

Distributed Storage in the Cloud



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About Presentation

High Level Overview, Do not
Expect Deep Details

I'm not Expert in all
technologies covered, speak up
if I'm wrong and correct me

How do you
take your
Cloud ?



Freedom or Serfdom ?



- 
- CLOUD NATIVE**
COMPUTING FOUNDATION



- 

Giving Cloud Its Originally Intended Role of Commodity Infrastructure

What is Cloud Computing?

An analogy: think of electricity services...

You simply plug into a vast electrical grid managed by experts to get a low cost, reliable power supply – available to you with much greater efficiency than you could generate on your own.

Power is a utility service - available to you on-demand and you pay only for what you use.





**Can I deploy solution in my
Environment without incurring
additional costs ?**



**Do I have a broad choice of
vendors if I need help ?**



**Can I improve software so it
solves my needs better ?**

Practical Open Source



kubernetes

Kubernetes – Leading Open Source Orchestration for Public or Private Cloud

Applications



Uses Orchestration

Orchestration

Kubernetes



Uses Provider

Provider



Storage Types to Consider

- **Node Local Storage**
- **Network Attached Block Storage**
- **Network File System**
- **HTTP(S) Accessible Object Store**
- **Queues/Streams/Pipelines**
- **Databases**



DATA MODEL



**QUERY
LANGUAGE**



PURPOSE



**INTERNAL DESIGN
CONSIDERATIONS**

Databases are Complicated!

Relational

Key Value

Document

**Time
Series**

Graph

Other

Common Data Models



Multi-Model

Some Databases Support Multiple Data Models, Some even Talk Different Languages/Protocols

Shapechangers

Clickhouse can speak PostgreSQL and MySQL Protocols

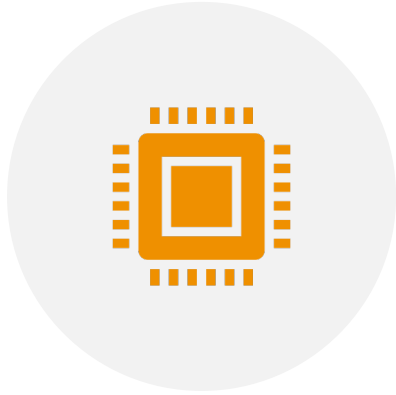
VictoriaMetrics has InfluxDB and Graphite API

FerretDB allows to use PostgreSQL as if it were MongoDB

Babelfish turns PostgreSQL in MS SQL Compatible Database

Purpose and Design

- **Operational/Transactional vs Analytical**
- **Cache vs Persistence**
- **Fully in Memory vs Storage Based**
- **Natively Distributed vs Fully Replicated**
- **Column Store vs Row Store**
- **Blockchain Based**



**REDUNDANCY, PERFORMANCE,
SCALE**



**CLOUD DOES NOT WORK WELL
WITH “PET” MODEL**



**COUNT ON ANY NODE CAN
DISAPPEAR WITHOUT A TRACE**

Why Distributed?

Let's Look into Storage Types and Options!

Commodity Storage



Has Relatively Simple Interface



Small/Medium Effort for Migration



Does not Create Strong Vendor Lock-In



**Often Makes Sense to use Cloud Vendors
solution as a “Building Block”**

Node Local Storage



Basically, Local Disk

All Major Clouds Have Options

Performance can Differ by a Lot!

NVMe Flash storage tends to be the fastest

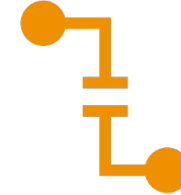
Great a Building Block for Distributed Storage or Local Processing needs



**AWS: Elastic Block
Store (EBS)**



**Azure: Managed
Disks**



**GCP: Persistent Disk
(Zonal and Regional)**

Network Block Storage - Clouds

**NetApp Cloud
Volumes
ONTAP**

**Portworx
Persistent
Volumes**

Network Block Storage: Vendors



Ceph



Rook



Longhorn



OpenEBS



OpenStack Block Storage (cinder)

