Module 4_1

HBase

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Introduction

An open source, non-relational, distributed database

HBase is an open source, non-relational, distributed database modeled after Google's BigTable and is written in Java. It is developed as part of Apache Software Foundation's Apache Hadoop project and runs on top of HDFS, providing BigTable-like capabilities for Hadoop. That is, it provides a fault-tolerant way of storing large quantities of sparse data.

HBase Features

- Hadoop database modelled after Google's BigTable
- Column oriented data store, known as Hadoop Database
- Support random real-time CRUD operations (unlike HDFS)
- NoSQL Database
- Open source, written in Java
- Run on a cluster of commodity hardware

When to use HBase?

- When you need high volume data to be stored
- Un-structured data
- Sparse data
- Column-oriented data
- Versioned data (same data template, captured at various time, time-elapse data)
- When you need high scalability

Which one to use?

- **HDFS**
  - Only append dataset (no random write)
  - Read the whole dataset (no random read)
- **HBase**
  - Need random write and/or read
  - Has thousands of operation per second on TB+ of data
- **RDBMS**
  - Data fits on one big node
  - Need full transaction support
  - Need real-time query capabilities

HBase vs. RDBMS

	HBase	RDBMS
Hardware architecture	Similar to Hadoop. Clustered commodity hardware. Very affordable.	Typically large scalable multiprocessor systems. Very expensive.
Fault Tolerance	Built into the architecture. Lots of nodes means each is relatively insignificant. No need to worry about individual node downtime.	Requires configuration of the HW and the RDBMS with the appropriate high availability options.
Typical Database Size	Terabytes to Petabytes - hundred of millions to billions of rows.	Gigabytes to Terabytes – hundred of thousands to millions of rows.
Data Layout	A sparse, distributed, persistent, multidimensional sorted map.	Rows or column oriented.
Data Types	Bytes only.	Rich data type support.
Transactions	ACID support on a single row only	Full ACID compliance across rows and tables
Query Language	API primitive commands only, unless combined with Hive or other technology	SQL
Indexes	Row-Key only unless combined with other technologies such as Hive or IBM's BigSQL	Yes
Throughput	Millions of queries per second	Thousands of queries per second

- Given this RDBMS:

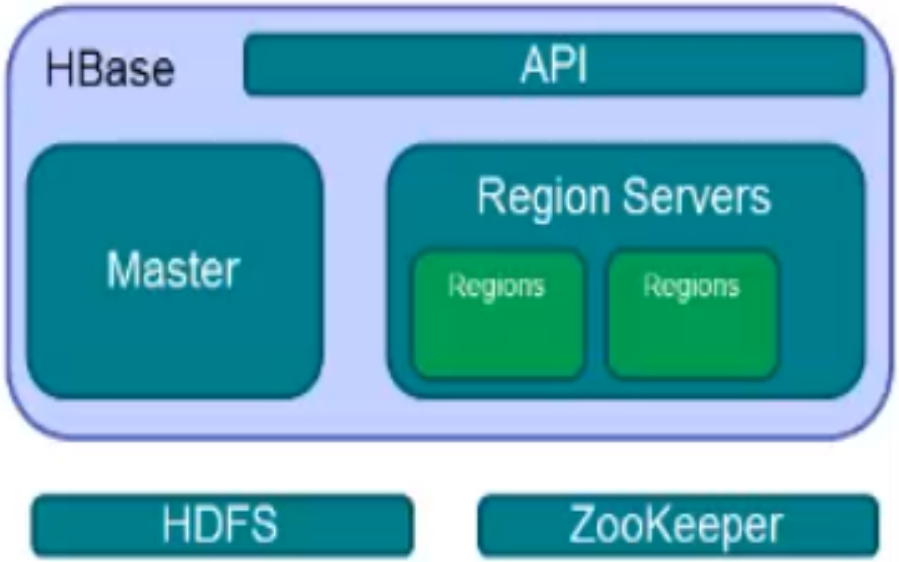
ID (Primary key)	Last name	First name	Password	Timestamp
1234	Smith	John	Hello, world!	20130710
5678	Cooper	Joyce	wysiwyg	20120825
5678	Cooper	Joyce	wisiwig	20130916

- Logical view in HBase:

Row-Key	Value (CF, Qualifier, Version)
1234	info {'lastName': 'Smith', 'firstName': 'John'} pwd {'password': 'Hello, world!'}
5678	info {'lastName': 'Cooper', 'firstName': 'Joyce'} pwd {'password: 'wysiwyg'@ts 20130916, 'password': 'wisiwig'@ts 20120825}

HBase Components

- **Region**
  - Row of table are stores
- **Region Server**
  - Hosts the tables
- **Master**
  - Coordinating the Region Servers
- **API**
  - The Java Client API
- **ZooKeeper**
- **HDFS**



HBase Shell Commands

- See the list of the tables

```
list
```

- Create a table:

```
create 'testTable', 'cf'
```

- Insert data into a table:

  Insert at rowA, column "cf:columnName" with a value of "val1"

```
put 'testTable', 'rowA', 'cf:columnName', 'val1'
```

HBase Shell Commands (Cont.)

