5: We innovate quickly

Well over 100 new features added since launch

Release every two weeks

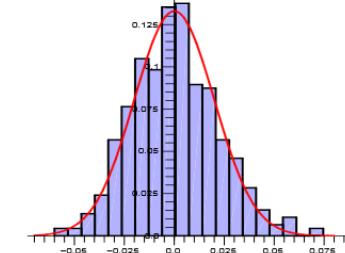
Automatic patching



# Benefit #6: Amazon Redshift is powerful

- Approximate functions
- User defined functions
- Machine learning
- Data science

*HyperLogLog: analysis of a near-optimal cardinality algorithm*



# Benefit #7: Amazon Redshift has a large ecosystem

## Data integration



## Business intelligence



## Systems integrators



# Benefit #8: Service oriented architecture



RDS/Aurora



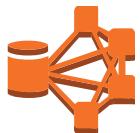
EC2/SSH



DynamoDB



Amazon ML



EMR



Amazon  
Redshift



CloudSearch



Data Pipeline



S3



Amazon Kinesis



Amazon  
Mobile  
Analytics

# Use cases

# NTT Docomo: Japan's largest mobile service provider

68 million customers

Tens of TBs per day of data across a mobile network

6 PB of total data (uncompressed)

Data science for marketing operations, logistics, and so on

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Greenplum on-premises



Scaling challenges

Performance issues

Need same level of security

Need for a hybrid environment

# Nasdaq: powering 100 marketplaces in 50 countries



Orders, quotes, trade executions,  
market “tick” data from 7 exchanges

7 billion rows/day

Analyze market share, client activity,  
surveillance, billing, and so on

---

Microsoft SQL Server on-premises

Expensive legacy DW  
(\$1.16 M/yr.)

Limited capacity (1 yr. of data  
online)

Needed lower TCO

Must satisfy multiple security  
and regulatory requirements  
Similar performance

# Getting started

# Provisioning

# Enter cluster details

CLUSTER DETAILS   NODE CONFIGURATION   ADDITIONAL CONFIGURATION   REVIEW

Provide the details of your cluster. Fields marked with \* are required.

Cluster Identifier\*

ptest

This is the unique key that identifies a cluster.  
This parameter is stored as a lowercase string.  
(e.g. my-dw-instance)

Database Name

webinardb

Optional. A default database named dev is created for the cluster. Optionally, specify a custom database name (e.g. mydb) to create an additional database.

Database Port\*

5439

Port number on which the database accepts connections.

Master User Name\*

pavanpo

Name of master user for your cluster. (e.g. awsuser)

Master User Password\*

\*\*\*\*\*

Password must contain 8 to 64 printable ASCII characters excluding: /, ", ', \, and @. It must contain 1 uppercase letter, 1 lowercase letter, and 1 number.

Confirm Password\*

\*\*\*\*\*

Confirm Master User Password.

Cancel

Continue

# Select node configuration



Choose a number of nodes and Node Type below. Number of Compute Nodes is required for multi-node clusters.

Node Type

Specifies the compute, memory, storage, and I/O capacity of the cluster's nodes.

CPU 7 EC2 Compute Units (2 virtual cores) per node

Memory 15 GiB per node

Storage 160GB SSD storage per node

I/O Performance Moderate

Cluster Type

Number of Compute Nodes\*

Single Node clusters consist of a single node which performs both leader and compute functions.

Maximum 1

Minimum 1

# Select security settings and provision

Provide the optional additional configuration details below.

Cluster Parameter Group **default.redshift-1.0** ▾ Parameter group to associate with this cluster.

Encrypt Database  None  KMS  HSM [Learn more about database encryption](#)

Master Key **(default) aws/redshift** ▾  

Description Default master key that protects my Redshift clusters when no other key is defined

Account This account (052854472383)

KMS Key ID alias/aws/redshift

Configure Networking Options:

Choose a VPC **vpc-d6f4feb** ▾ The identifier of the VPC in which you want to create your cluster

Cluster Subnet Group **ppdwssubnetgrp** ▾ Selected Cluster Subnet Group may limit the choice of Availability Zones

Publicly Accessible **Yes** ▾ Select Yes if you want the cluster to be accessible from the public internet. Select No if you want it to be accessible only from within your private VPC network

Choose a Public IP Address **No** ▾ Select Yes if you want to select your own public IP address from a list of elastic IP (EIP) addresses that are already configured for your cluster's VPC. Select No if you want Amazon Redshift to provide an EIP for you instead.

Availability Zone **No Preference** ▾ The EC2 Availability Zone that the cluster will be created in.

Optionally, associate your cluster with one or more security groups.

VPC Security Groups **appservers-prodapp1 (sg-467e9129)**  
rds-dbserver-prodapp1 (sg-79cd3c16)  
**quick-start-3 (sg-1e7e9171)**  
quick-start-2 (sg-48a7b824)

List of VPC Security Groups to associate with this cluster.

 Cluster **ppptest** is being created.

Note: Your cluster may take a few minutes to launch.

[View your cluster on the Clusters dashboard.](#)

Optionally, create a basic alarm for this cluster.

Create CloudWatch Alarm  Yes  No Create a CloudWatch alarm to monitor the disk usage of your cluster.

[Cancel](#)

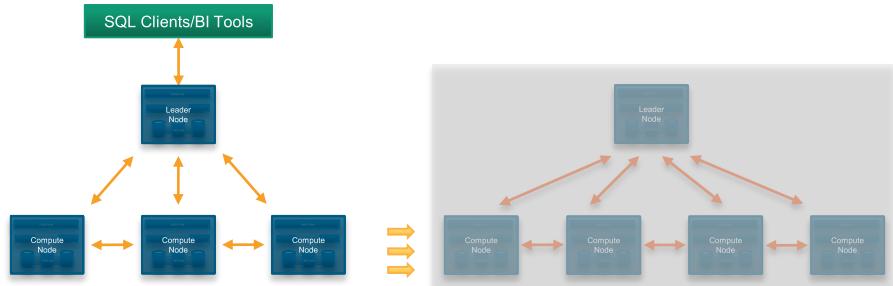
[Previous](#)

[Continue](#)

# Point-and-click resize



# Resize



- Resize while remaining online
- Provision a new cluster in the background
- Copy data in parallel from node to node
- Only charged for source cluster

# Data modeling

# Zone maps

SELECT COUNT(\*) FROM LOGS WHERE DATE = '09-JUNE-2013'

Unsorted table



MIN: 01-JUNE-2013

MAX: 20-JUNE-2013



MIN: 08-JUNE-2013

MAX: 30-JUNE-2013



MIN: 12-JUNE-2013

MAX: 20-JUNE-2013



MIN: 02-JUNE-2013

MAX: 25-JUNE-2013

Sorted by date



MIN: 01-JUNE-2013

MAX: 06-JUNE-2013



MIN: 07-JUNE-2013

MAX: 12-JUNE-2013



MIN: 13-JUNE-2013

MAX: 18-JUNE-2013



MIN: 19-JUNE-2013

MAX: 24-JUNE-2013

# Sort keys

- Single column
- Compound
- Interleaved

# Single column

[ SORTKEY ( date ) ]

Date	Region	Country
2-JUN-2015	Oceania	New Zealand
2-JUN-2015	Asia	Singapore
2-JUN-2015	Africa	Zaire
2-JUN-2015	Asia	Hong Kong
3-JUN-2015	Europe	Germany
3-JUN-2015	Asia	Korea

