CSC 244 – Dr Ying Jin
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ClustrixDB

Course Project

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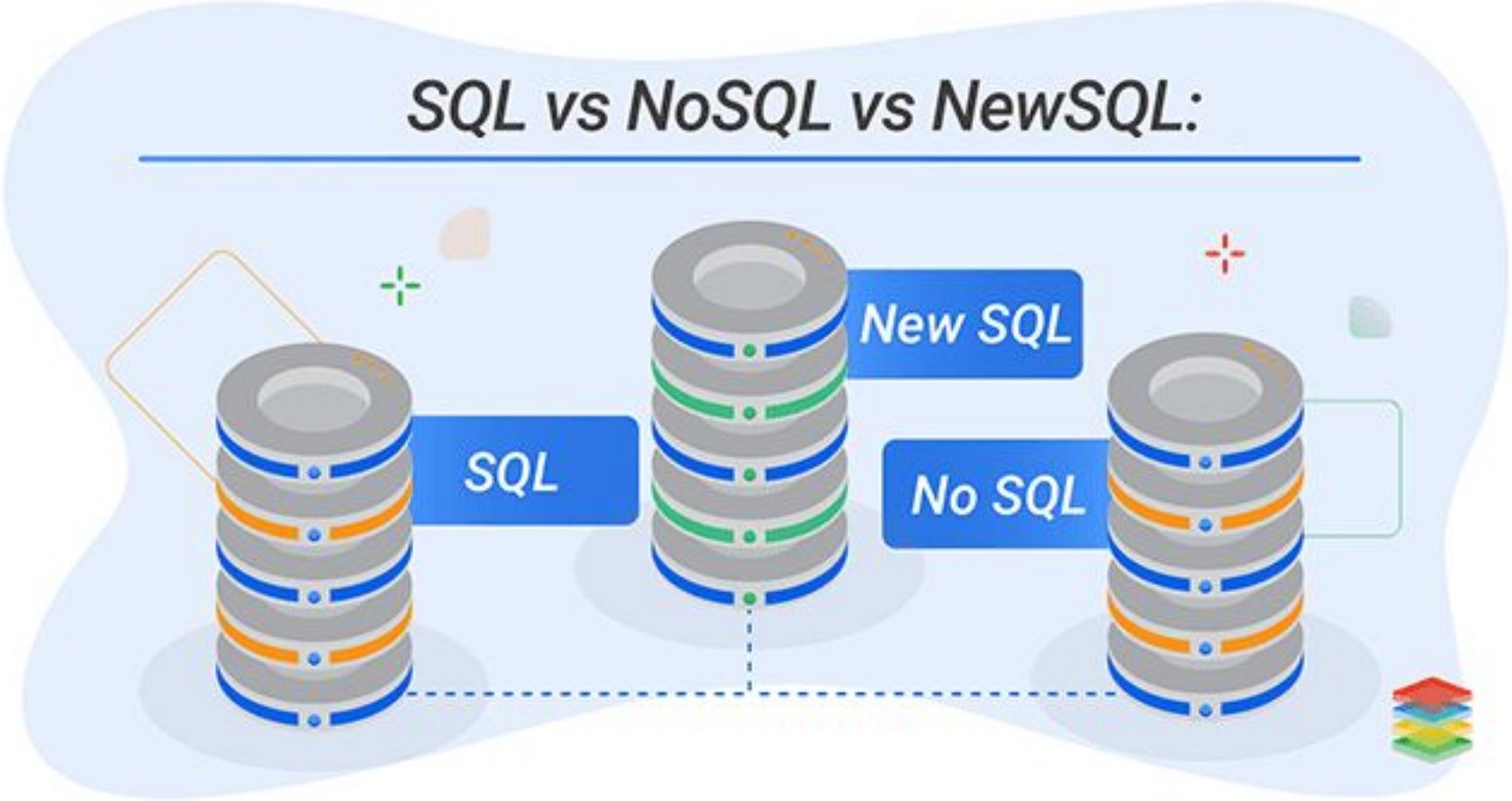
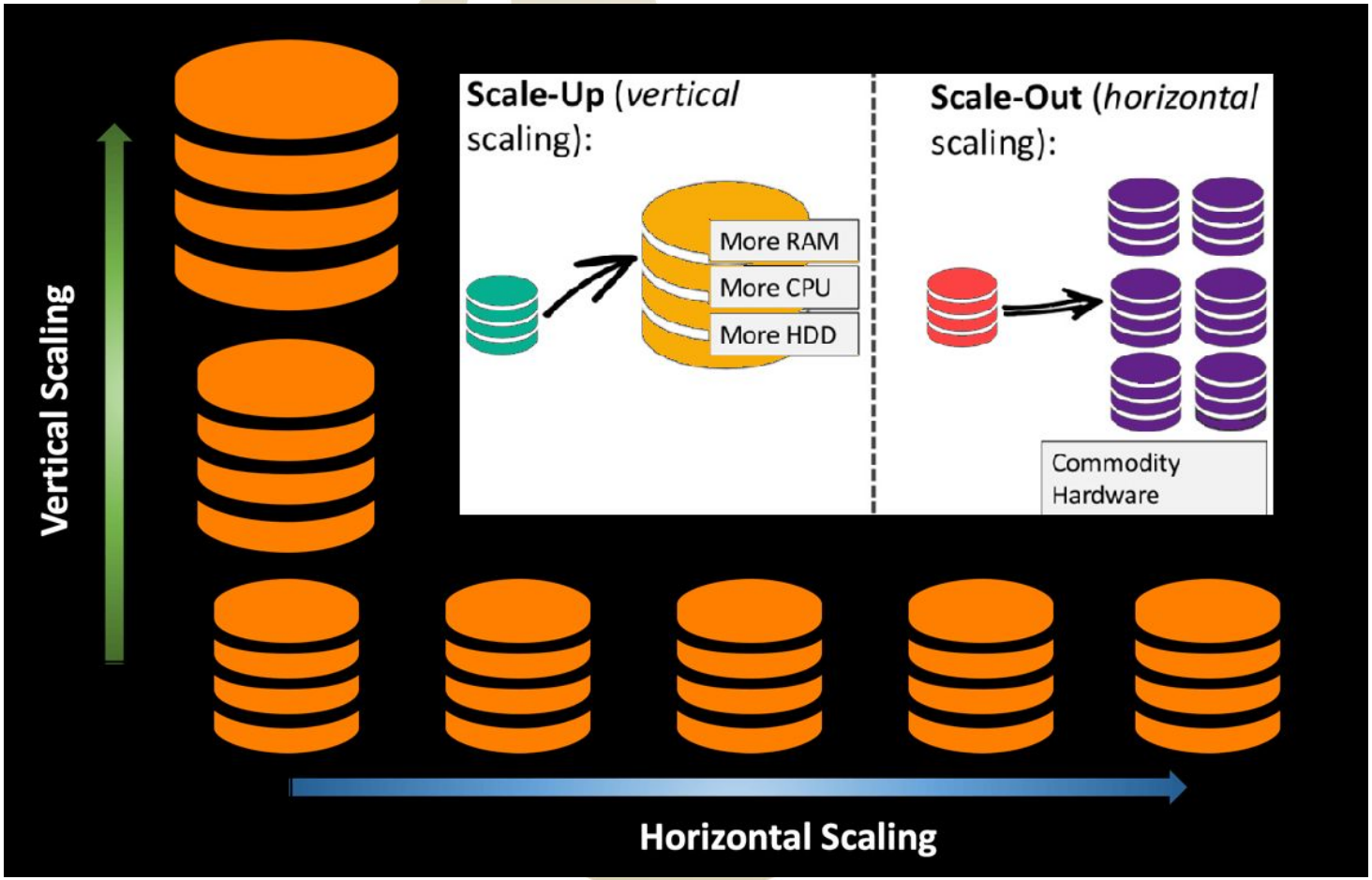
Introduction