- Retrieve data from a table:
  Retrive "rowA" from the table "testTable"
  ```
  get 'testTable', 'rowA'
  ```
- Iterate through a table:
  ```
  – scan 'testTable'
  ```
- Delete a table:
  ```
  disable 'testTable'
  drop 'testTable'
  ```

Hands-On: Running HBase

HBase shell

Row key	personal data	professional data

```
$hbase shell
hbase(main):001:0> create 'employee', 'personal data',
'professional data'
hbase(main):002:0> list
```

```
TABLE
employee
1 row(s) in 0.0310 seconds
```

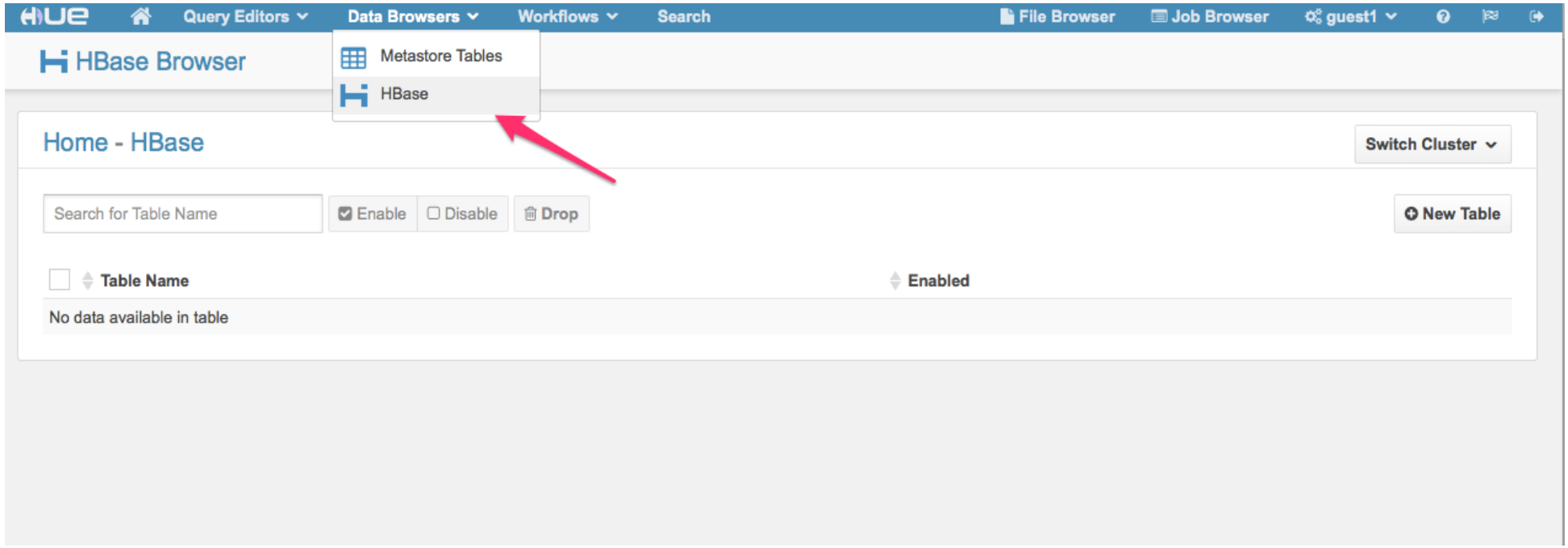
Create Data

COLUMN FAMILIES

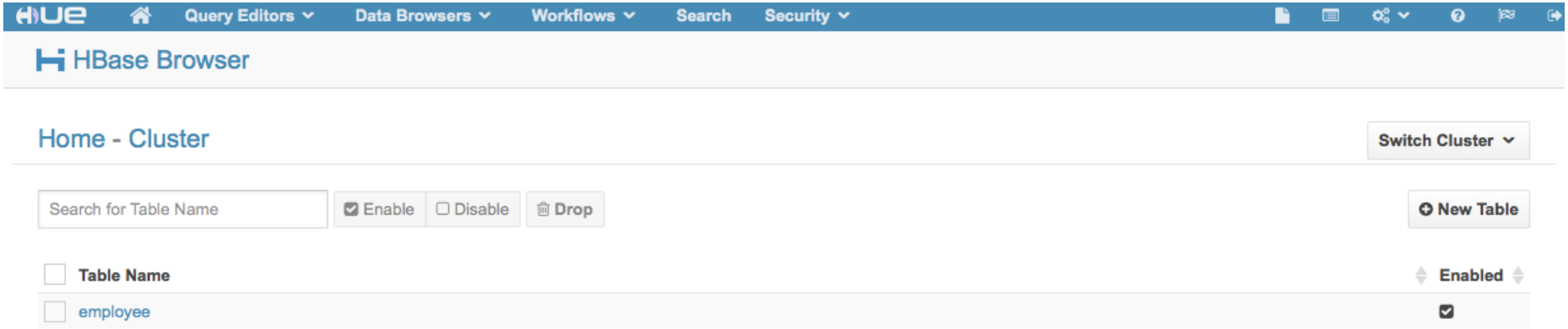