- Best for:
  - Queries that use first column (that is, *date*) as primary filter
  - Can speed up joins and group bys
  - Quickest to VACUUM

# Compound

- Table is sorted by first column, then second column, and so on
- [ SORTKEY COMPOUND ( date, region, country ) ]

Date	Region	Country
2-JUN-2015	Africa	Zaire
2-JUN-2015	Asia	Korea
2-JUN-2015	Asia	Singapore
2-JUN-2015	Europe	Germany
3-JUN-2015	Asia	Hong Kong
3-JUN-2015	Asia	Korea

- Best for:
  - Queries that use first column as primary filter, then other columns
  - Can speed up joins and group bys
  - Slower to VACUUM

# Interleaved

- Equal weight is given to each column

[ SORTKEY INTERLEAVED ( date, region, country) ]

Date	Region	Country
2-JUN-2015	Africa	Zaire
3-JUN-2015	Asia	Singapore
2-JUN-2015	Asia	Korea
2-JUN-2015	Europe	Germany
3-JUN-2015	Asia	Hong Kong
2-JUN-2015	Asia	Korea

- Best for:
  - Queries that use different columns in filter
  - Queries get faster the more columns used in the filter
  - Slowest to VACUUM

# Distribution

- EVEN
- KEY
- ALL

# Distribution

ID	Gender	Name
101	M	John Smith
292	F	Jane Jones
139	M	Peter Black
446	M	Pat Partridge
658	F	Sarah Cyan
164	M	Brian Snail
209	M	James White
306	F	Lisa Green



ID	Gender	Name
101	M	John Smith
306	F	Lisa Green



ID	Gender	Name
292	F	Jane Jones
209	M	James White



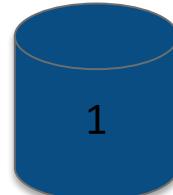
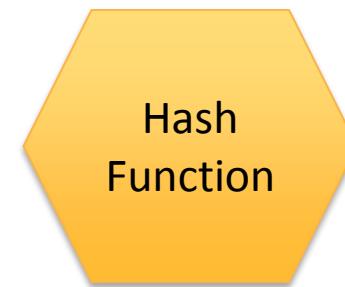
ID	Gender	Name
139	M	Peter Black
164	M	Brian Snail



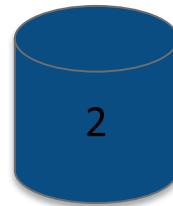
ID	Gender	Name
446	M	Pat Partridge
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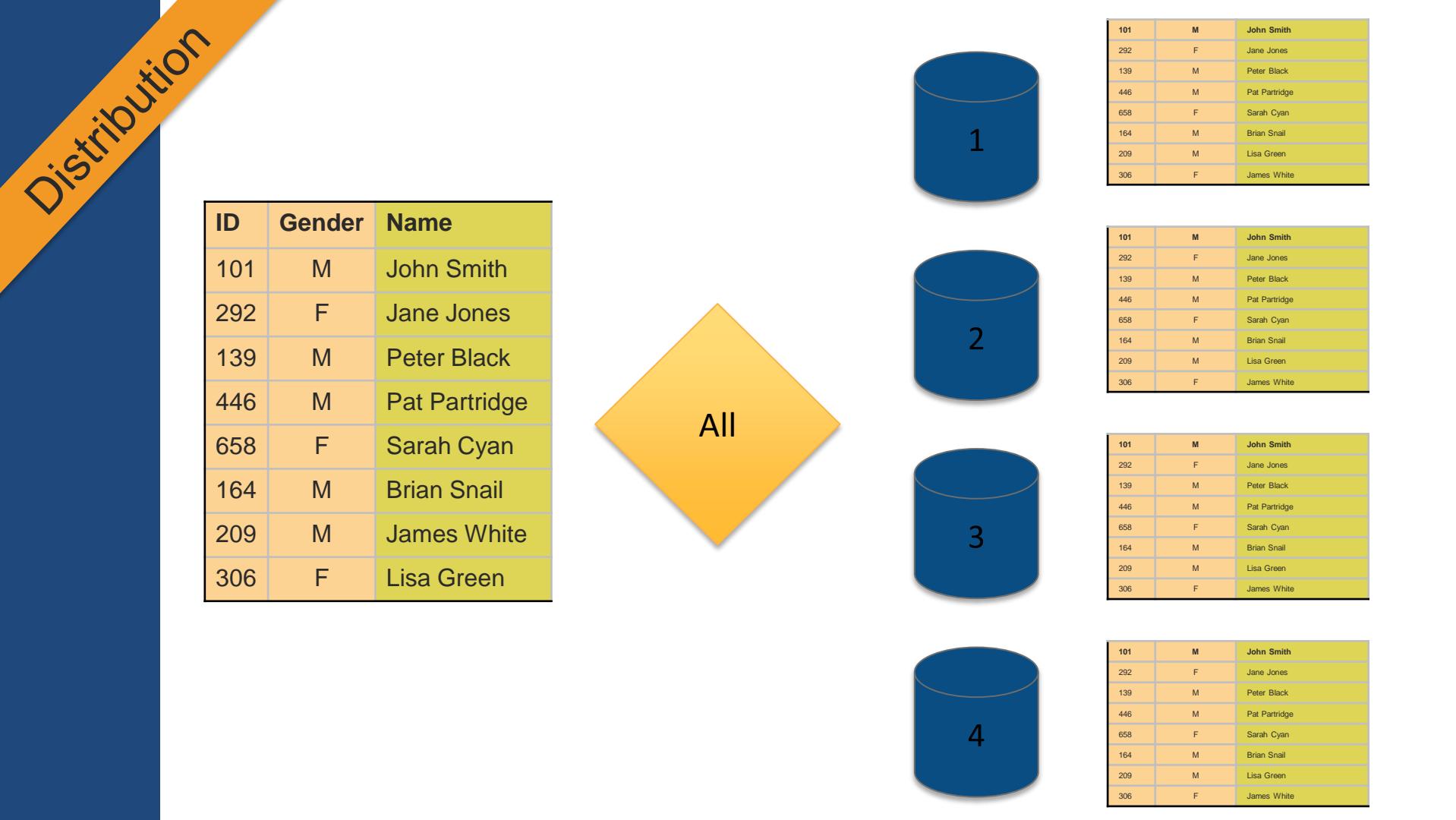