- Relational Database has been the prime data management standard.
- The need for faster, more scalable and flexible data management system raised in the recent years, that led to the development of NoSQL.
- However, NoSQL compromised on SQL and ACID to obtain Scalability.
- Hence, NewSQL was brought into light which is ACID compliant, SQL based, Scalable, Distributed and highly available RDBMS system.
- Few of the NewSQL databases are ClusterixDB, NuoDB and VoltDB. They are capable of automated recovery on failure and are suitable for Billions of transactions on Billions of rows of data.

OldSQL vs NoSQL vs NewSQL



Scaling

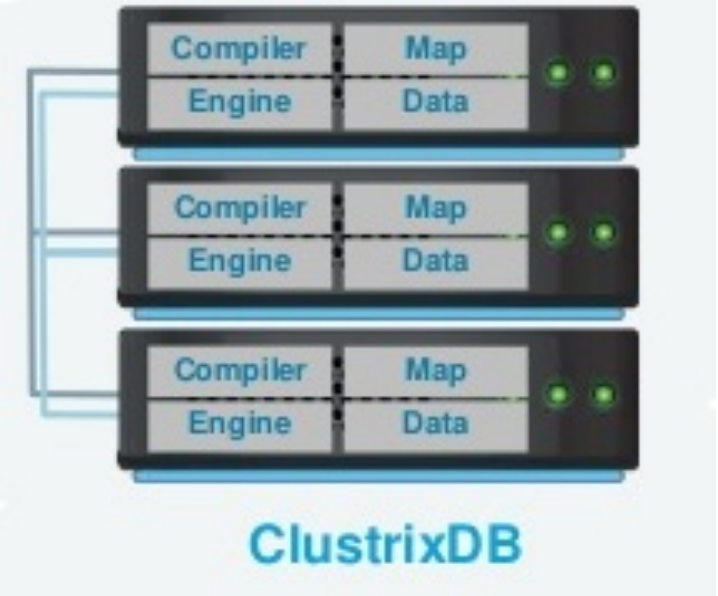

Vertical Scaling
Scale-Up (vertical scaling):
More RAM
More CPU
More HDD
Scale-Out (horizontal scaling):
Commodity Hardware
Horizontal Scaling

ClustrixDB

- ClusterixDB is considered to be first ever SQL database that uses Scale-Out approach engineered for the cloud.
- It provides a lot of flexibility, resilience, availability and is sensitive to the performance characteristics like throughput and latency.
- This database is prominent among E-commerce website for the same reason.