Row key	personal data		professional data	
empid	name	city	designation	salary
1	raju	hyderabad	manager	50,000
2	ravi	chennai	sr.engineer	30,000
3	rajesh	delhi	jr.engineer	25,000

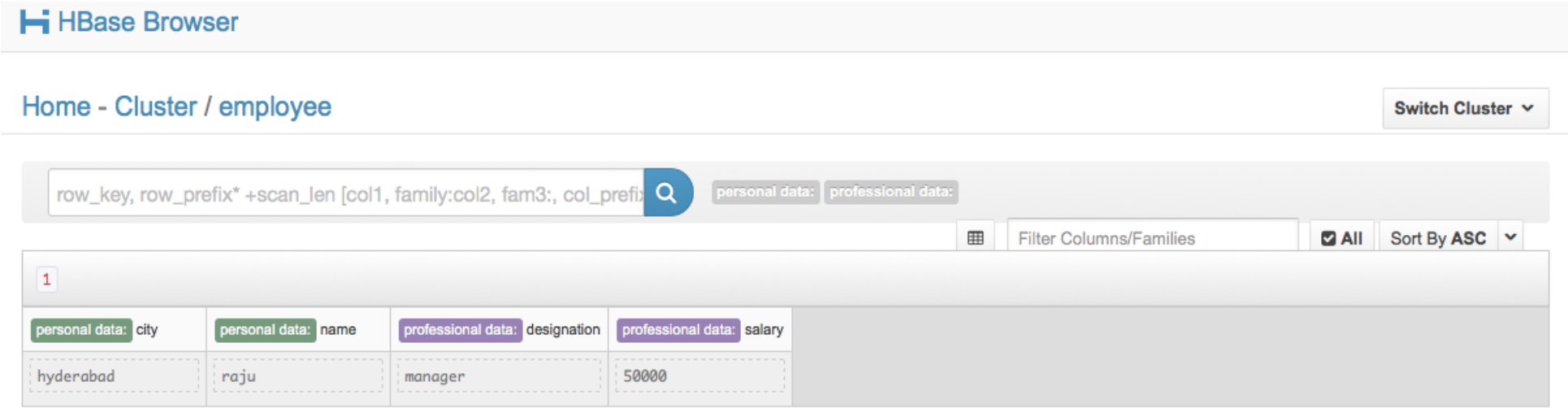
```
hbase(main):010:0> put 'employee','1','personal data:name','raju'
0 row(s) in 0.1720 seconds

hbase(main):011:0> put 'employee','1','personal data:city','hyderabad'
0 row(s) in 0.0140 seconds


hbase(main):018:0> put 'employee','1','professional data:designation','manager'
0 row(s) in 0.0110 seconds

hbase(main):019:0> put 'employee','1','professional data:salary','50000'
0 row(s) in 0.0070 seconds
```