ID	Gender	Name
139	M	Peter Black
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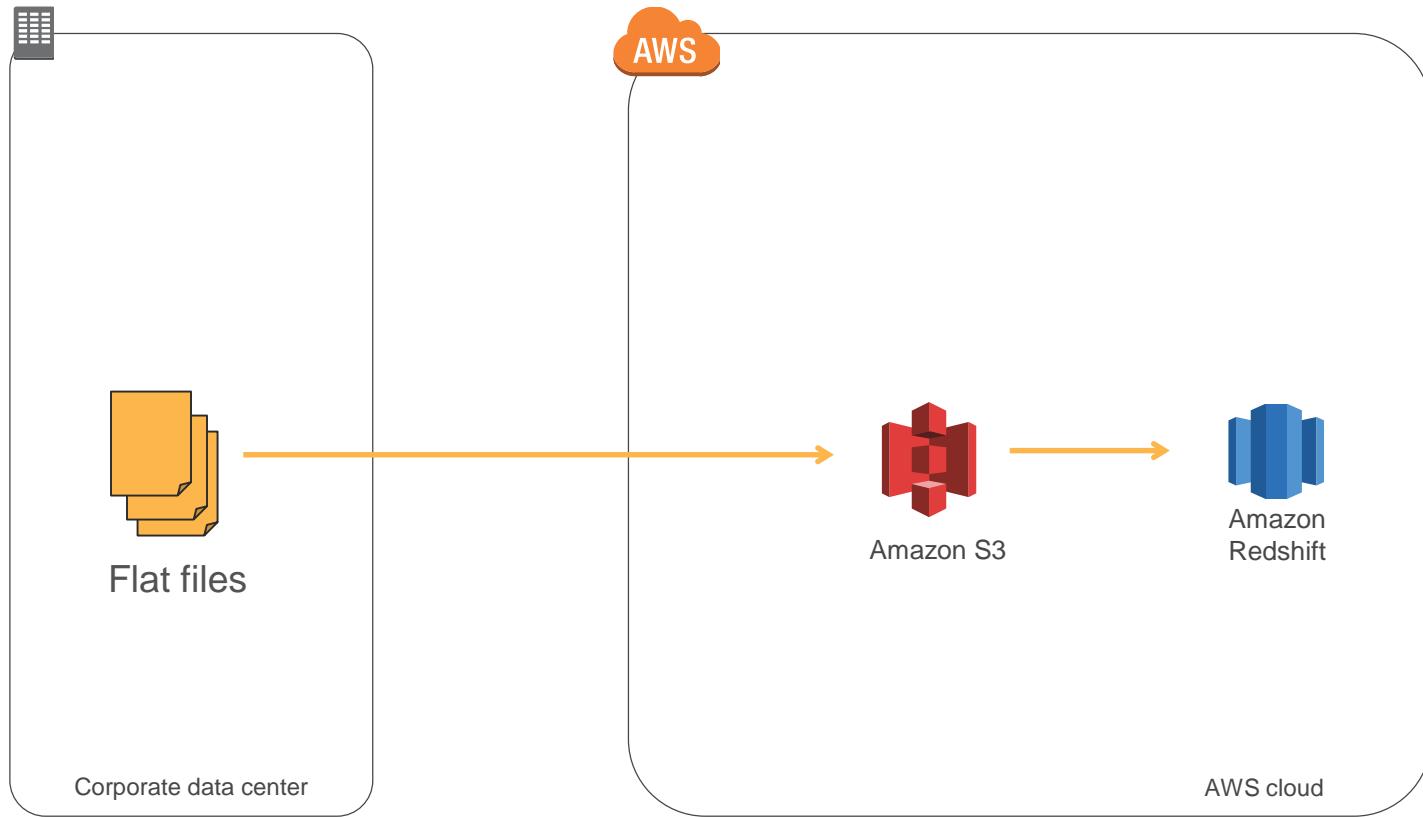


# Distribution

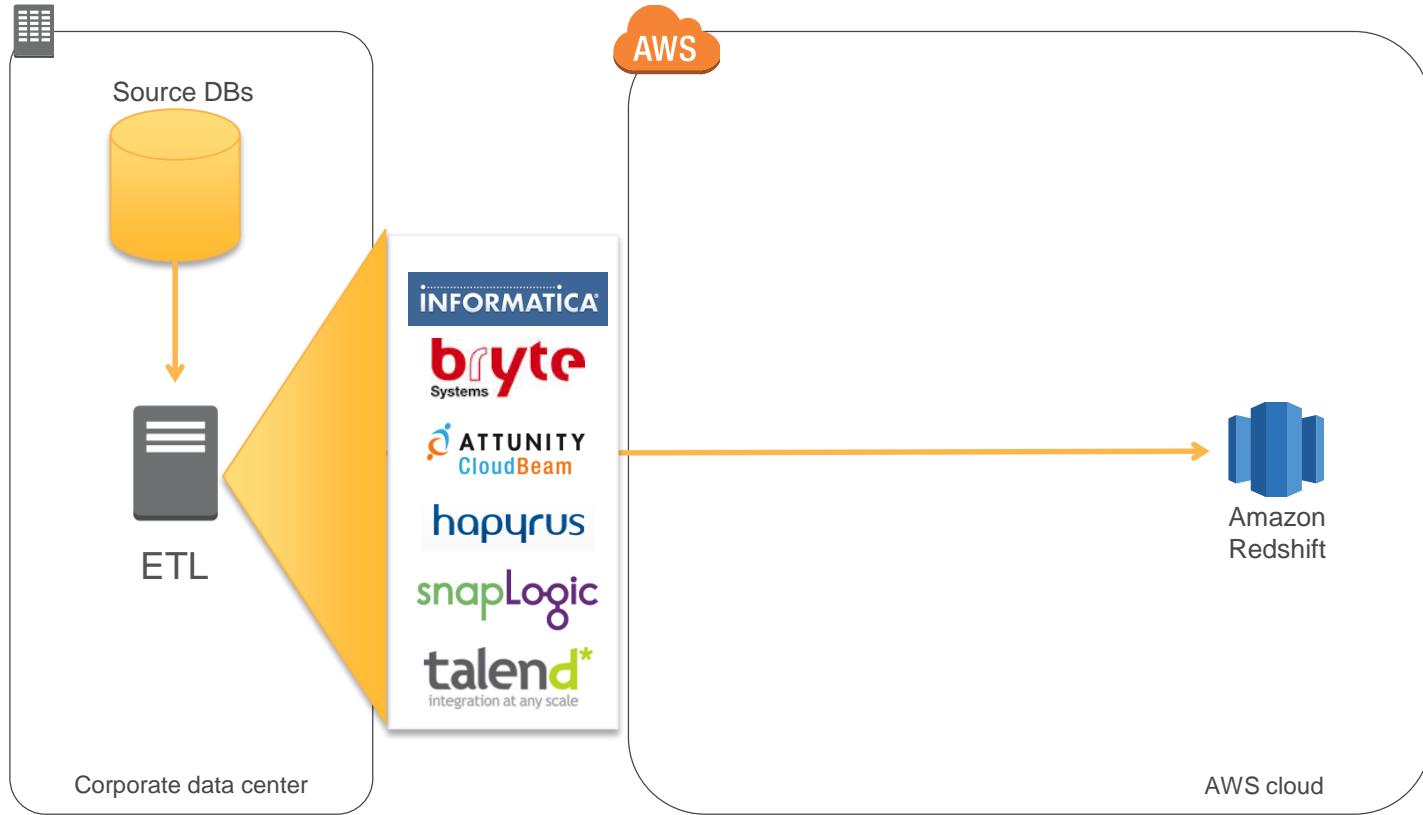
- EVEN
  - Tables with no joins or group bys
  - Small dimension tables (<1000)
- KEY
  - Large fact tables
  - Large dimension tables
- ALL
  - Medium dimension tables (1K–2M)

