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EXPERT SOLUTIONS FOR .NET DEVELOPERS

ROCK THE CODE TOUR 2017 | CHICAGO

Big Data on Azure

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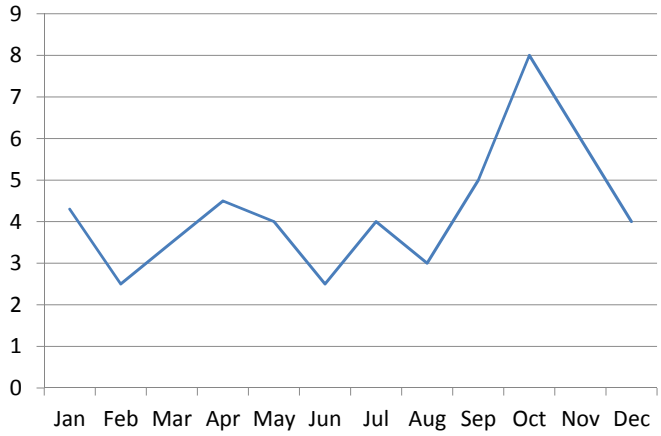
Cloud Computing

Host some or all
of your data or application
on a third-party server
in a highly-scalable,
highly-reliable way

Advantages of Cloud Computing

- Lower capital costs
- Flexible operating cost (Rent vs Buy)
- Platform as a Service
- Freedom from infrastructure / hardware
- Redundancy
- Automatic monitoring and failover

Demand and Capacity



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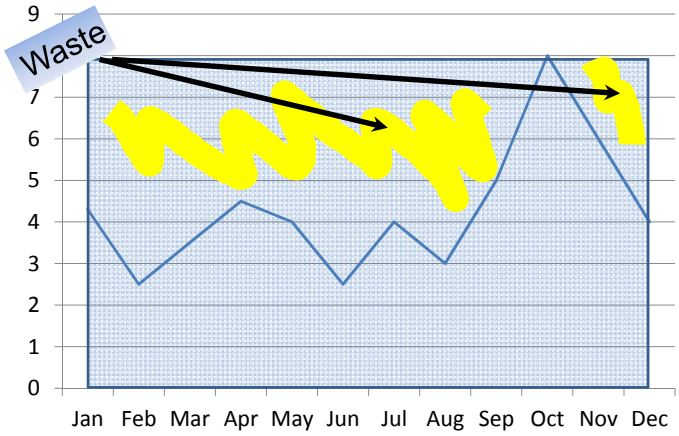
Demand and Capacity



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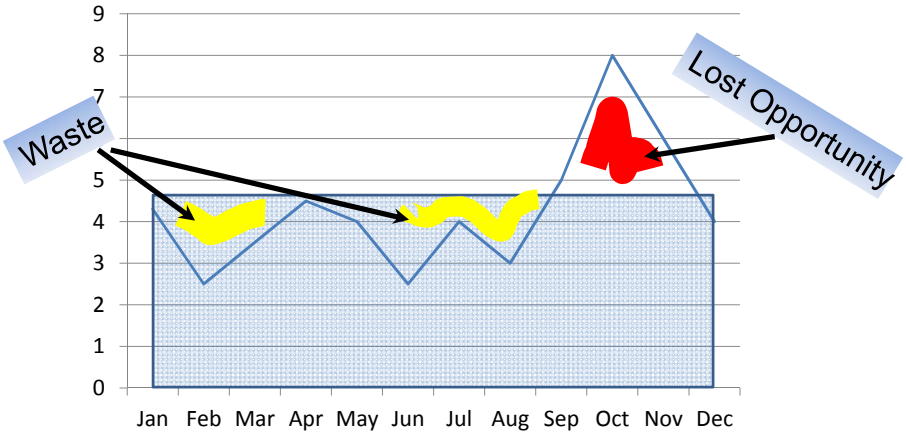

