大数据Hadoop高薪直通车课程

HBase 初窥使用

讲师：轩宇（北风网版权所有)

课程大纲

1 海量数据实时查询

2 HBase 设计概念

3 HBase 架构配置

4 HBase Shell使用

5 HBase 物理模型

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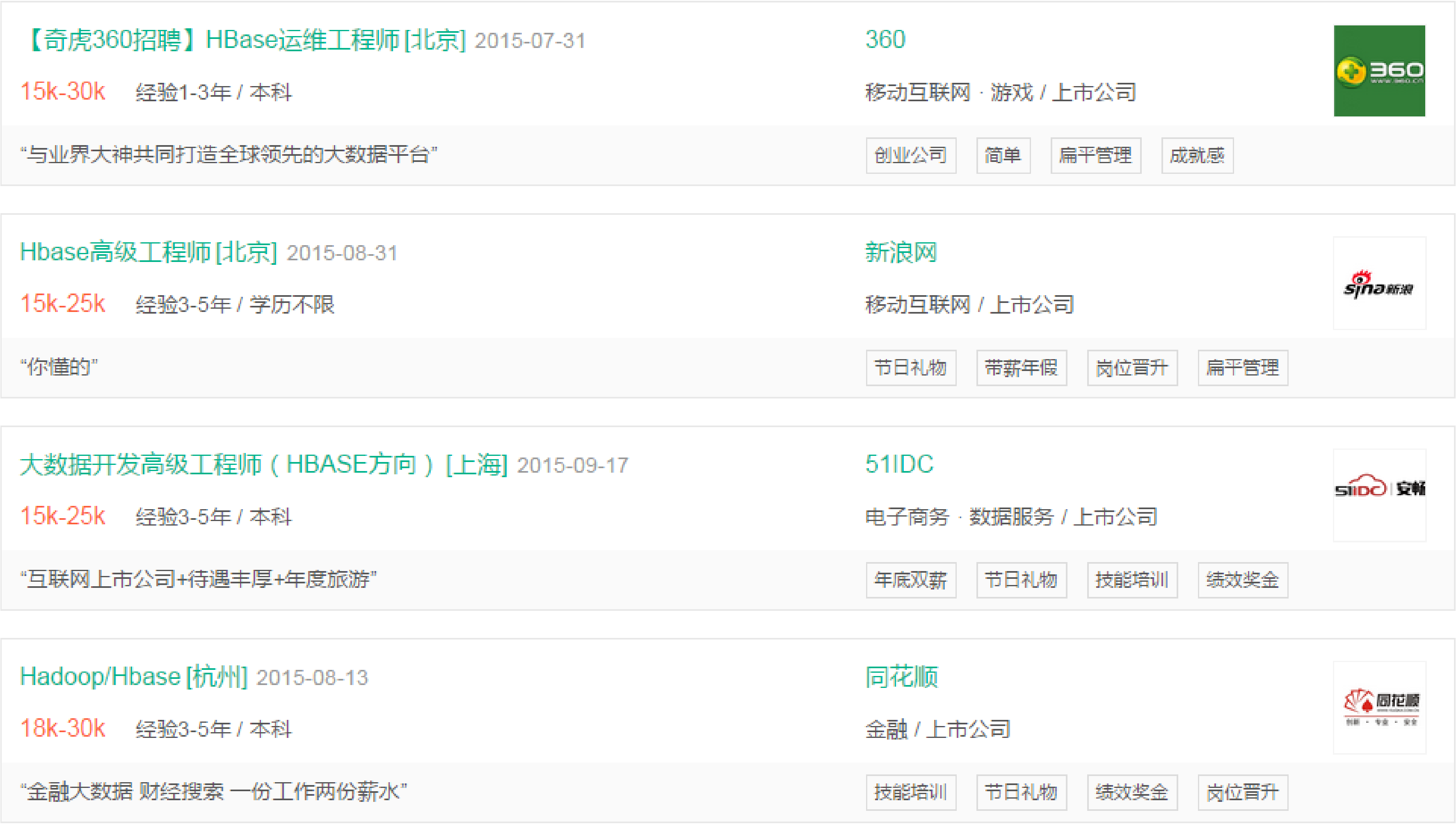
拉勾网之大数据HBase招聘需求