# Loading data

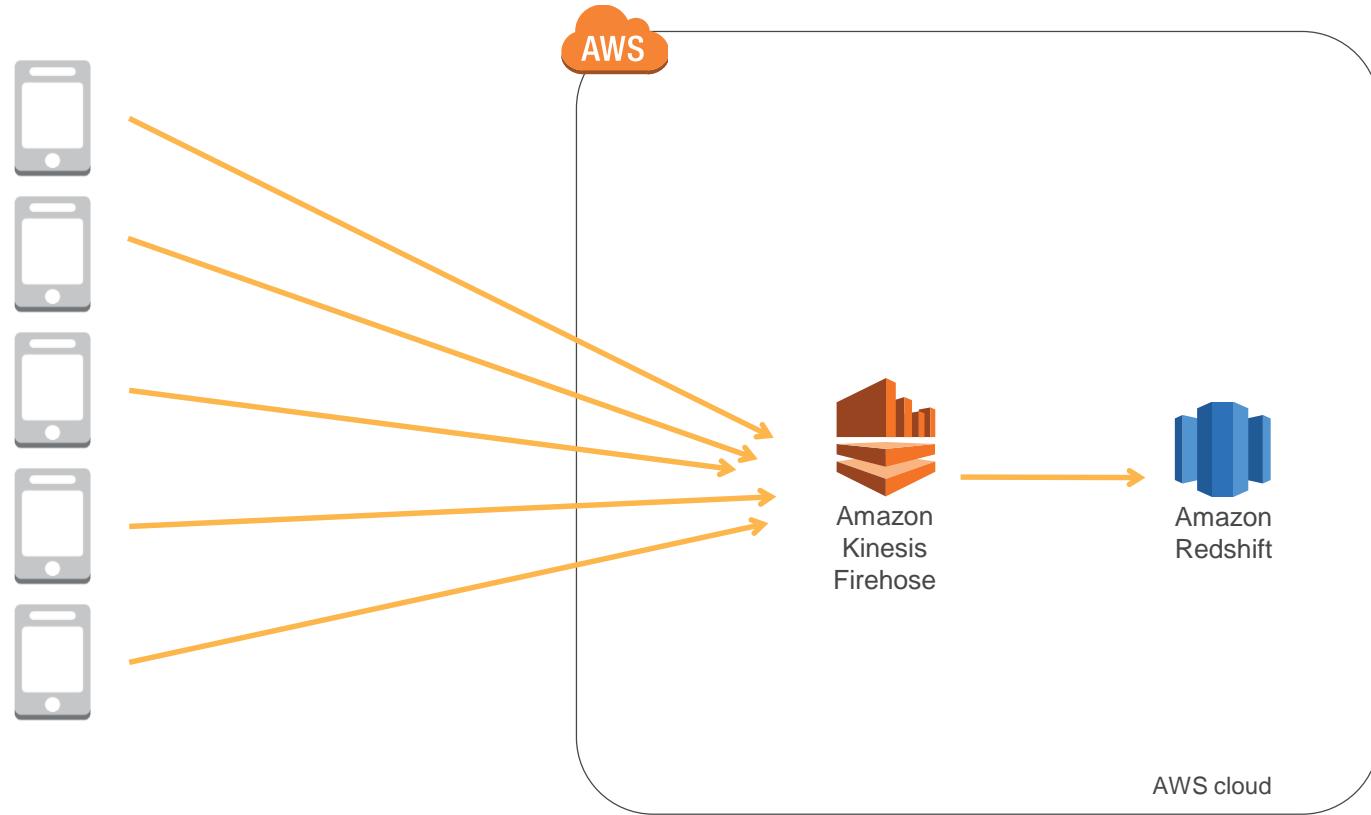
# Data loading options



# Data loading options



# Data loading options



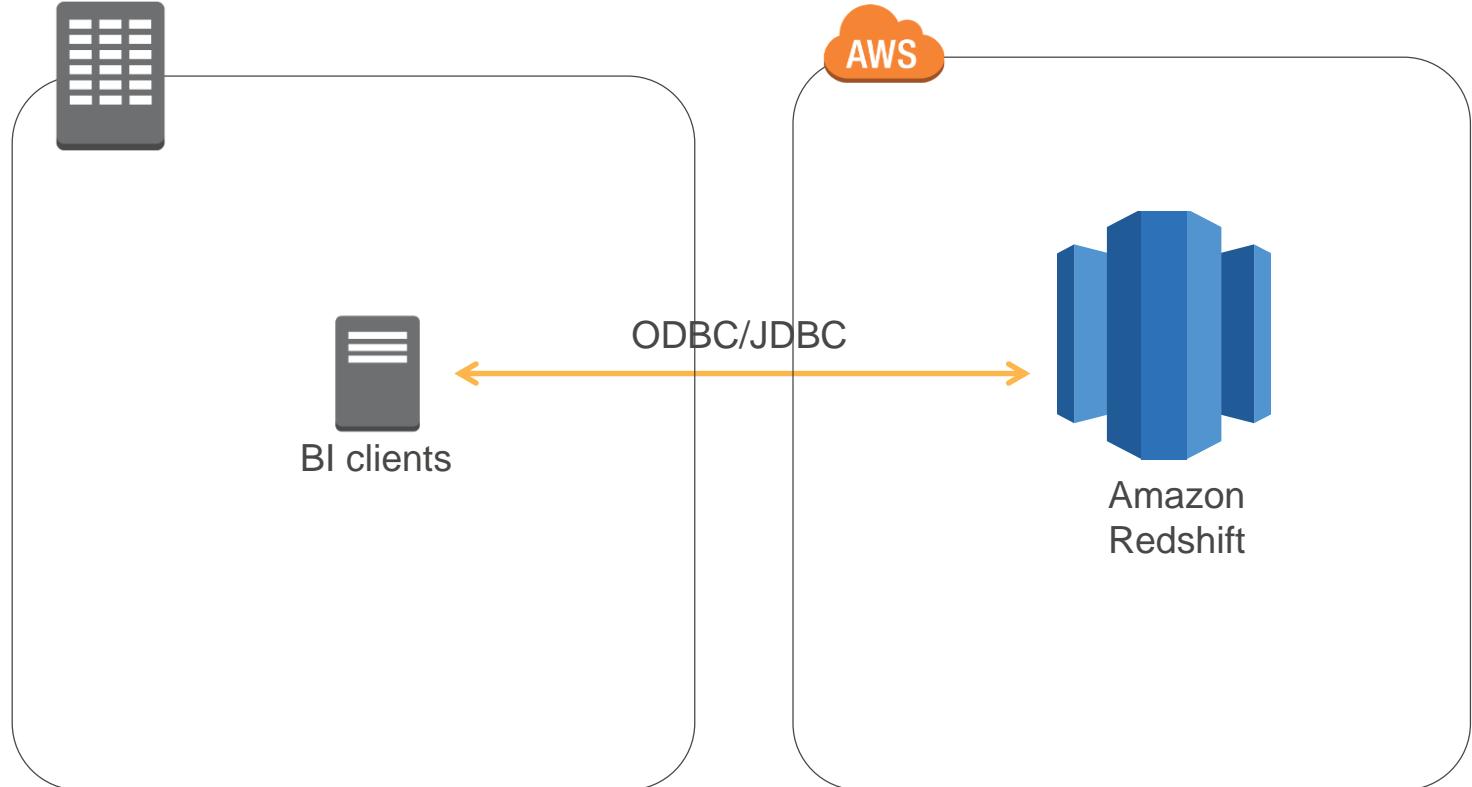
# Querying

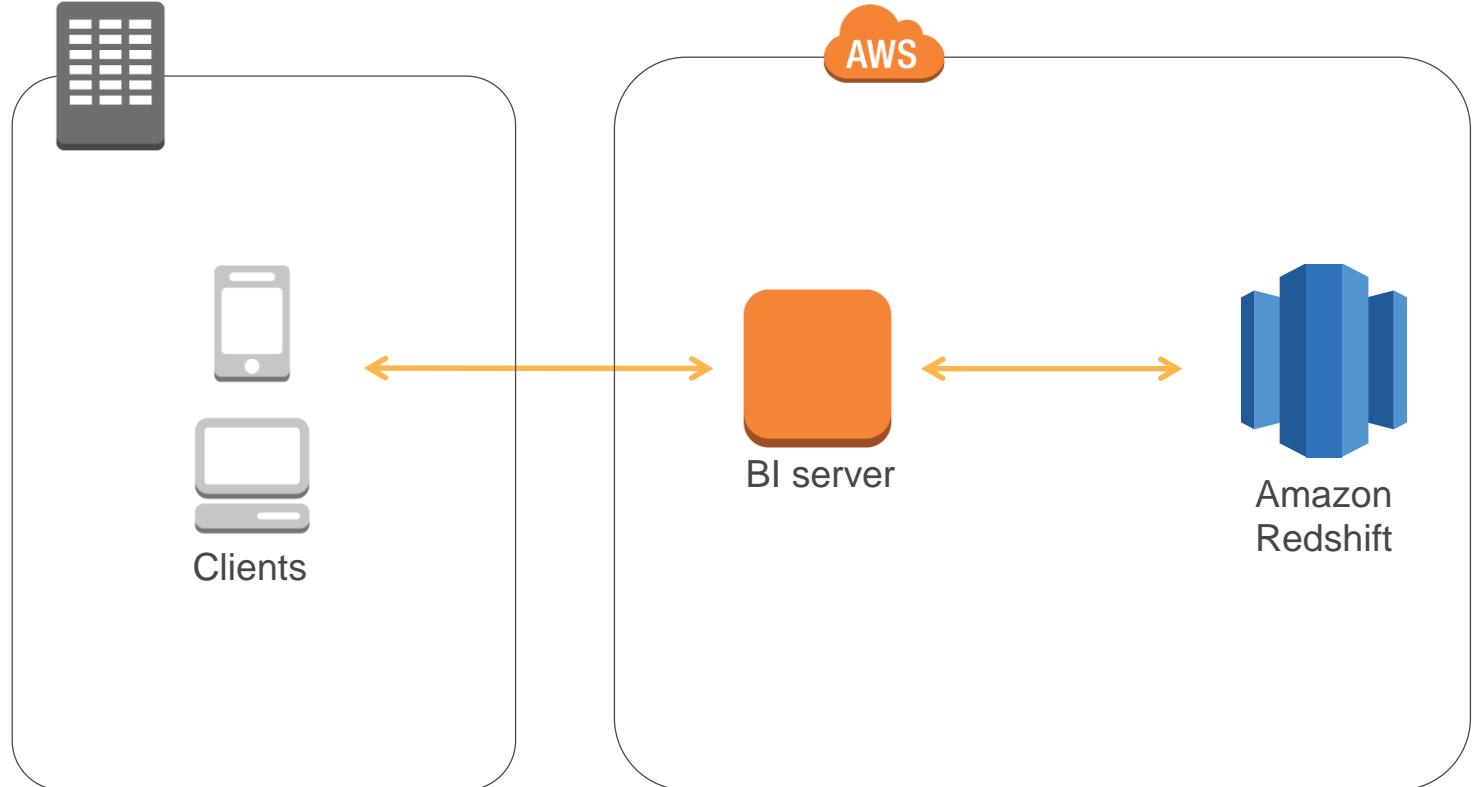
# Amazon Redshift works with your existing analysis tools



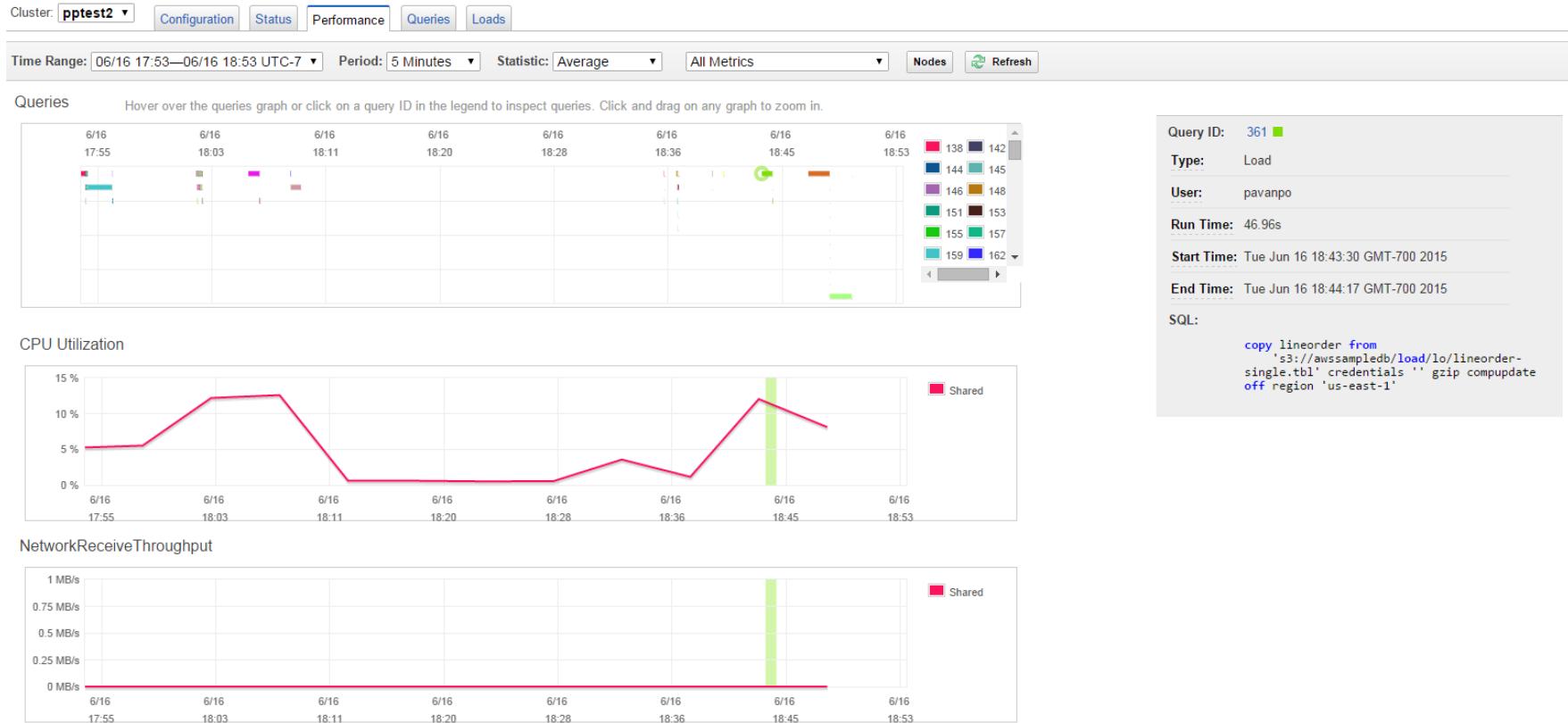
JDBC/ODBC







# Monitor query performance





# Getting started with Redshift

## Experiences from Yle

@AlekRossi  
Aleksi.Rossi@yle.fi

2016-05-04



Marc Andreessen Retweeted



**Kashmir Hill** @kashhill · 6h

State Department official says @KimKardashian gets more retweets in 3 days than ISIS ever has [fusion.net/story/265944/i...](http://fusion.net/story/265944/i...)