Network Block Storage: Open Source



**AWS: Elastic File System
(EFS)**



Azure: Azure Files

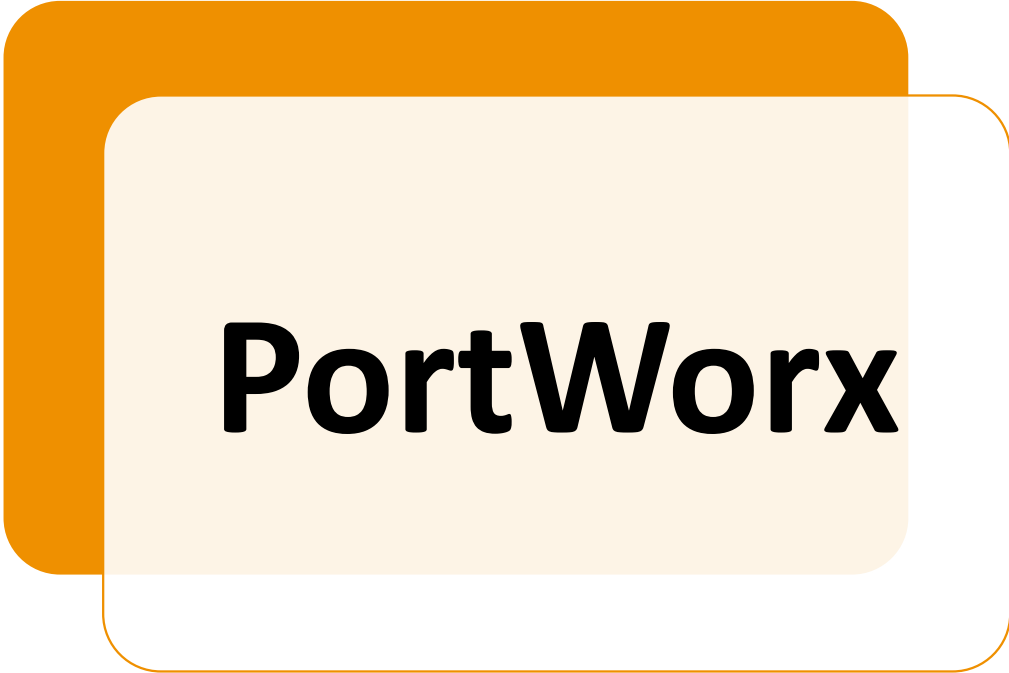


GCP: Filestore

File Storage: Clouds

The logo for NetApp, featuring the company name in a bold, black, sans-serif font. The text is centered within a light beige rounded rectangle, which is itself set against a larger orange rounded rectangle with a drop shadow effect.

NetApp

The logo for PortWorx, featuring the company name in a bold, black, sans-serif font. The text is centered within a light beige rounded rectangle, which is itself set against a larger orange rounded rectangle with a drop shadow effect.

PortWorx

File Storage: Vendors

Ceph

Longhorn

Rook

OpenEBS

**OpenStack
Shared File
System (manila)**

File Storage: Open Source



AWS: S3



Azure: Blob Storage



GCP: Google Storage

Object Storage: Clouds

Object Storage: Vendors

NetApp

PortWorks

Wasabi

Blackblaze B2

Digital Ocean

Open Telekom Cloud



Minio

Ceph

Rook

Object Store: Open Source

Datastores and Databases

Highly Differentiated

“Similar” Offerings are NOT Easily Replicable

Important to use Open Source Solutions if you want to avoid Vendor LockIn

Queues,
Streams, Data
Pipelines

**Moving Data around with
Persistence**

Is NOT conventional Database

**Key part of many modern data
architectures**

AWS

- Kinesis
- Data Pipeline
- Simple Queueing Service (SQS)
- Simple Notification Service (SNS)
- Managed Kafka

Azure

- Data Factory
- Event Hubs
- Event Hubs for Apache Kafka

GCP

- Dataflow
- Pub/Sub

Queues: Clouds



**Confluent
Kafka**

**Aiven
Managed
Kafka**

Red Panda

Queues: Proprietary

**Apache
Kafka**

**Apache
Pulsar**

RabbitMQ

ActiveMQ

**Many
Others....**

Queues: Open Source



AWS

Aurora (MySQL, PostgreSQL)

RDS (MySQL, PostgreSQL,
MariaDB, Oracle, SQL Server)



Azure

SQL Database

Azure Database (MySQL,
PostgreSQL, MariaDB)

Hyperscale



GCP

Spanner

CloudSQL (MySQL, PostgreSQL,
SQL Server)