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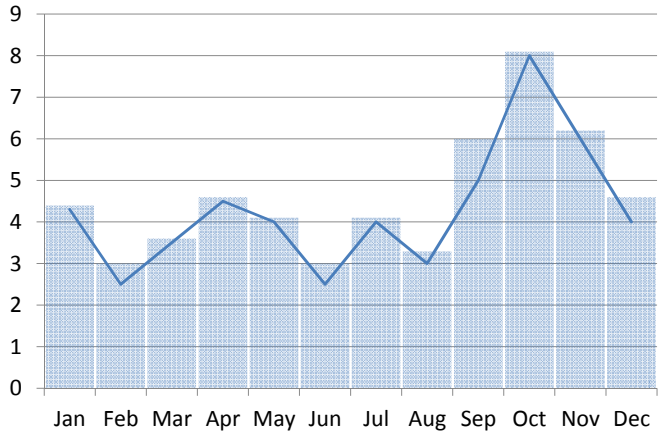

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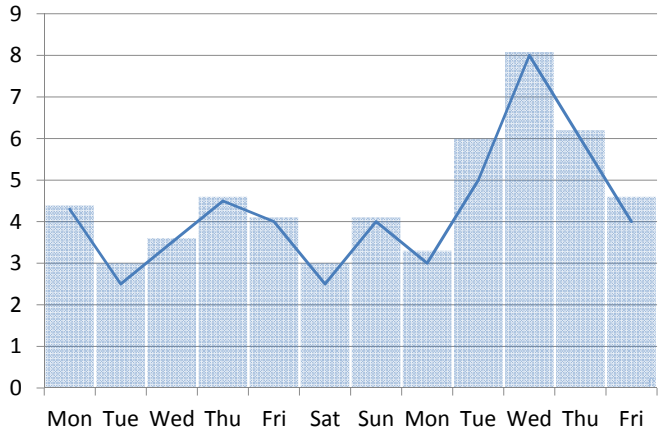

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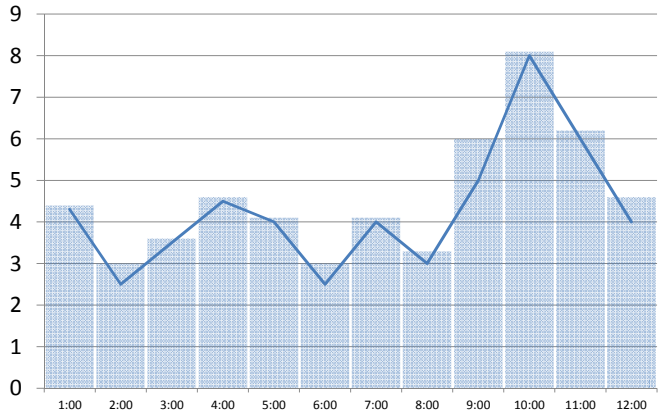

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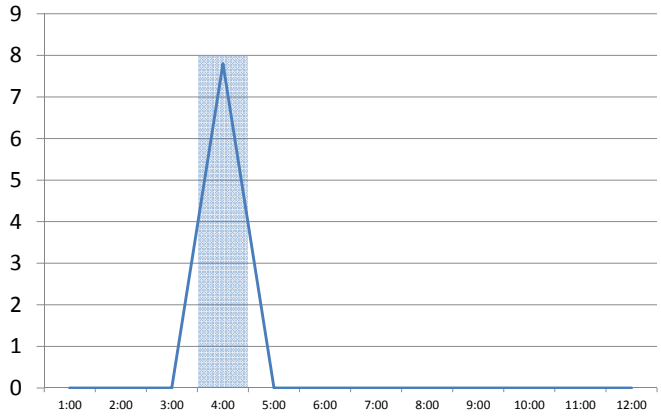
Big Data Demand