45



26

•••

[View summary](#)

Marc Andreessen Retweeted



**Tim Fernholz** @TimFernholz · 2h

The @NewYorker buying Twitter ads to promote its article about how Twitter is dying kind of undercuts the thesis



**The New Yorker**  @NewYorker

Is Twitter in trouble? [nyer.cm/IjuFJgG](http://nyer.cm/IjuFJgG)  
#myTNY



The End of Twitter - The New Yorker

Twitter used to be essential. But now...

[newyorker.com](http://newyorker.com)



30

20

↗ Promoted

373

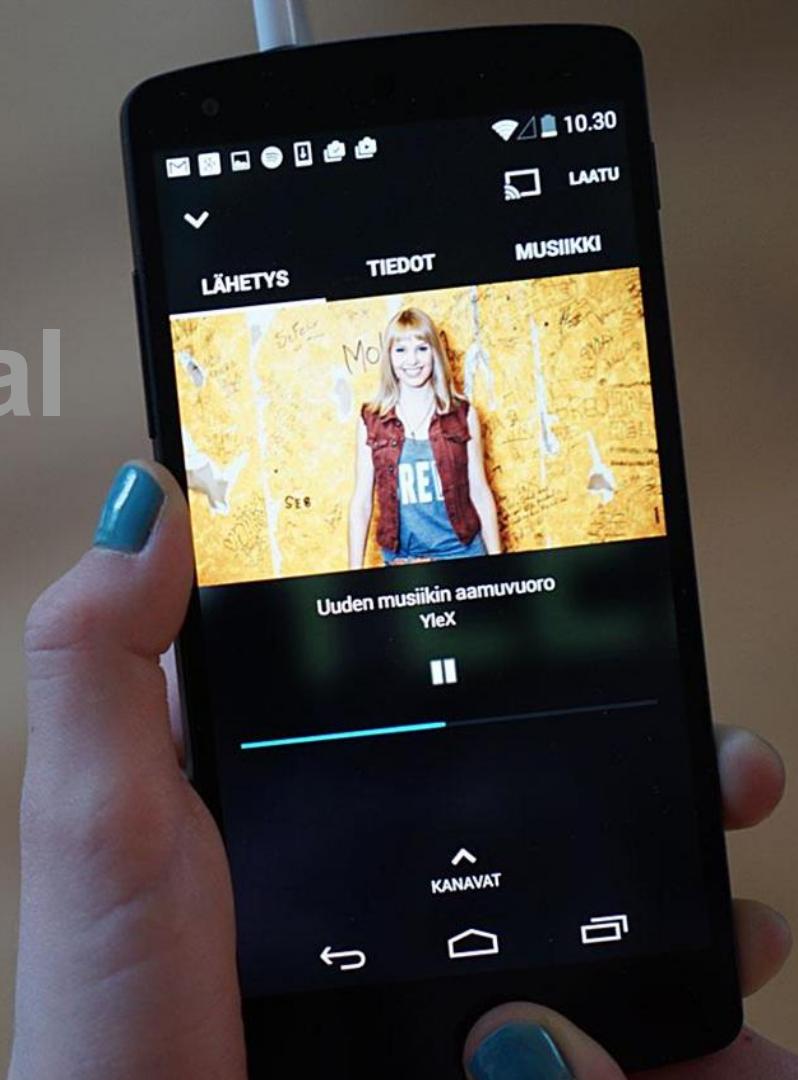


421

...

# Vision 2018

# The best personal user experience



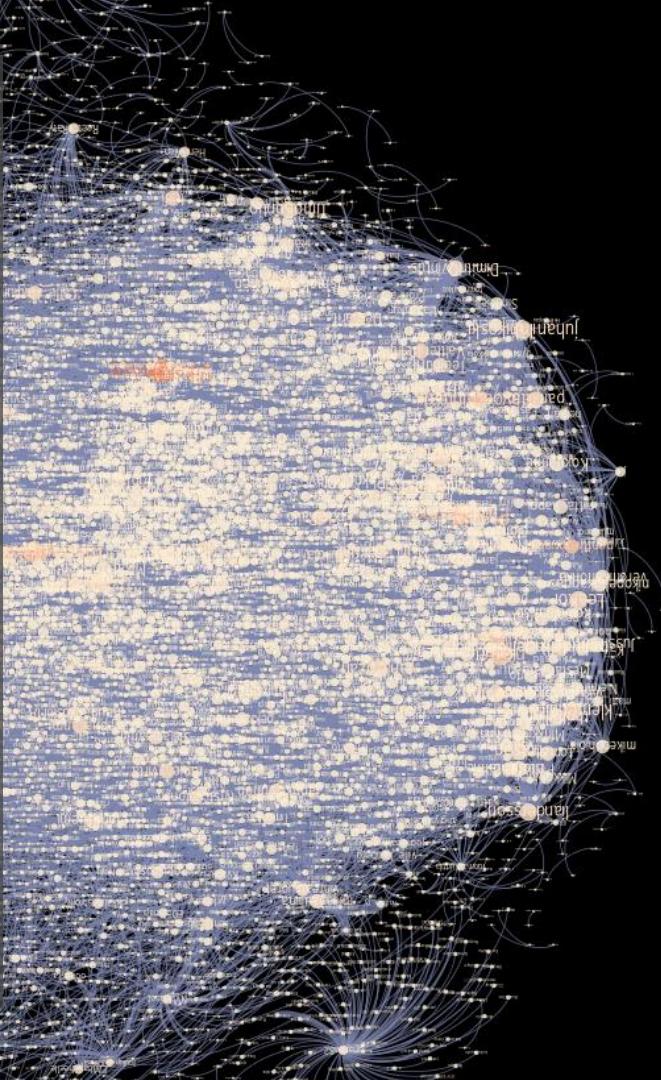
# Big Data =



[https://www.flickr.com/photos/rh/toy/2090024683/in/photolist-gdMuh-4-7GacYw-iMv-AH-5NiuOU-pVKYKn-9uDnR-bvtCC4gdLnk-ekYLQy-9iLRV-mWf6ci-Mju2c\\_uoFols-H92oE-92kp1F-5YiLt-b2wDV-h4Rv8y-7R6usE-5hrCby-6i9QD-p-1mPvIn815-1-WCr-19rFiH-2Wa9nS-fS7qOg-qbA7WS-4CjMAu-kwvvnZ-kwxBv1-am-oct-p1mpRv-8eKo29-7mfH7s-mWxwjs-n4cSv-/n3E71-a-w/1-twp3Ge-ddn5G7-55K5h1-crnmZbT-egsmCb-75pdDG-4mocg-jeap0-HEfdL8cy-54Xbr-2TSuaX](https://www.flickr.com/photos/rh/toy/2090024683/in/photolist-gdMuh-4-7GacYw-iMv-AH-5NiuOU-pVKYKn-9uDnR-bvtCC4gdLnk-ekYLQy-9iLRV-mWf6ci-Mju2c_uoFols-H92oE-92kp1F-5YiLt-b2wDV-h4Rv8y-7R6usE-5hrCby-6i9QD-p-1mPvIn815-1-WCr-19rFiH-2Wa9nS-fS7qOg-qbA7WS-4CjMAu-kwvvnZ-kwxBv1-am-oct-p1mpRv-8eKo29-7mfH7s-mWxwjs-n4cSv-/n3E71-a-w/1-twp3Ge-ddn5G7-55K5h1-crnmZbT-egsmCb-75pdDG-4mocg-jeap0-HEfdL8cy-54Xbr-2TSuaX)