Relational Transactional - Cloud

Oracle

**Microsoft
(SQL Server)**

**Yugabyte
Cloud**

**CochroachDB
Cloud**

**Instaclustr
Managed
PostgreSQL**

**Aiven
Managed
Databases**

**SkySQL
(MariaDB in
the cloud)**

TiDB Cloud

Relational Transactional Proprietary

PostgreSQL

MySQL

MariaDB

Yugabyte

TiDB

Percona Distributions for MySQL and PostgreSQL

Relational Transactional – Open Source

Relational Analytical - Cloud

AWS

- RedShift
- Athena

Azure

- Synapse Analytics
- Data Lake Analytic

GCP

- BigQuery

Relational
Analytical -
Proprietary

Oracle

Snowflake

Vertica

Managed DataBricks

SingleStore

Oracle HeatWave

Spark

Hadoop

Presto

Trino

ClickHouse

MariaDB
ColumnStore

TiDB (HTAP)

Relational Analytical – Open Source

**AWS:
DocumentDB**

**Azure:
CosmosDB**

**GCP:
Firestore**

Document Store - Cloud

MongoDB Atlas

MongoDB Enterprise

Couchbase Cloud

Couchbase Enterprise

Document Store - Proprietary



**MONGODB
COMMUNITY**



**COUCHBASE
COMMUNITY**



**RELATIONAL
DATABASES**



**PERCONA SERVER
FOR MONGODB**

Document Store – Open Source (and Source Available)

Key-Value Stores for Caching: Cloud

AWS

- ElastiCache

Azure

- Cache
- Cache for Redis

GCP

- Memstore

The logo for Redis Enterprise, featuring the text "Redis Enterprise" in a bold, black, sans-serif font. The text is centered within a light orange rounded rectangle, which is itself set against a larger, darker orange rounded rectangle.

**Redis
Enterprise**

The logo for Redis Cloud, featuring the text "Redis Cloud" in a bold, black, sans-serif font. The text is centered within a light orange rounded rectangle, which is itself set against a larger, darker orange rounded rectangle.