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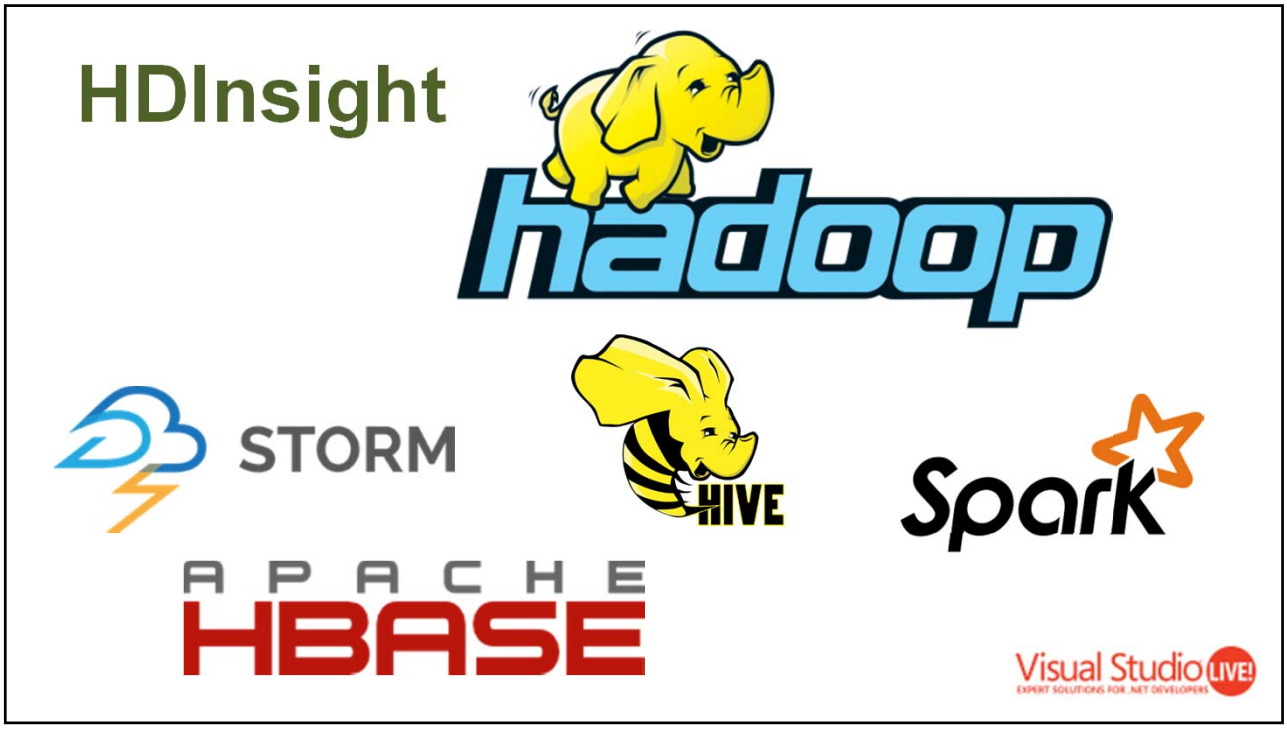
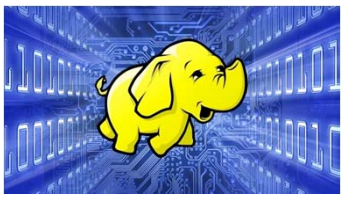


Azure HDInsight

- Microsoft Azure's big-data solution using Hadoop
  - Open-source framework for storing and analyzing massive amounts of data on clusters built from commodity hardware
  - Uses Hadoop Distributed File System (HDFS) for storage
- Employs the open-source Hortonworks Data Platform implementation of Hadoop
  - Includes HBase, Hive, Pig, Storm, Spark, and more
- Integrates with popular BI tools
  - Includes Power BI, Excel, SSAS, SSRS, Tableau

Apache Hadoop on Azure

- Automatic cluster provisioning and configuration
  - Bypass an otherwise manual-intensive process
- Cluster scaling
  - Change number of nodes without deleting/re-creating the cluster
- High availability/reliability
  - Managed solution - 99.9% SLA
  - HDInsight includes a secondary head node
- Reliable and economical storage
  - HDFS mapped over Azure Blob Storage
  - Accessed through “wasb://” protocol prefix