# Big Data =

# Big Dada



# Big Data

Government

Yle News

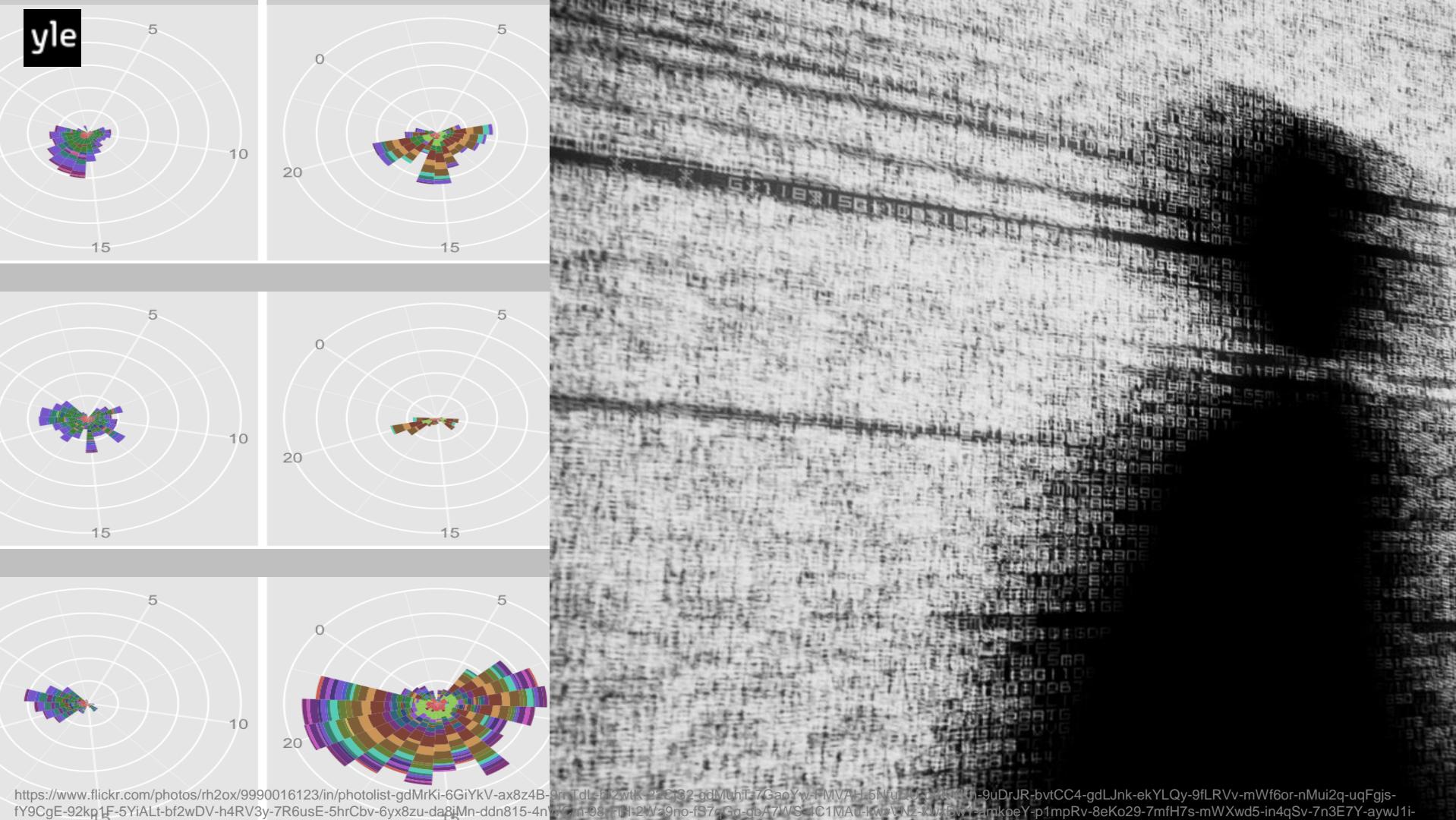
One journalist

Betr 2020

# Big Data =

## Small data

yle



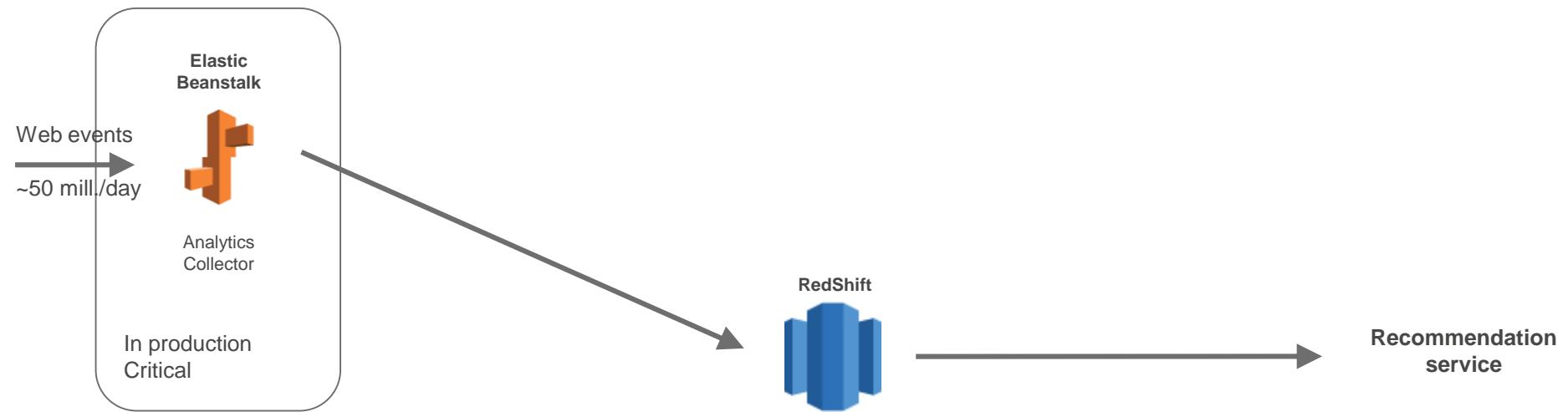
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# Painpoint #1

# Losing data

# Yle Analytics Pipeline – First idea



Painpoint #2  
Cloud doesn't  
scale?