Architecture

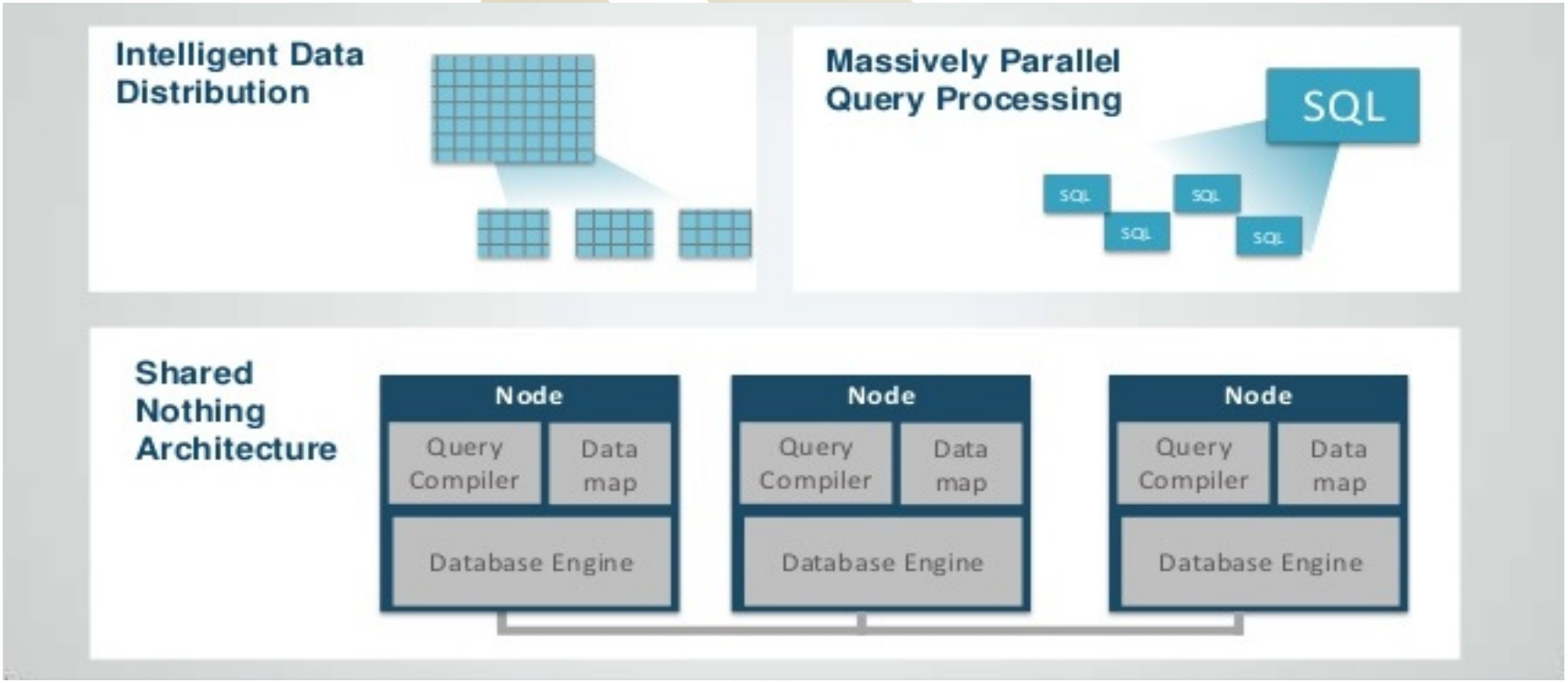
- Database Engine
- Query Compiler
- Data Table Slices
- Data Map



ClustrixDB

Data Distribution

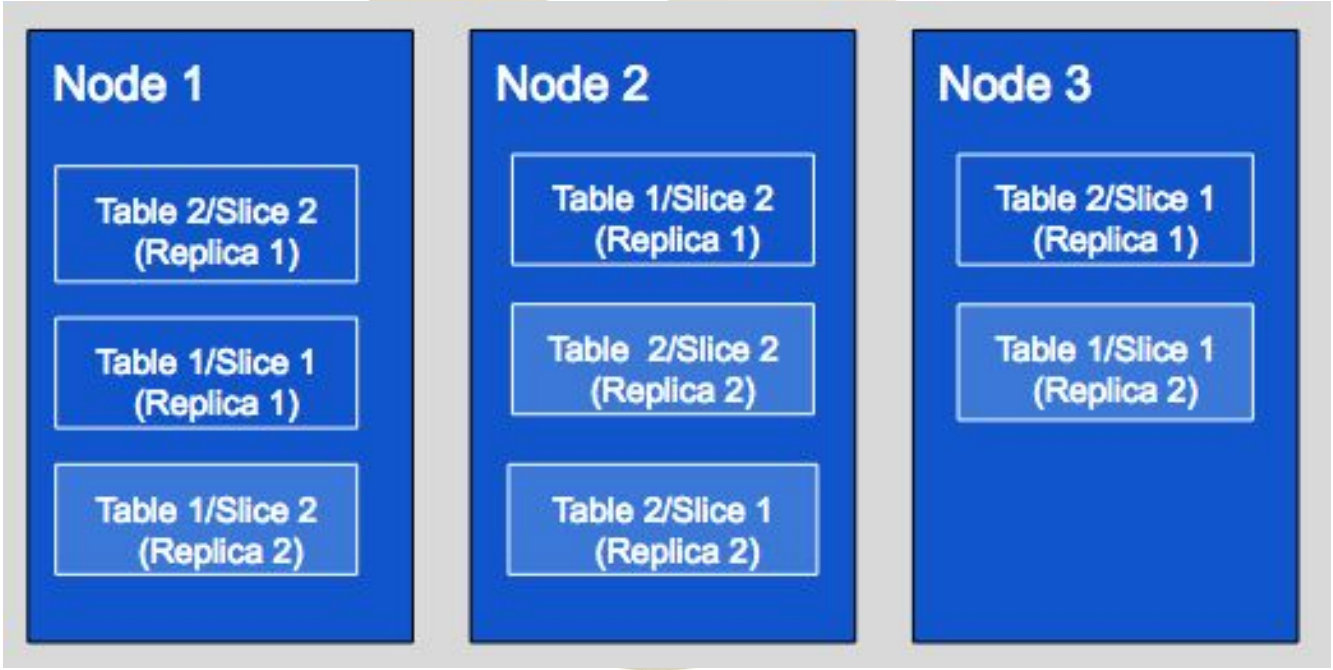
- Data auto-splits into slices.
- Every slice has a replica on another node.