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Lambda Architecture

- Batch Layer
- Speed Layer
- Serving Layer

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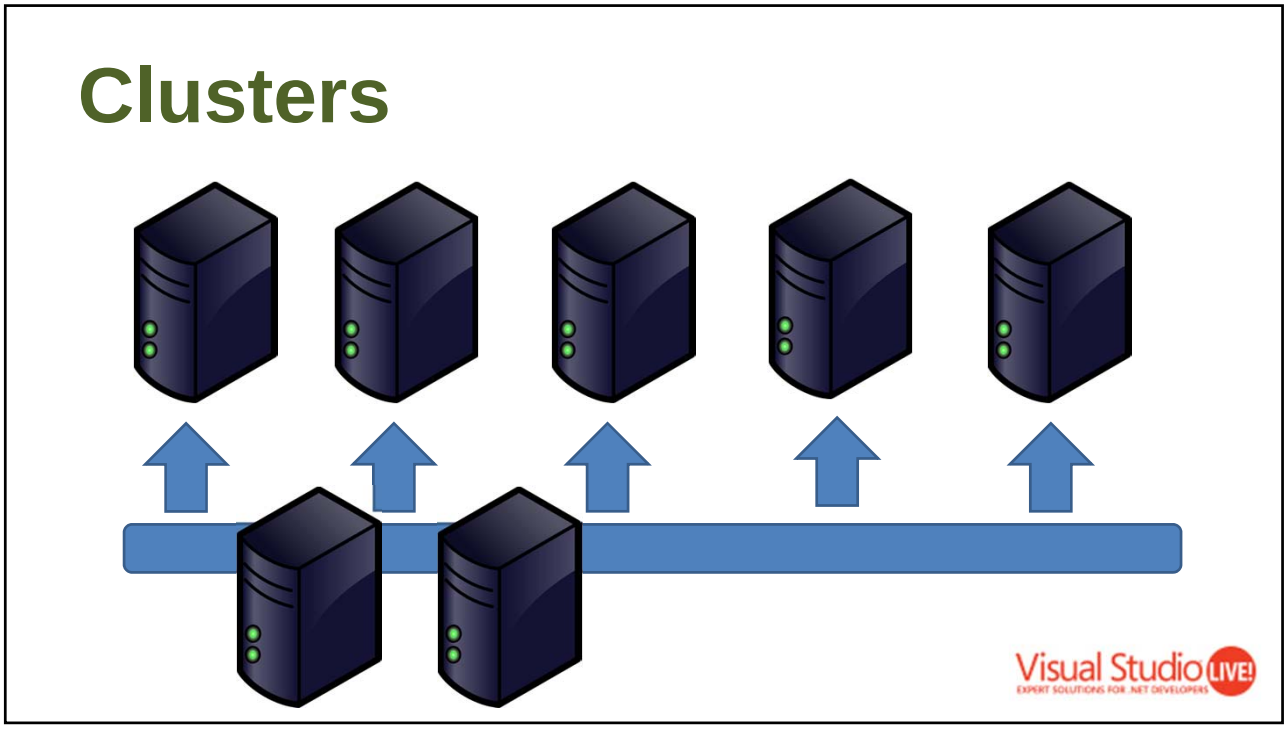
Clusters