**Redis
Cloud**

Key-Value Stores for Caching – Proprietary

Redis

Memcached

KeyDB

Key-Value Stores for Caching: Open Source

**AWS:
DynamoDB**

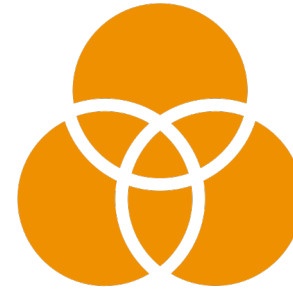
**Azure:
CosmosDB**

**GCP: Big
Table**

Persistent Key-Value Stores : Cloud



Redis Cloud



“Enterprise” Versions of Open
Source Solutions

Peristent Key Value Stores - Proprietary

Persistent Key-
Value Stores:
Open Source

Redis

Cassandra

ScyllaDB

Aerospike

Tarantool

**Apache
Ignite**

**Relational
Databases**



AWS: Timestream



**Azure: Azure Data
Explorer**



GCP: Cloud BigTable

Time Series Databases: Cloud

**Enterprise
Versions of Open
Core Products**

**Cloud DBaaS of
Open
Source/Open
Core Products**

Time Series: Proprietary

TimescaleDB

InfluxDB

OpenTSB

Prometheus

VictoriaMetrics

Cortex

M3

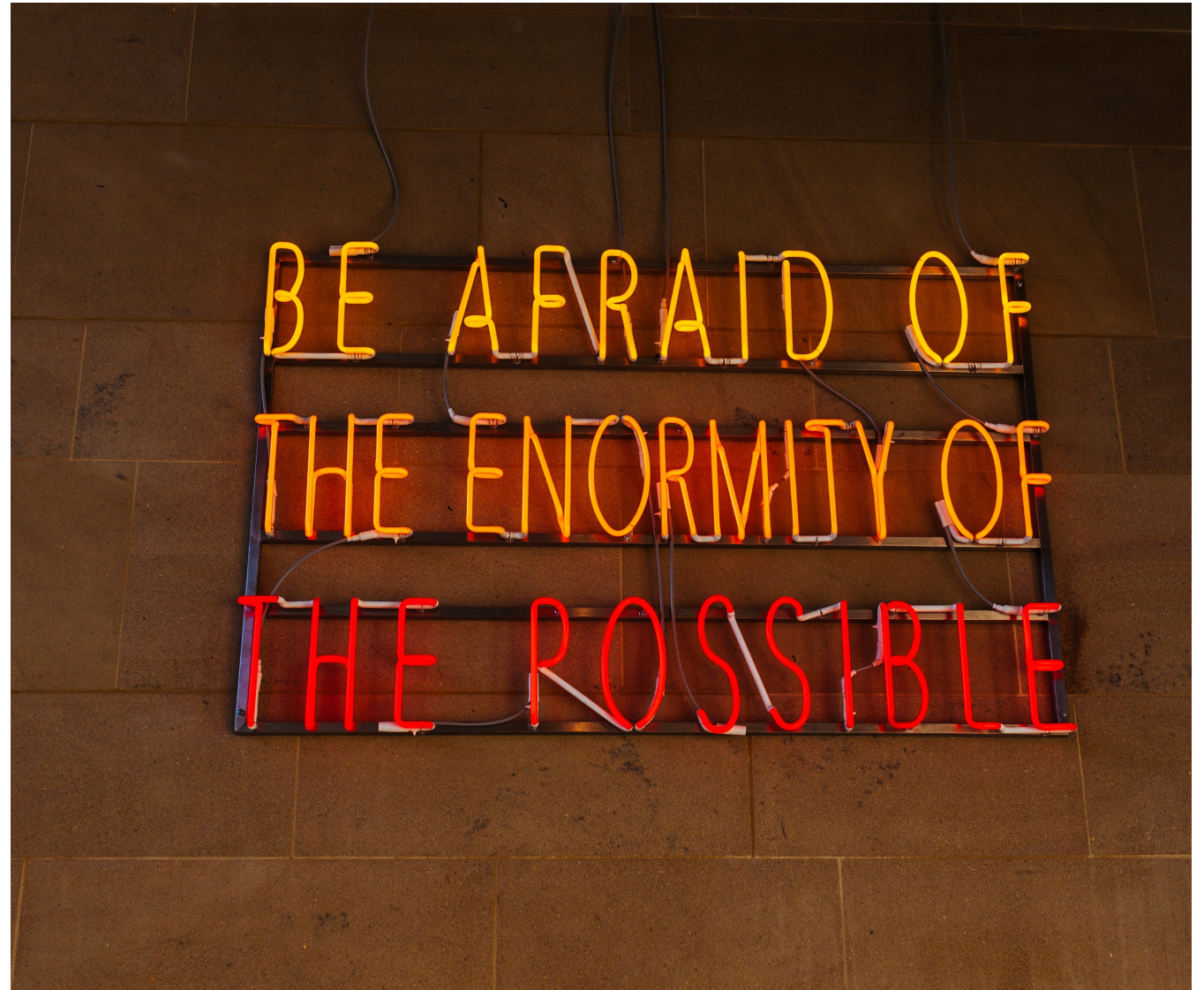
Graphite

Time Series: Open Source

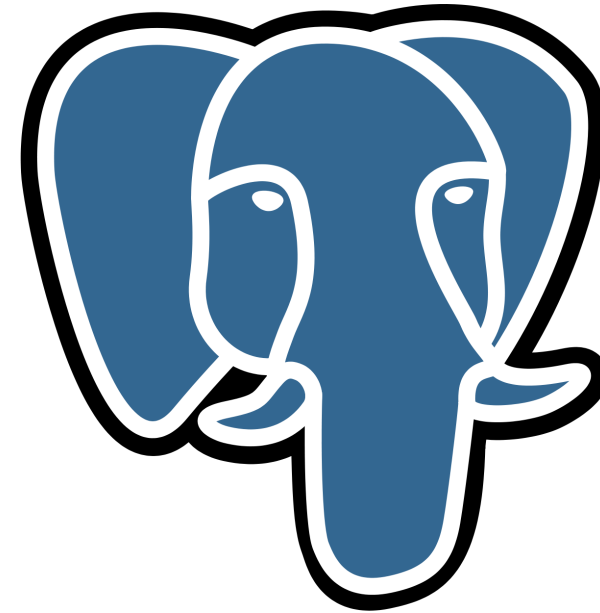
Percona's Role



Pushing Boundaries of Open Source Databases



Focus on MySQL,
MongoDB,
PostgreSQL



Percona
Distributions for
MySQL, MongoDB,
PostgreSQL

Linux and
Kubernetes
(Operator)
Deployment

100% Free and Open Source Database Software

Percona Monitoring and Management (PMM)

Single Pane of Glass for MySQL, MongoDB, PostgreSQL

Observability

Management

DBaaS Experience



PERCONA
Monitoring and Management

Distributed Storage in the Cloud



Is Quite Complicated



No One Size Fits all – look for the best tool for the job



If you so desire there are great Open Source Solutions available

Thank you, Let's Connect!

<https://www.linkedin.com/in/peterzaitsev/>

<https://twitter.com/PeterZaitsev>

<http://www.peterzaitsev.com>