Implementing Real-Time Analysis with Hadoop in Azure HDInsight

01 | Using HBase for NoSQL Data

Microsoft

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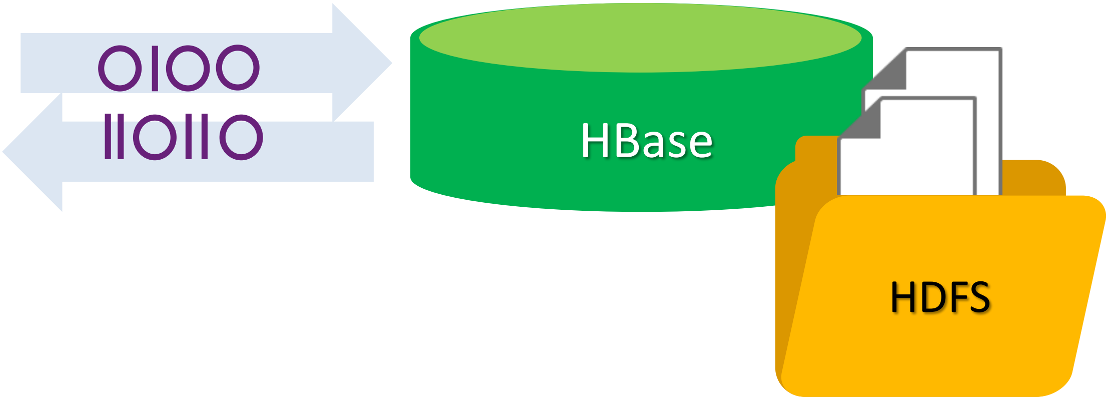
- What is Apache HBase?
- How is HBase Supported in Azure HDInsight?
- How Does HBase Store Data?
- How Do You Work with an HBase Table?
- How Do You Bulk Load Data into HBase?
- How Do You Query HBase Tables from Hive?
- How Do You Query HBase Tables using SQL?
- How Do You Build an HBase Client?

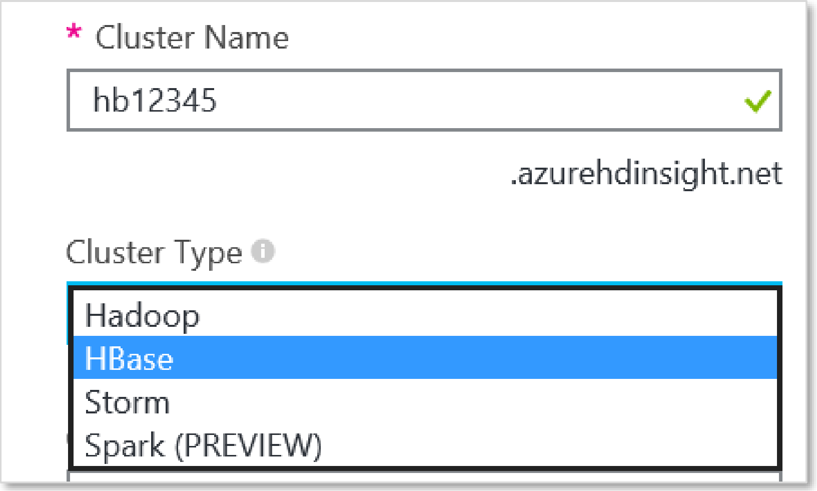
What is Apache HBase?



- A low-latency, NoSQL database built on Hadoop
- Modeled on Google's BigTable
- HBase stores data in StoreFiles on HDFS

How is HBase Supported in Azure HDInsight?

- HDInsight supports an **HBase** cluster type
  - Choose Cluster Type in the Azure Portal
- Can be provisioned in a virtual network



* Cluster Name

hb12345 ✓

.azurehdinsight.net

Cluster Type

Hadoop

HBase

Storm

Spark (PREVIEW)