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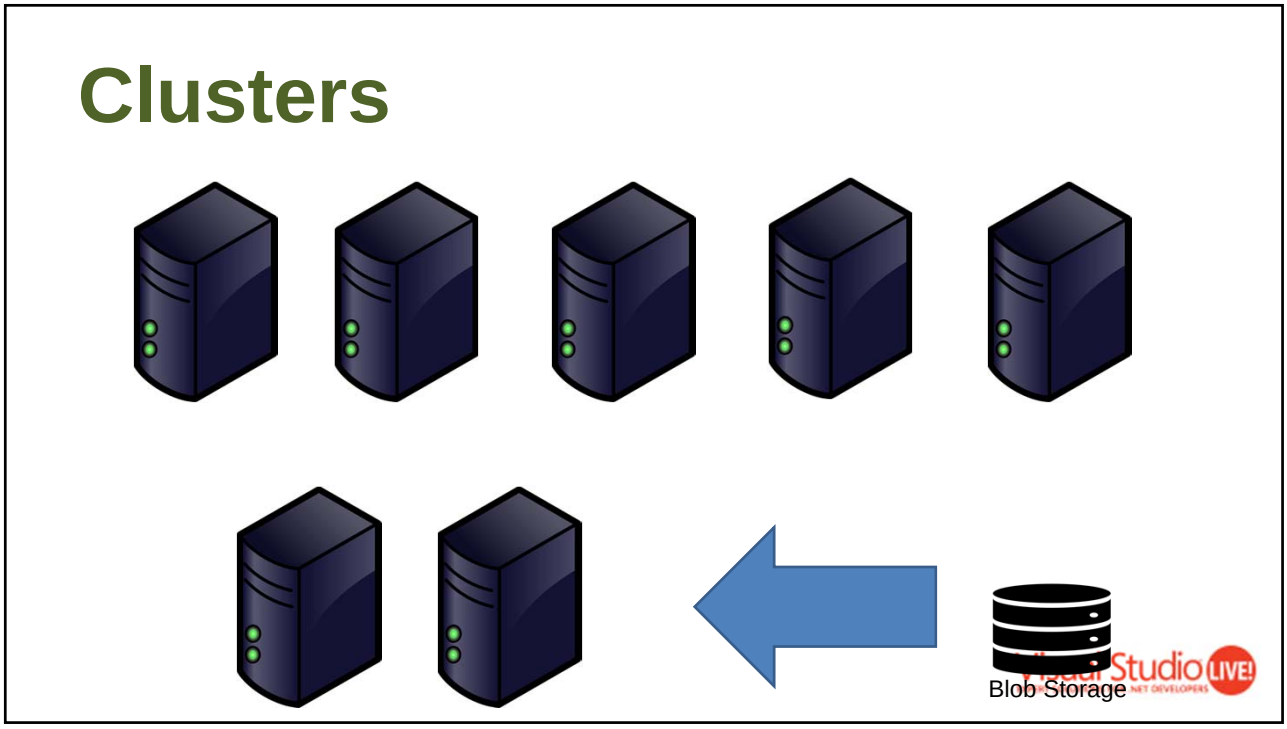
Clusters
Blob Storage
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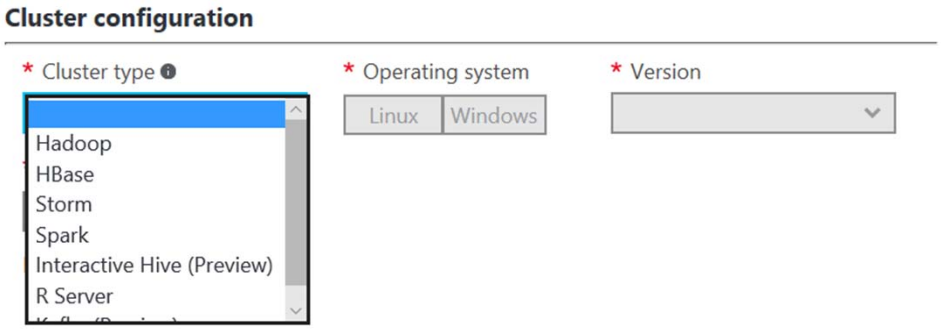
HDInsight Cluster Types