【奇虎360招聘】HBase运维工程师[北京] 2015-07-31

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企业海量数据查询

- 项目需求功能描述
  - 海量数据
  - 实时查询（准实时查询）
  - 场景
    - 交通数据
    - 账单数据（话费账单、银行交易账单）
    - 游戏数据
    - 电商交易数据
- 数据采集
  - sqoop（Flume）
  - Kettle
  - program（JDBC与Java API）

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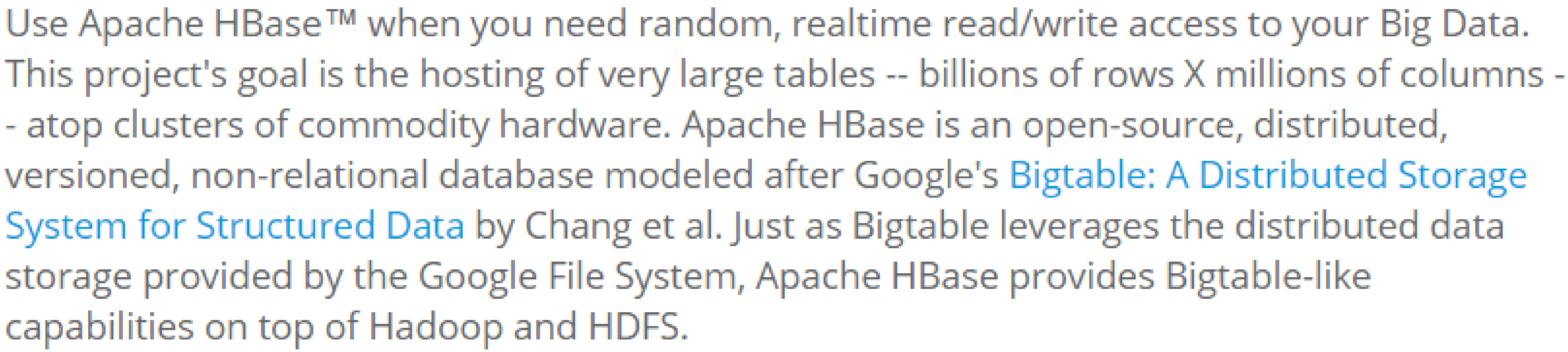
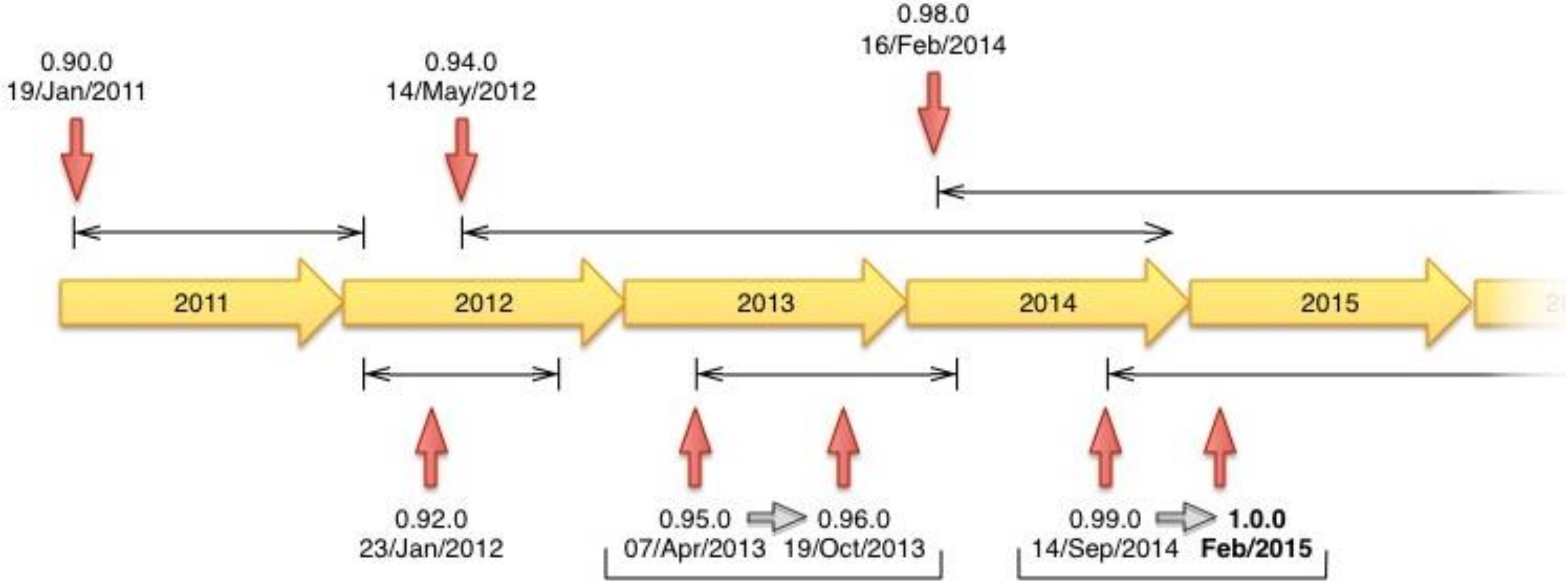
What is HBase?