DEMO

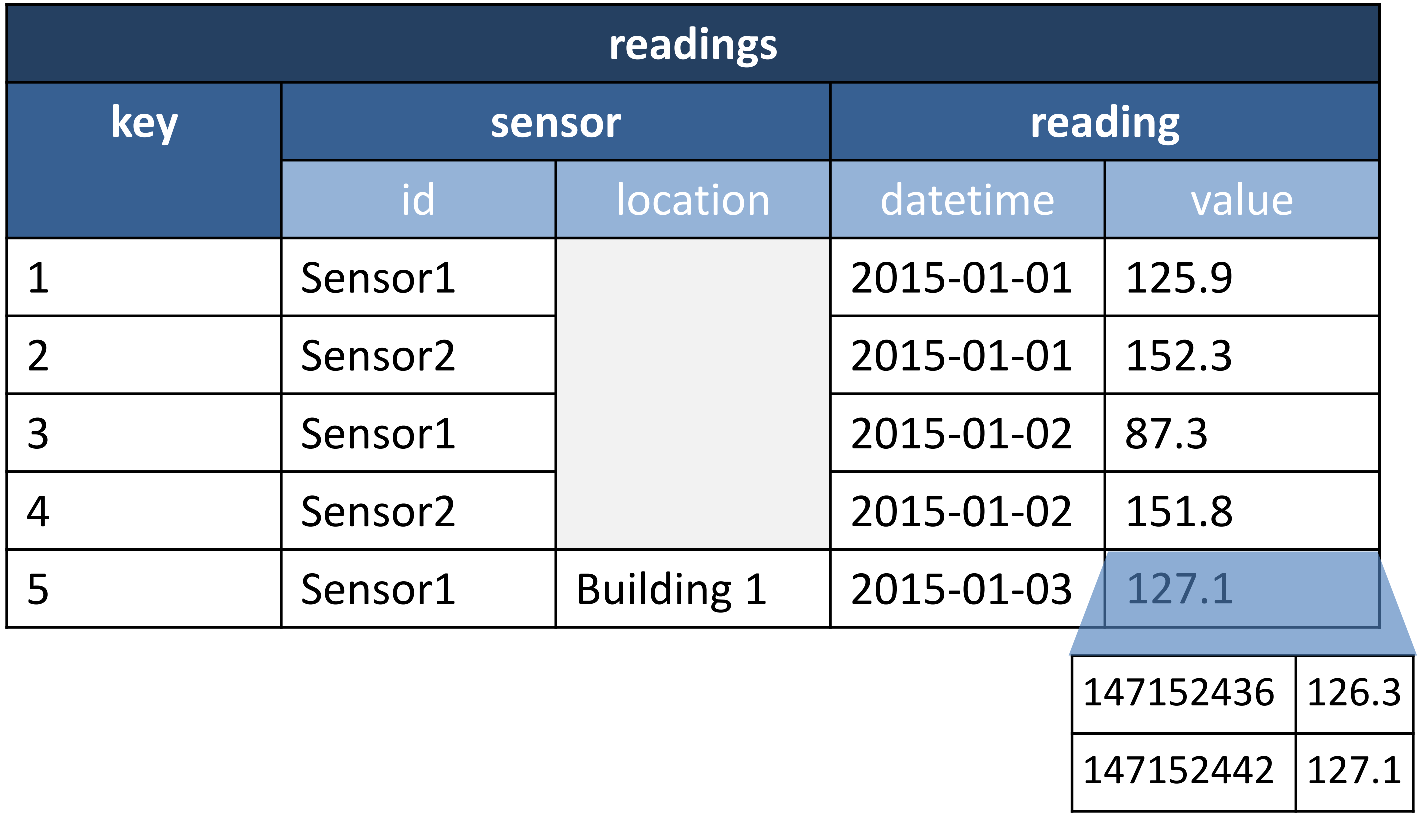
Provisioning an HBase Cluster

How Does HBase Store Data?

- Data is stored as key-value pairs
- Table schema arranges values into *column families*
- Column family schema is flexible
- Columns are row-specific

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2		2015-01-01	152.3
3	Sensor1		2015-01-02	87.3
4	Sensor2		2015-01-02	151.8
5	Sensor1	Building 1	2015-01-03	126.3

- Cells in a table are versioned
- Each versioned cell value is indicated by a timestamp



readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2		2015-01-01	152.3
3	Sensor1		2015-01-02	87.3
4	Sensor2		2015-01-02	151.8
5	Sensor1	Building 1	2015-01-03	127.1

147152436	126.3
147152442	127.1

How Do You Work with an HBase Table?

```
create 'readings', 'sensor', 'reading'
```

readings		
key	sensor	reading

```
put 'readings', '2', 'reading:value', '157.6'
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2	Building 2	2015-01-01	157.6