ClustrixDB

Rebalancer

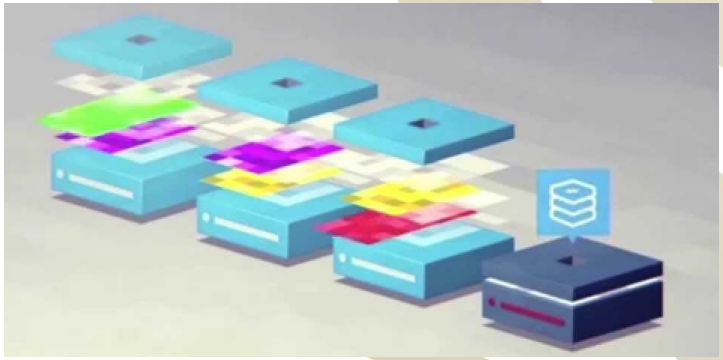
- This is how the Rebalancer slices and replicates tables across nodes.
- Replicas of tables are dispersed throughout the cluster to ensure fault tolerance.
- Every Table Slice is replicated on a different node at least one time.



ClustrixDB

Scaling

- ClustrixDB aims at enabling scaling of reads and writes without sharding.
- Both Scale-out and Scale-in can be done by adding or removing nodes as per need and the data is automatically redistributed by the rebalancer.