Apache HBase™ is the Hadoop database, a distributed, scalable, big data store.

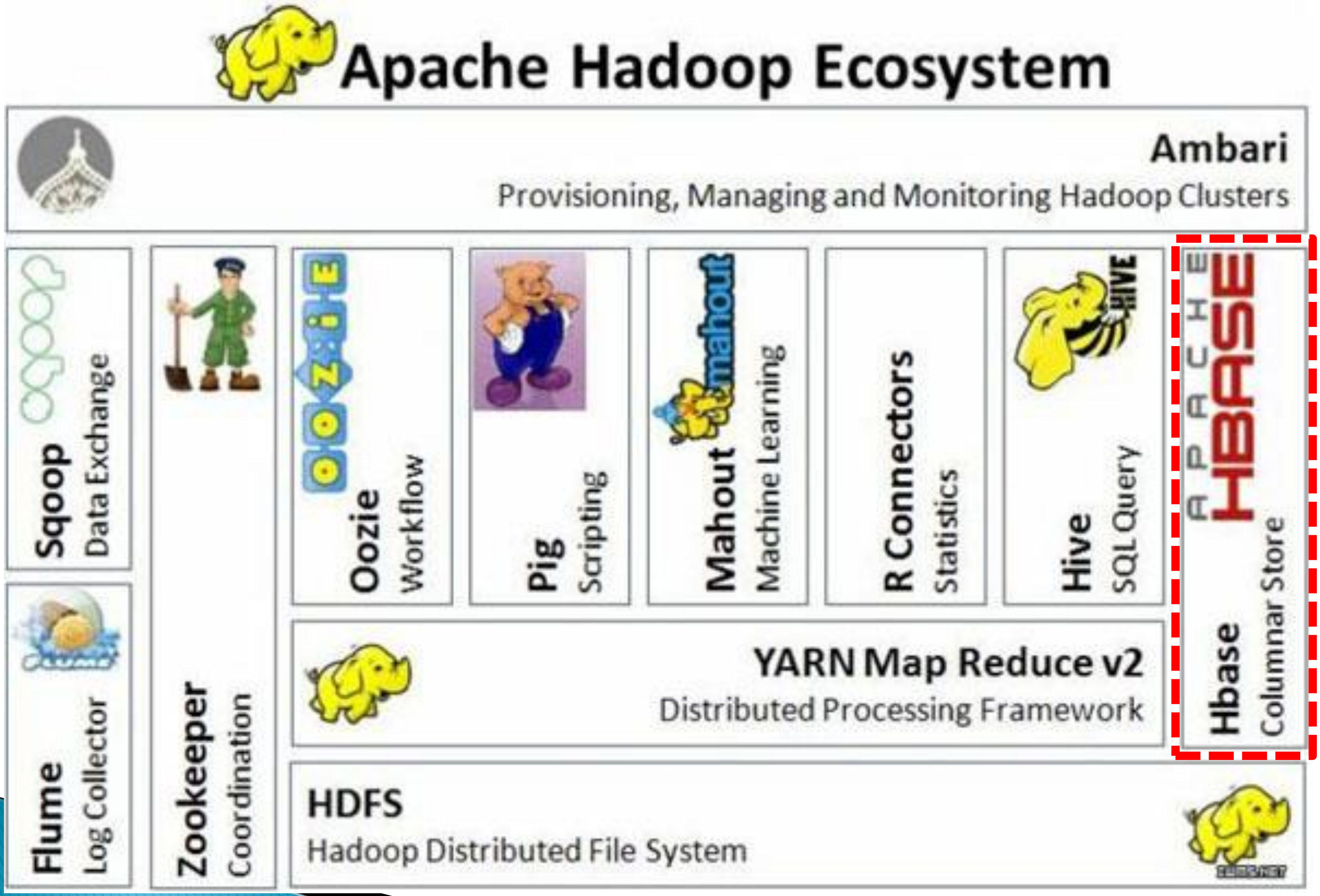


Use Apache HBase™ when you need random, realtime read/write access to your Big Data. This project's goal is the hosting of very large tables -- billions of rows X millions of columns -- atop clusters of commodity hardware. Apache HBase is an open-source, distributed, versioned, non-relational database modeled after Google's Bigtable: A Distributed Storage System for Structured Data by Chang et al. Just as Bigtable leverages the distributed data storage provided by the Google File System, Apache HBase provides Bigtable-like capabilities on top of Hadoop and HDFS.