- Hadoop: Query workloads
  - Reliable data storage, simple MapReduce
- HBase: NoSQL workloads
  - Distributed database offering random access to large amounts of data
- Apache Storm: Stream workloads
  - Real-time analysis of moving data streams
- Apache Spark: High-performance workloads
  - In-memory parallel processing

Cluster Creation



Cluster Creation

```
{
  "$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "parameters": {
    "clusterName": {
      "type": "string",
      "metadata": {
        "description": "The name of the HDInsight cluster to create."
      }
    },
    "clusterLoginUserName": {
      "type": "string",
      "defaultValue": "admin",
      "metadata": {
        "description": "These credentials can be used to submit jobs to the cluster and to log into cluster
dashboards."
      }
    },
    "clusterLoginPassword": {
```

Demo

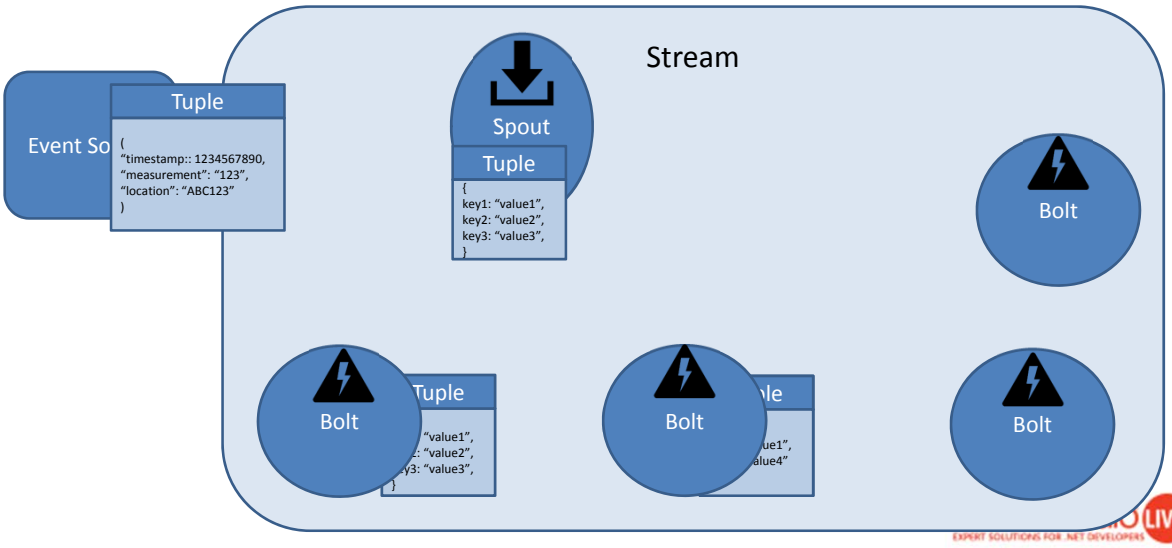
Storm

- Apache Storm is a distributed, fault-tolerant, open-source computation system that allows you to process data in real-time with Hadoop.
- Apache Storm on HDInsight allows you to create distributed, real-time analytics solutions in the Azure environment by using Apache Hadoop.
- Storm solutions can also provide guaranteed processing of data, with the ability to replay data that was not successfully processed the first time.
- Ability to write Storm components in **C#, JAVA and Python**.
- Azure Scale up or Scale down without an impact for running Storm topologies.
- Ease of provision and use in Azure portal.
- Visual Studio project templates for Storm apps

Storm

- Apache Storm apps are submitted as Topologies.
- A topology is a graph of computation that processes streams
- Stream: An unbound collection of tuples. Streams are produced by spouts and bolts, and they are consumed by bolts.
- Tuple: A named list of dynamically typed values.
- Spout: Consumes data from a data source and emits one or more streams.
- Bolt: Consumes streams, performs processing on tuples, and may emit streams. Bolts are also responsible for writing data to external storage, such as a queue, HDInsight, HBase, a blob, or other data store.
- Nimbus: JobTracker in Hadoop that distribute jobs, monitoring failures.

Apache Storm Topology



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APACHE HBASE

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HBase

- Apache HBase is an open-source, **NoSQL** database that is built on Hadoop and modeled after Google BigTable.
- HBase provides random access and strong consistency for large amounts of **unstructured** and **semistructured** data in a **schemaless** database organized by **column families**
- Data is stored in the rows of a table, and data within a row is grouped by column family.
- The open-source code scales **linearly** to handle **petabytes** of data on thousands of nodes. It can rely on data redundancy, batch processing, and other features that are provided by distributed applications in the Hadoop ecosystem.

HBase

- HBase Commands:
  - create ➔ Equivalent to create table in T-SQL
  - get ➔ Equivalent to select statements in T-SQL
  - put ➔ Equivalent to update, Insert statement in T-SQL
  - scan ➔ Equivalent to select (no where condition) in T-SQL
  - delete ➔ Equivalent to delete in T-SQL
- **HBase shell** is your query tool to execute in CRUD commands to a HBase cluster.
- Data can also be managed using the **HBase C# API**, which provides a client library on top of the **HBase REST API**.
- An HBase database can also be queried by using **Hive**.

HBase

Column family “a”

Column family “b”

Column family “c”

RowKey	a:1	a:2	a:3	a:4	b:1	b:2	c:numA
982069	10	20	30	40	5	7	4
926025	9	11	21		4	9	3
254114	11	15	22	35	7	11	4
881514	8	14			2	3	2

HBase

Column family “temperature”

Column family “pressure”

Column family “avg_temp”

RowKey	a:1	a:2	a:3	a:4	b:1	b:2	c:numA
982069	10	20	30	40	5	7	4
926025	9	11	21		4	9	3
254114	11	15	22	35	7	11	4
881514	8	14			2	3	2

Demo

Hive

- Apache Hive is a **data warehouse system for Hadoop**, which enables data summarization, querying, and analysis of data by using **HiveQL** (a query language similar to SQL).
- Hive understands how to work with structured and semi-structured data, such as text files where the fields are delimited by specific characters.
- Hive also supports custom **serializer/deserializers** for complex or irregularly structured data.
- Hive can also be extended through **user-defined functions (UDF)**.
- A UDF allows you to implement functionality or logic that isn't easily modeled in HiveQL.