```
get 'readings', '2'
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2	Building 2	2015-01-01	157.6

COLUMN	CELL
sensor:id	timestamp=142361, value=Sensor2
sensor:location	timestamp=142366, value=Building 2
reading:datetime	timestamp=142363, value=2015-01-01
reading:value	timestamp=142381, value=157.6

```
get 'readings', '2', {COLUMN => [reading:value]}
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2	Building 2	2015-01-01	157.6

COLUMN	CELL
reading:value	timestamp=142379, value=152.3

```
get 'readings', '2', {TIMERANGE => [0,142380]}
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2	Building 2	2015-01-01	157.6

COLUMN	CELL
sensor:id	timestamp=142361, value=Sensor2
sensor:location	timestamp=142366, value=Building 2
reading:datetime	timestamp=142363, value=2015-01-01
reading:value	timestamp=142379, value=152.3

```
scan 'readings'
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2	Building 2	2015-01-01	157.6

ROW	COLUMN+CELL
1	column=sensor:id, timestamp=142356, value=Sensor1
1	column=reading:datetime, timestamp=142357, value=2015-01-01
1	column=reading:value, timestamp=142359, value=125.9
2	column=sensor:id, timestamp=142361, value=Sensor2
2	column=sensor:location, timestamp=142366, value=Building 2
2	column=reading:datetime, timestamp=142363, value=2015-01-01
2	column=reading:value, timestamp=142381, value=157.6

```
scan 'readings', {LIMIT => 1}
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2	Building 2	2015-01-01	157.6
3	Sensor1	Building 1	2015-01-02	87.3

ROW	COLUMN+CELL
1	column=sensor:id, timestamp=142356, value=Sensor1
1	column=reading:datetime, timestamp=142357, value=2015-01-01
1	column=reading:value, timestamp=142359, value=125.9

```
scan 'readings', {STARTROW=>'2', STOPROW=>'3'}
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2	Building 2	2015-01-01	157.6

ROW	COLUMN+CELL
2	column=sensor:id, timestamp=142361, value=Sensor2
2	column=sensor:location, timestamp=142366, value=Building 2
2	column=reading:datetime, timestamp=142363, value=2015-01-01
2	column=reading:value, timestamp=142375, value=157.6
3	column=sensor:id, timestamp=142371, value=Sensor1
3	column=sensor:location, timestamp=142372, value=Building 1
3	column=reading:datetime, timestamp=142373, value=2015-01-02

```
delete 'readings', '2', 'sensor:location'
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2		2015-01-01	157.6
3	Sensor1	Building 1	2015-01-02	87.3
4	Sensor2	Building 2	2015-01-02	151.8
5	Sensor1	Building 1	2015-01-03	126.3
6	…			

```
deleteall 'readings', '4'
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2		2015-01-01	157.6
3	Sensor1	Building 1	2015-01-02	87.3
5	Sensor1	Building 1	2015-01-03	126.3
6	…			