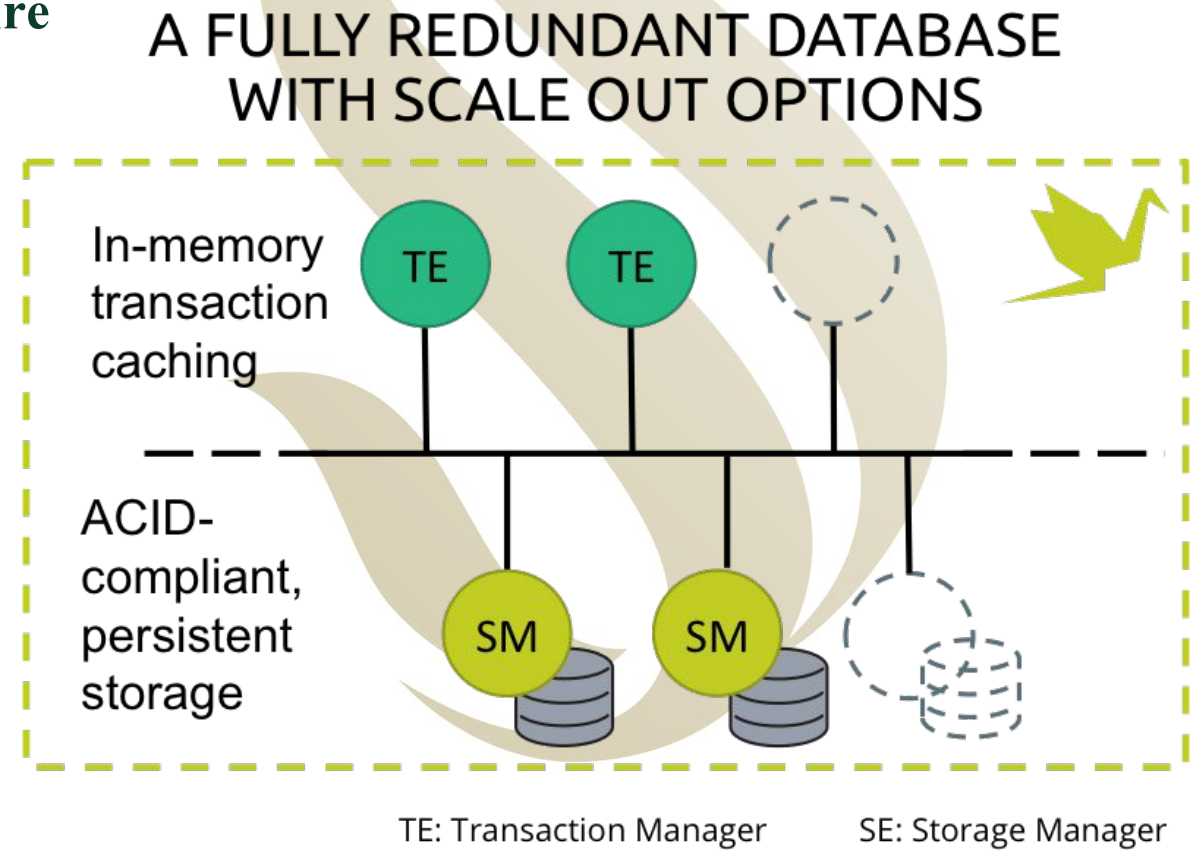
Replication and Recovery

- If a node fails, ClustrixDB immediately begin using replicas of the failed node's data from other nodes.
- The Rebalancer then immediately begins reprotecting that data by making new copies onto different nodes.

NuoDB

- NuoDB is an elastically scalable 100% SQL ACID compliant New SQL database.
- They are elastically scalable since they can scale even across data centers.