HBase Timeline



Apache Hadoop Ecosystem



HBase Basic Concepts

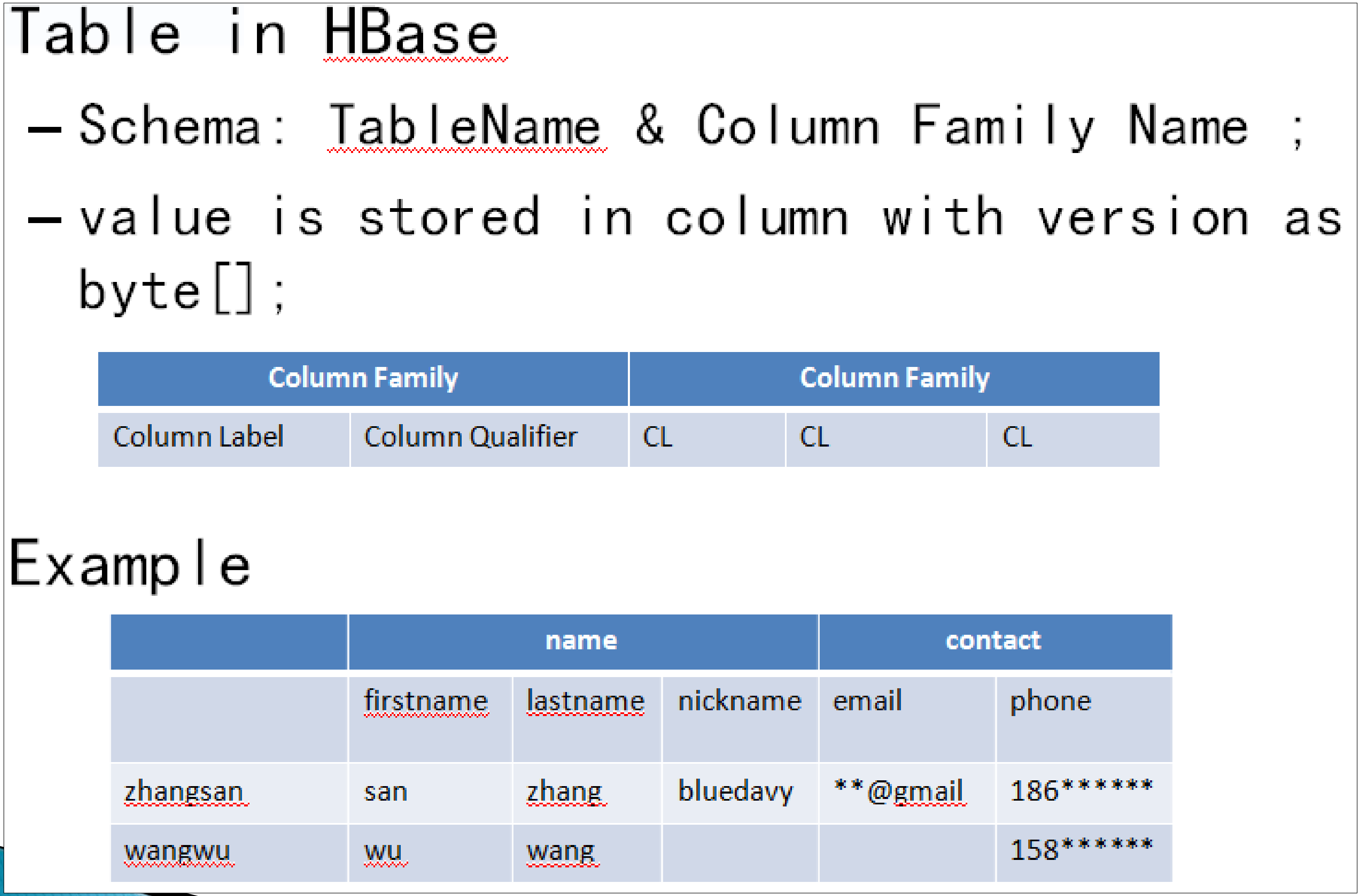


Table in HBase

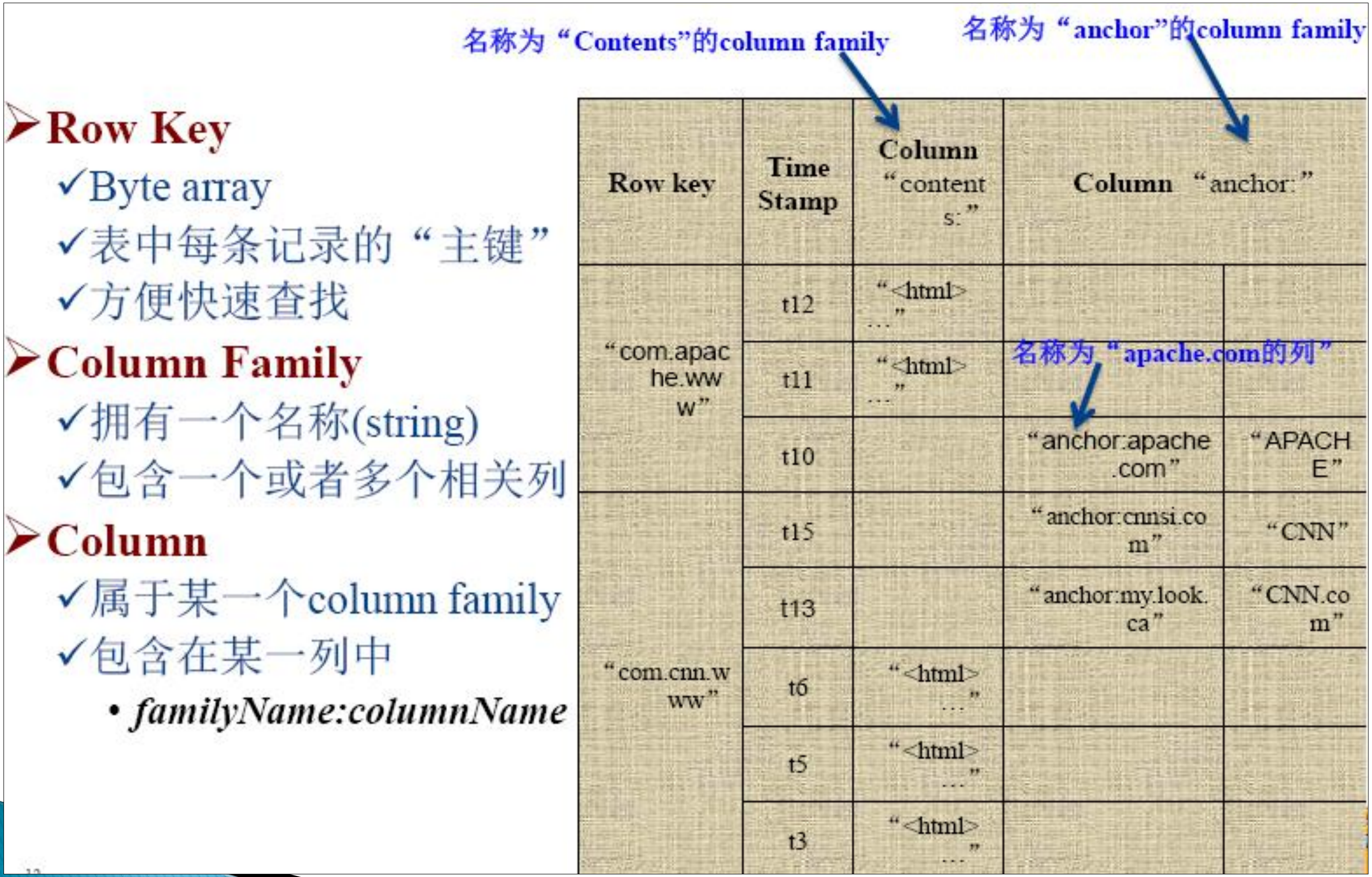
- Schema: TableName & Column Family Name ;
- value is stored in column with version as byte[];

Column Family		Column Family		
Column Label	Column Qualifier	CL	CL	CL

Example

	name			contact	
	firstname	lastname	nickname	email	phone
zhangsan	san	zhang	bluedavy	**@gmail	186******
wangwu	wu	wang			158******