Running HBase Browser

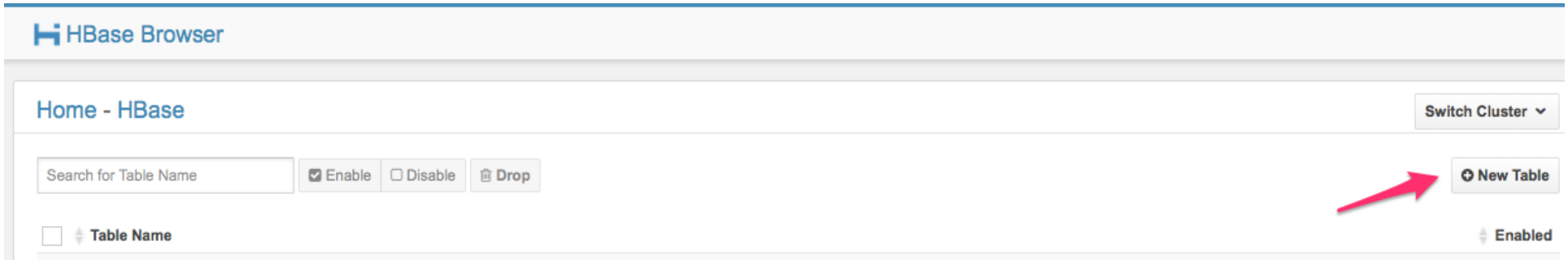


Viewing Employee Table

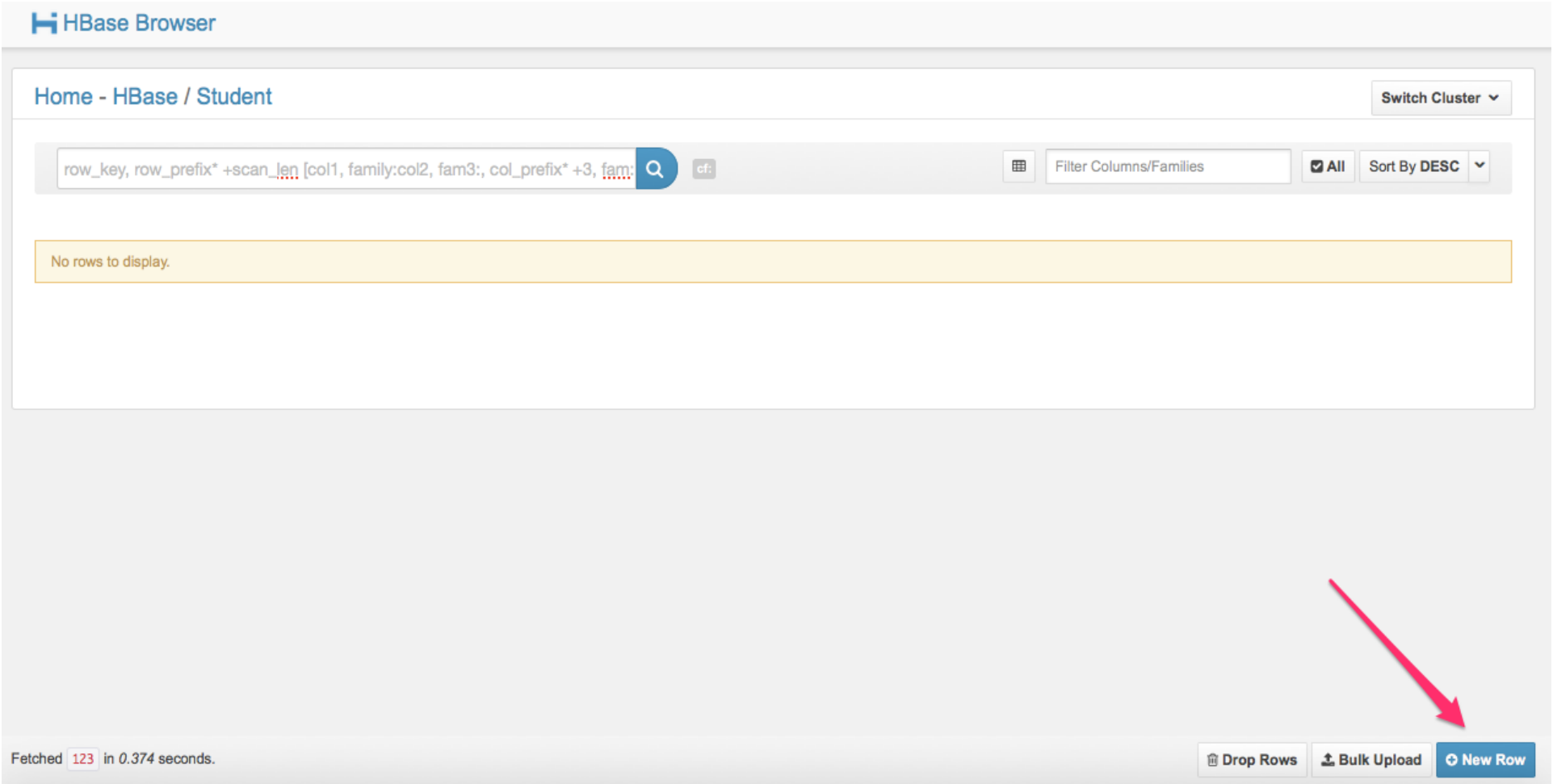




Create a table in HBase



Insert a new row in a table



Add field into a new row