# Painpoint #3

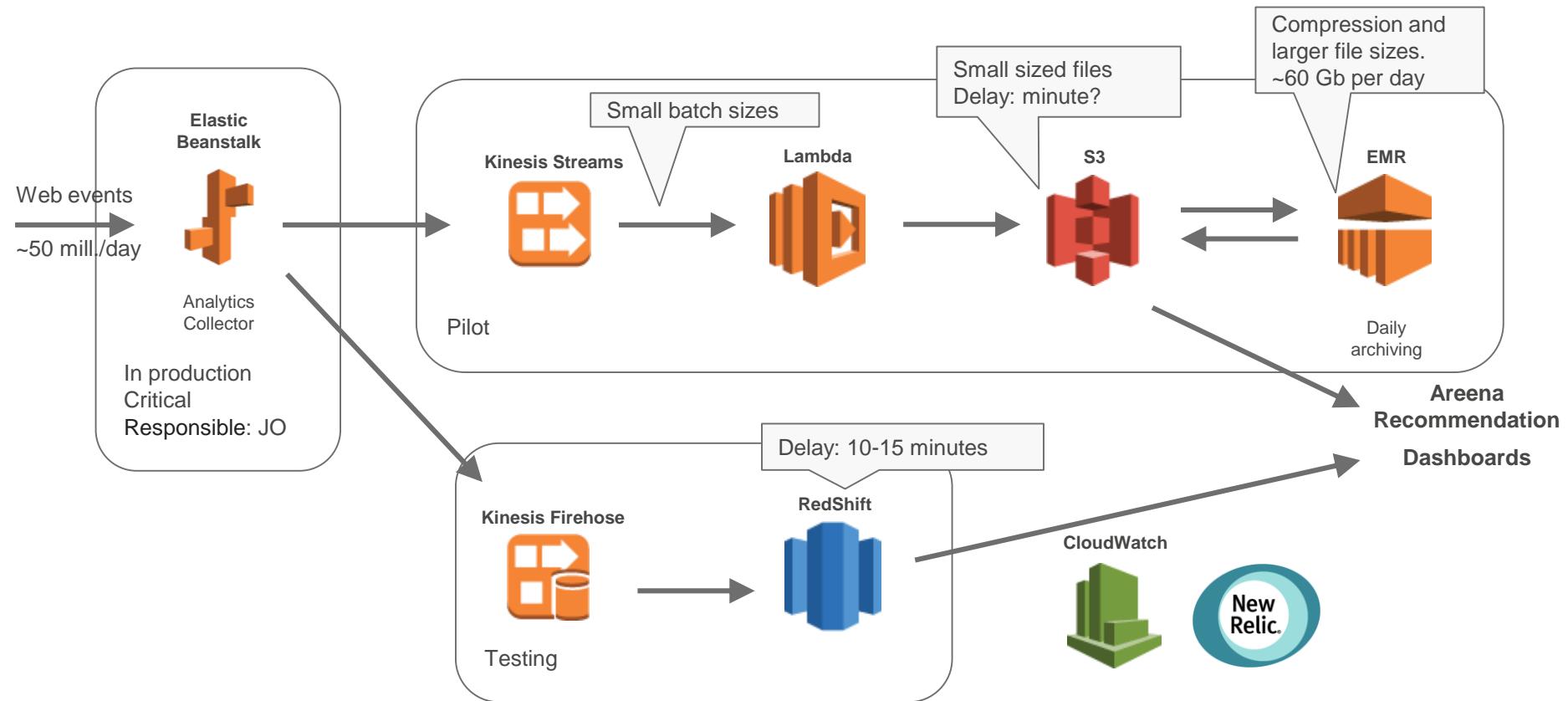
It's down

again?

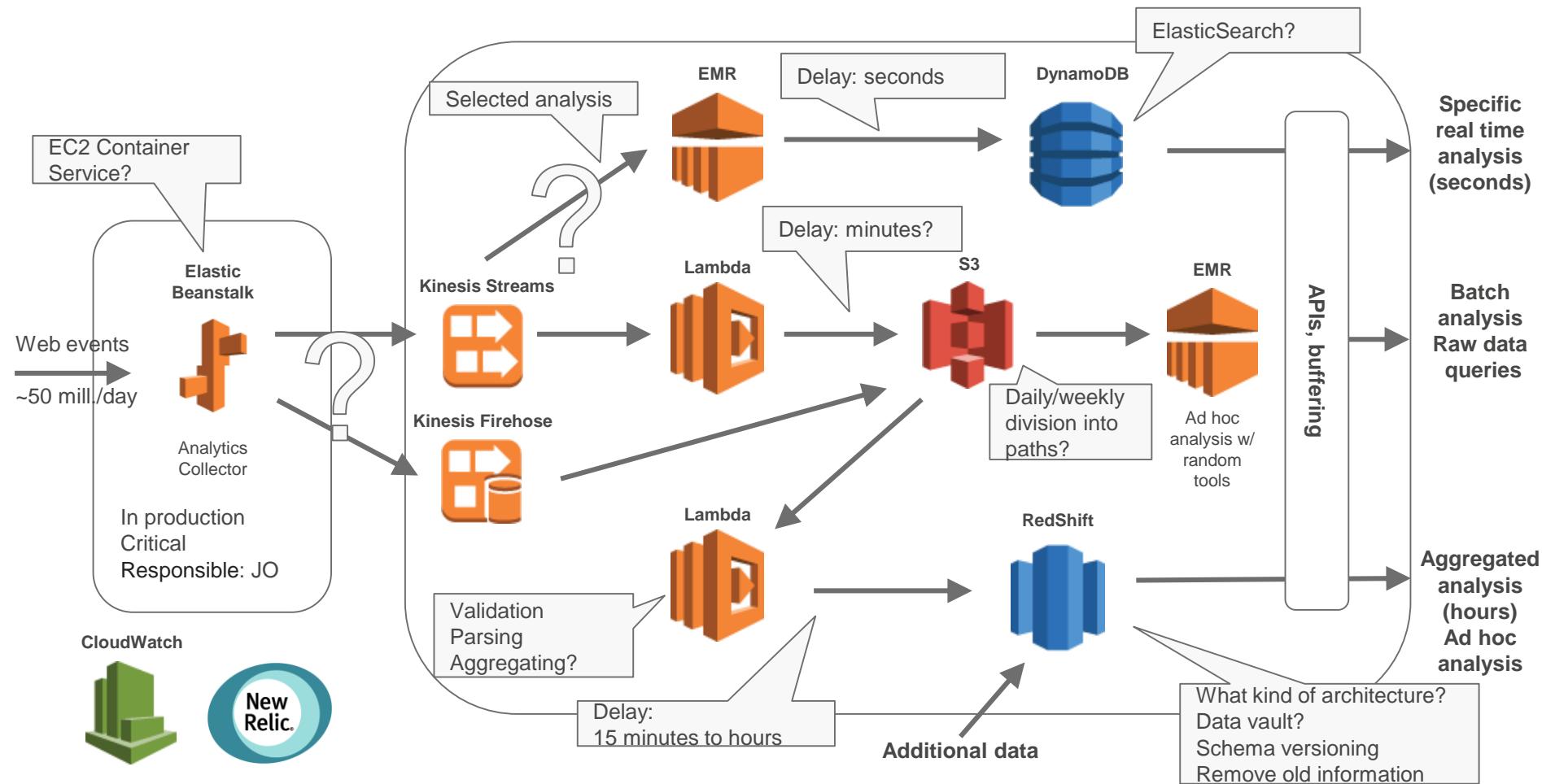
# Painpoint #4

## Where are the skills?

# Yle Analytics Pipeline - Current situation



# Yle Analytics Pipeline - Future scenario



Redshift is still  
being explored and  
looks promising!

Aleksi.Rossi@yle.fi  
@AlekRossi

Thanks!