Data Modeling



- **Row Key**
  - ✓Byte array
  - ✓表中每条记录的“主键”
  - ✓方便快速查找
- **Column Family**
  - ✓拥有一个名称(string)
  - ✓包含一个或者多个相关列
- **Column**
  - ✓属于某一个column family
  - ✓包含在某一列中
    - *familyName:columnName*

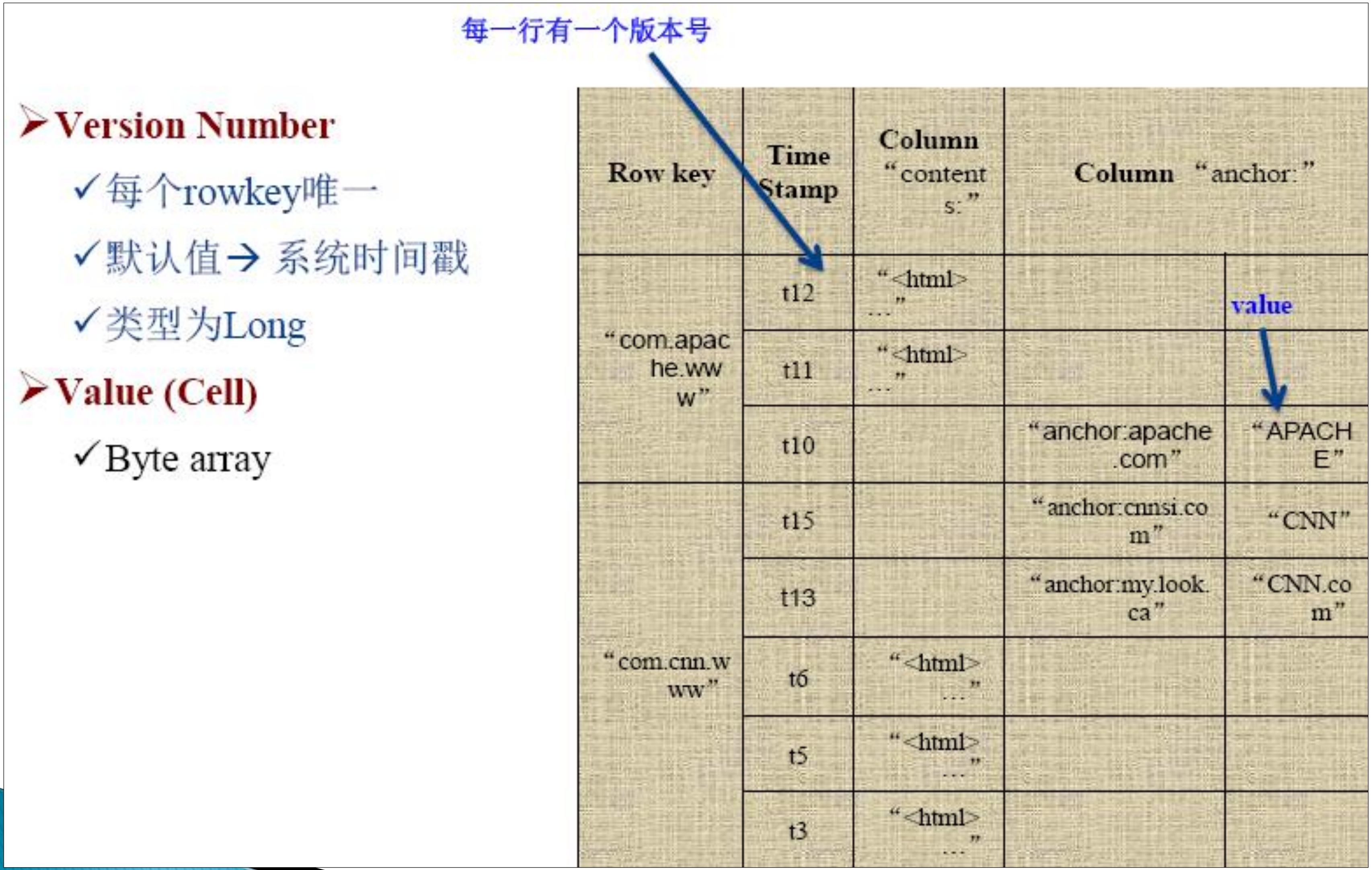
名称为“Contents”的column family

名称为“anchor”的column family

名称为“apache.com的列”