HiveQL

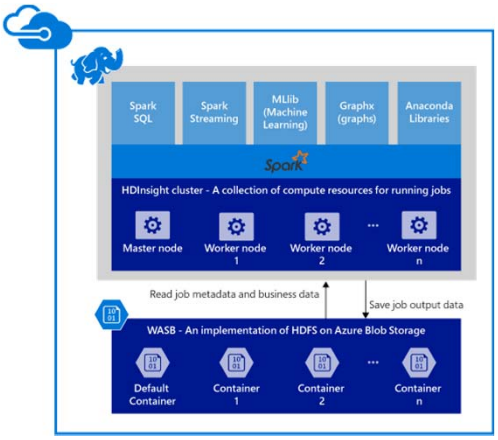
```
# Number of Records
SELECT COUNT(1) FROM www_access;

# Number of Unique IPs
SELECT COUNT(1) FROM ( \
  SELECT DISTINCT ip FROM www_access \
) t;

# Number of Unique IPs that Accessed the Top Page
SELECT COUNT(distinct ip) FROM www_access \
  WHERE url='/';

# Number of Accesses per Unique IP
SELECT ip, COUNT(1) FROM www_access \
  GROUP BY ip LIMIT 30;

# Unique IPs Sorted by Number of Accesses
SELECT ip, COUNT(1) AS cnt FROM www_access \
  GROUP BY ip
  ORDER BY cnt DESC LIMIT 30;

# Number of Accesses After a Certain Time
SELECT COUNT(1) FROM www_access \
  WHERE TD_TIME_RANGE(time, "2011-08-19", NULL, "PDT")
```

Apache Spark

- Interactive manipulation and visualization of data
  - Scala, Python, and R Interactive Shells
  - Jupyter Notebook with PySpark (Python) and Spark (Scala) kernels provide in-browser interaction
- Unified platform for processing multiple workloads
  - Real-time processing, Machine Learning, Stream Analytics, Interactive Querying, Graphing
- Leverages in-memory processing for really big data
  - Resilient distributed datasets (RDDs)
  - APIs for processing large datasets
  - Up to 100x faster than MapReduce

Spark Components on HDInsight

- Spark Core
  - Includes Spark SQL, Spark Streaming, GraphX, and MLlib
- Anaconda
- Livy
- Jupyter Notebooks
- ODBC Driver for connecting from BI tools (Power BI, Tableau)



Jupyter Notebooks on HDInsight

- Browser-based interface for working with text, code, equations, plots, graphics, and interactive controls in a single document.
- 

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Items of Note About HDInsight

- There is no “suspend” on HDInsight clusters
  - Provision the cluster, do work, then delete the cluster to avoid unnecessary charges
  - Storage can be decoupled from the cluster and reused across deployments
- Can deploy from the portal, but often scripted in practice
  - Easier/repeatable creation and deletion

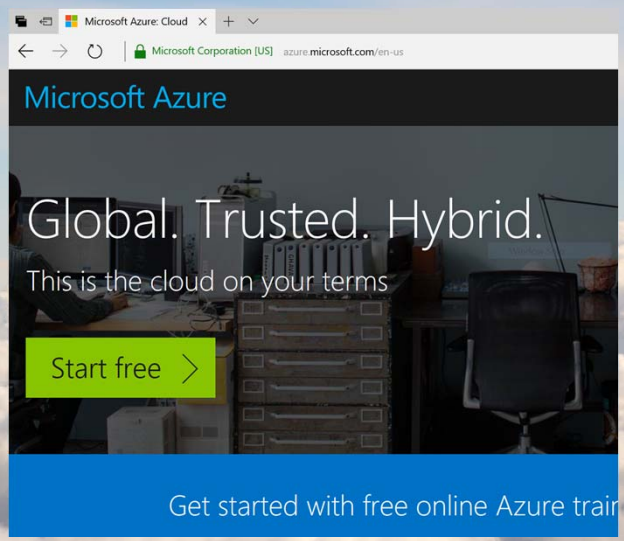
Links

www.slideshare.net/dgiard/big-data-on-azure-70554456

github.com/MSFTImagine/computerscience/tree/master/Workshop/7.%20HDInsight

Get Started

azure.com




Thank you!
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