```
drop 'readings'
```

readings				
key	sensor		reading	
	id	location	datetime	value
1	Sensor1		2015-01-01	125.9
2	Sensor2		2015-01-01	157.6
3	Sensor1	Building 1	2015-01-02	87.3
5	Sensor1	Building 1	2015-01-03	126.3
6	…			

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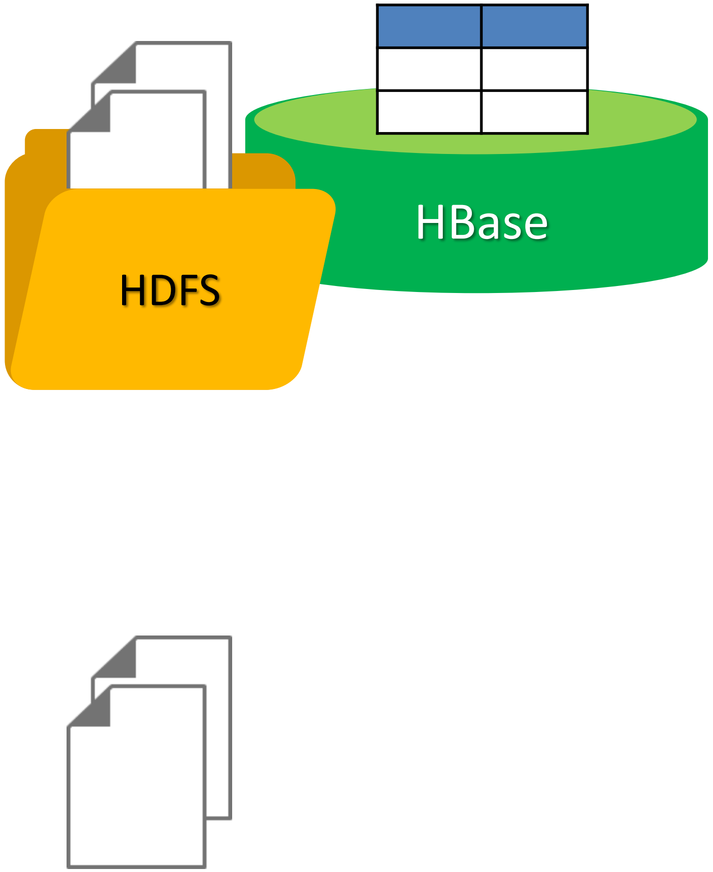
Working with an HBase Table

How Do You Bulk Load Data into HBase?

1. Upload data to HDFS
   - in Azure Storage
2. Import into a StoreFile
3. Load The StoreFile to an HBase table



`ImportTSV`

`LoadIncrementalHFiles`

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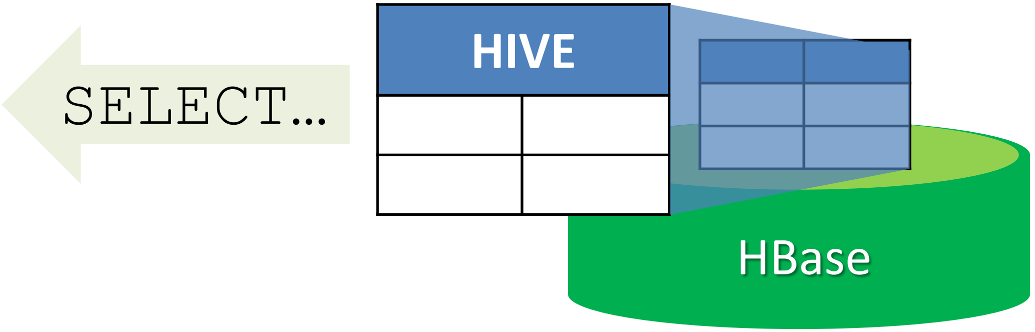
Bulk Loading Data into an HBase Table

How Do You Query HBase Tables from Hive?