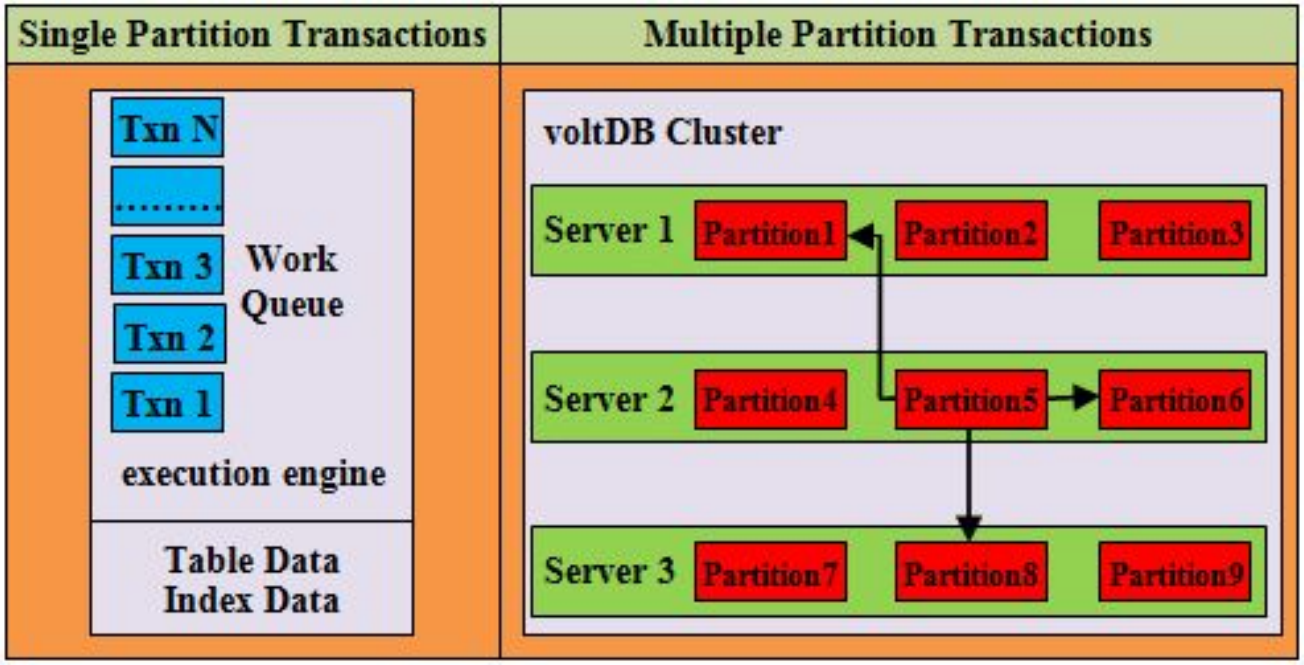
Architecture



VoltDB

- VoltDB is a database that was architected to be an in-memory fast RDBMS which is horizontally scalable and ACID compliant.

Architecture



ClustrixDB Implementation

Requirements:

- The machines used as servers should be running on CentOS or RHEL 7.4 OS or above with root privileges.
- A minimum of 3 servers are to be present in each cluster of ClustrixDB with each server having about 8 to 32 cores.
- Database storage is either an SSD with RAID-0 or SATA HDD.
- They need a RAM of 64GB or higher along with front and backend networks.

- Check if the required packages are present using the following commands:
  - sudo yum install bzip2 xz wget screen ntp ntpdate vim htop mdadm
  - sudo yum-config-manager --enable rhui-REGION-rhel-server-optional

- All the firewall services are then disabled so that the nodes can communicate with one another.
  - sudo systemctl start ntpd
  - sudo systemctl disable firewalld

- Disk based logging is enabled to store the logs on the disk instead of the RAM.

ClustrixDB Implementation

Installation

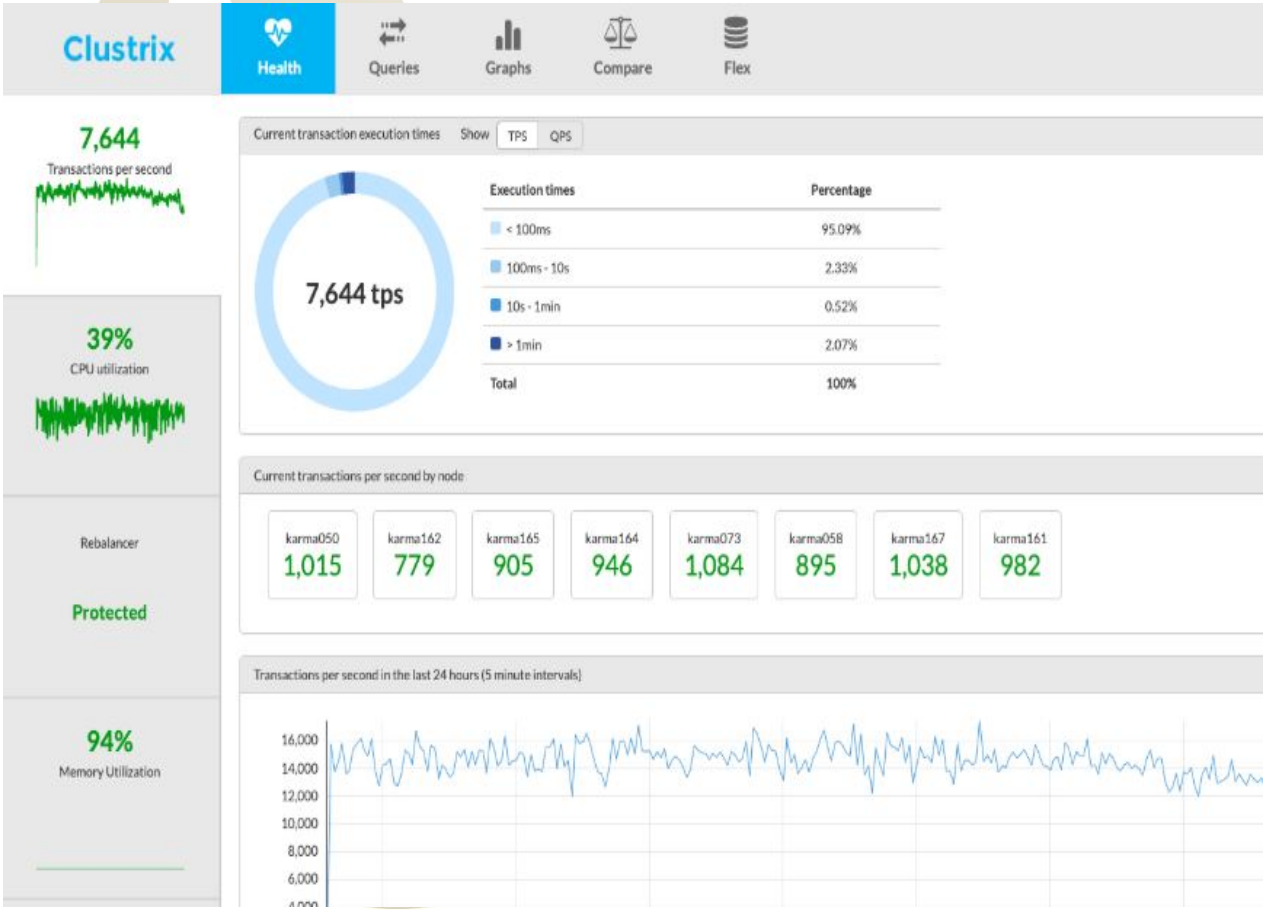
- An Installer and a license key are to be obtained by contacting Clustrix sales representatives.
- Login to each of the sessions on command prompt serving as a node as the root user with sudo permissions.
- The Clustrix Installer will automatically create 3 users:
  - root, clustrixDB Daemon(clxd), clustrixDB management(clxm).