```
CREATE EXTERNAL TABLE hivetable
(key STRING, col1 STRING, col2 STRING)
STORED BY 'org.apache.hadoop.hive.hbase.HBaseStoragehandler'
WITH SERDEPROPERTIES
('hbase.columns.mapping' = ':key,cf:col1, cf:col2')
TBLPROPERTIES('hbase.table.name' = 'hbtable')
```

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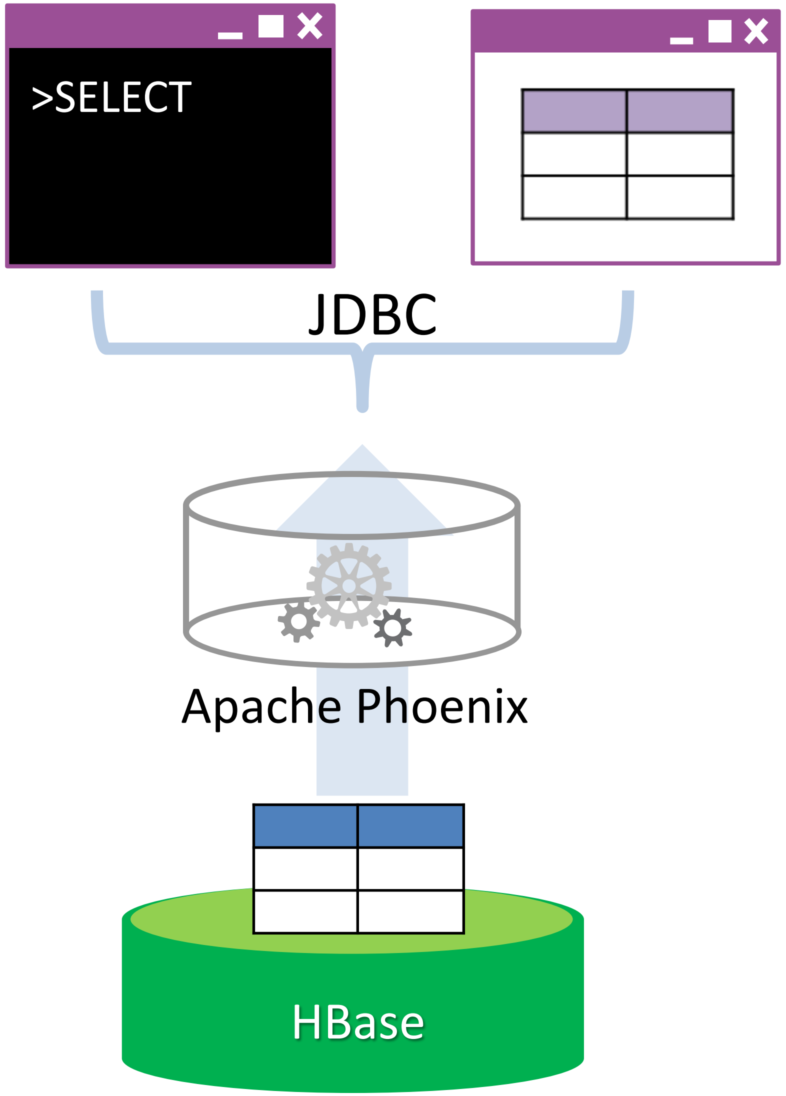
Querying HBase from Hive

How Do You Query HBase Tables using SQL?

- Apache Phoenix
  - Relational database engine built on HBase
  - Included in Azure HDInsight
- JDBC Interface
  - Clients connect using JDBC
  - SQLLine client included in HDInsight



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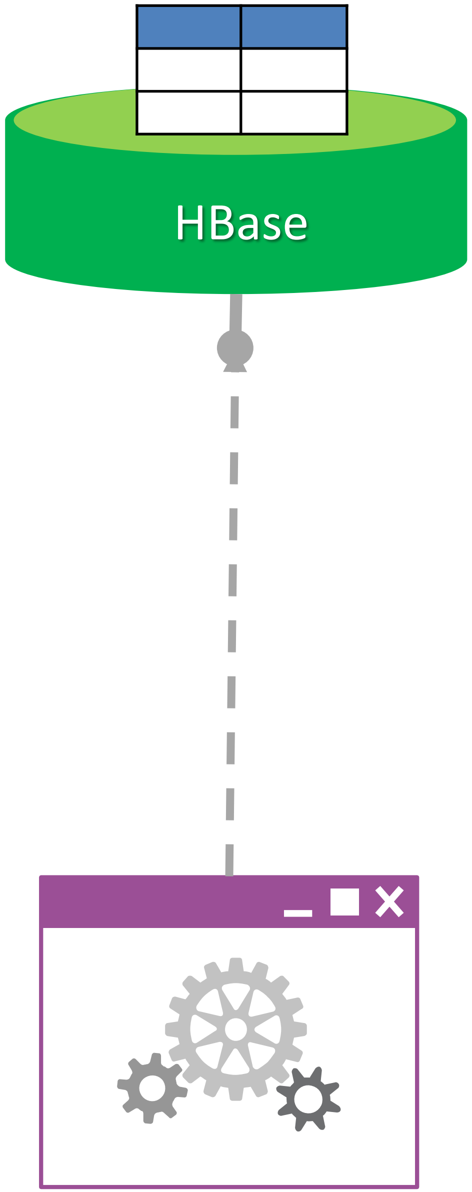
Using SQLLine to Query an HBase Table

How Do You Build an HBase Client?

- org.apache.hadoop.hbase._
  - Java libraries for HBase
    - HBaseConfiguration
    - HTable
    - Put, Get, Scan
- HBase Rest API Client
  - .NET wrapper around HBase REST API
    - HBaseClient
    - Scanner
    - CellSet
    - Cell



DEMO

Creating an HBase Client

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