- Now, we need to install the ClustrixDB installation file and untar it before running the installer script as follows:
  - tar xvfj current_version.el7.tar.bz2
  - sudo ./clxnode_install.py
- Before the cluster is formed place all the nodes in a secure environment allowing access between all nodes.
- Set the cluster license and add nodes to the clusters using the commands:
  - Set GLOBAL license = license_key_value ;
  - ALTER CLUSTER ADD ' node2_ip_address', 'node3_ip_address';

ClustrixDB Implementation

Graphical User Interface:

- Health Dashboard
- Queries
- Graphs
- Compare
- Flex



ClustrixDB Implementation

Query Language:

- Create Table:
  - CREATE TABLE `Foo`(`pk` INT(11) NOT NULL auto_increment, `a` INT(11),`b` INT(11),`c` INT(11),PRIMARY KEY (`pk`) ,KEY `idx_ab` (`a`, `b`)) auto_increment=50002;

- Select:
  - SELECT Bar.a,Sum(Bar.b) FROM Foo, Bar WHERE Foo.pk = Bar.pk GROUP BY Bar.a;

- DML supported commands:
  - Straight_Join, Distinct, [Left|Right|Outer] Join, Union, Limit, Asc, Order By, Having, For Update, Group By, Truncate, Load data Infile, Count(), Sum(), Group_concat(), Auto_increment.

- DDL supported commands:
  - ALTER CLUSTER ADD|DROP|SET MAX_FAILURES| RESIZE DEVICES Distribute

- ClustrixDB supports MySQL syntax for Stored Procedures as well as triggers.s

Summary

- ✔ ClustrixDB is a NewSQL database that can scale data without any need to shard.
- ✔ Conventional RDBMS characteristics such as ACID compliance, real-time referential integrity, multi-table joins are maintained.
- ✔ True data distribution with shared-nothing architecture is achieved.
- ✔ Scaling is achieved by simple methods of adding and removing resources and rebalancing data amongst the nodes.
- ✔ Fault tolerance is achieved by redundant copies of data present in various nodes.
- ✔ Automatic recovery of these nodes during unexpected failure helps prevent data loss.
- ✔ ClusterixDB is, hence, a complete and fast database that can provide online schema change mechanism without any service interruptions.

Thank You

Questions?

SACRAMENTO STATE
Redefine the Possible