Row key	Time Stamp	Column “contents:”	Column “anchor:”	
“com.apache.www”	t12	“<html>…”		
	t11	“<html>…”		
	t10		“anchor:apache.com”	“APACHE”
“com.cnn.www”	t15		“anchor:cnnsi.com”	“CNN”
	t13		“anchor:my.look.ca”	“CNN.com”
	t6	“<html>…”		
	t5	“<html>…”		
	t3	“<html>…”		

Data Modeling



- Version Number
  - ✓每个rowkey唯一
  - ✓默认值→ 系统时间戳
  - ✓类型为Long
- Value (Cell)
  - ✓Byte array

每一行有一个版本号

value

Row key	Time Stamp	Column “contents:”	Column “anchor:”	
“com.apache.www”	t12	“<html>…”		
	t11	“<html>…”		
	t10		“anchor:apache.com”	“APACHE”
“com.cnn.www”	t15		“anchor:cnnsi.com”	“CNN”
	t13		“anchor:my.look.ca”	“CNN.com”
	t6	“<html>…”		
	t5	“<html>…”		
	t3	“<html>…”		

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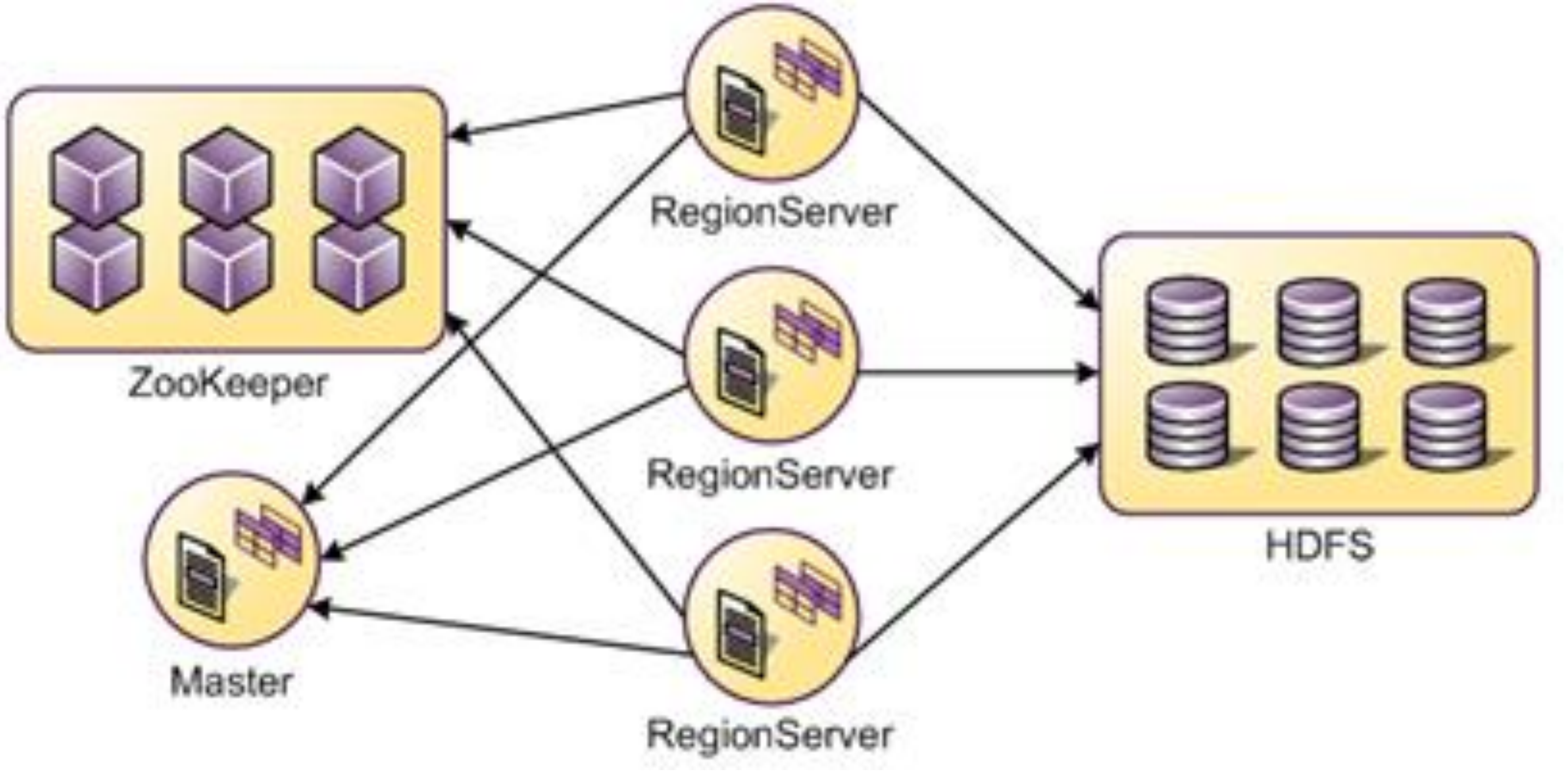
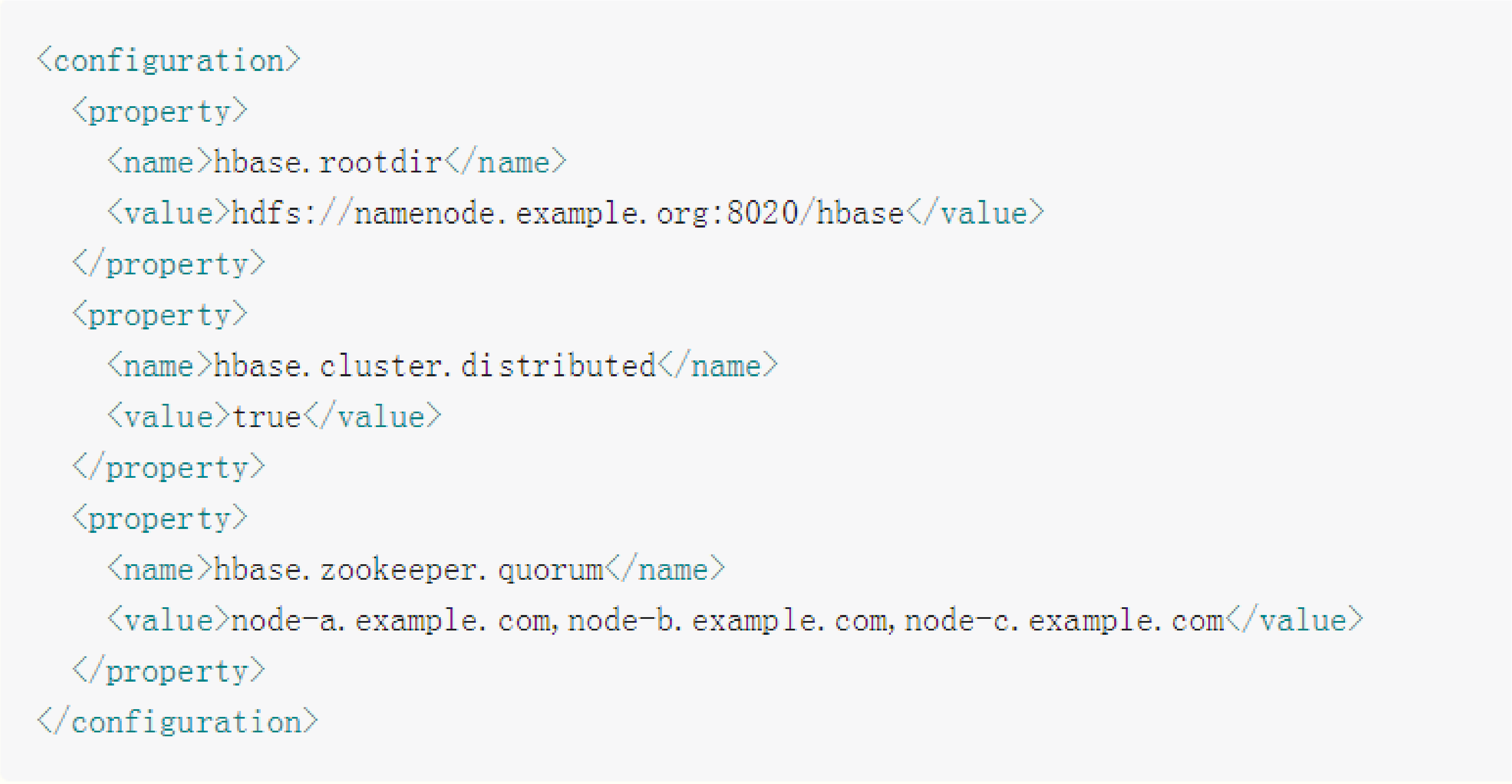
HBase 体系结构



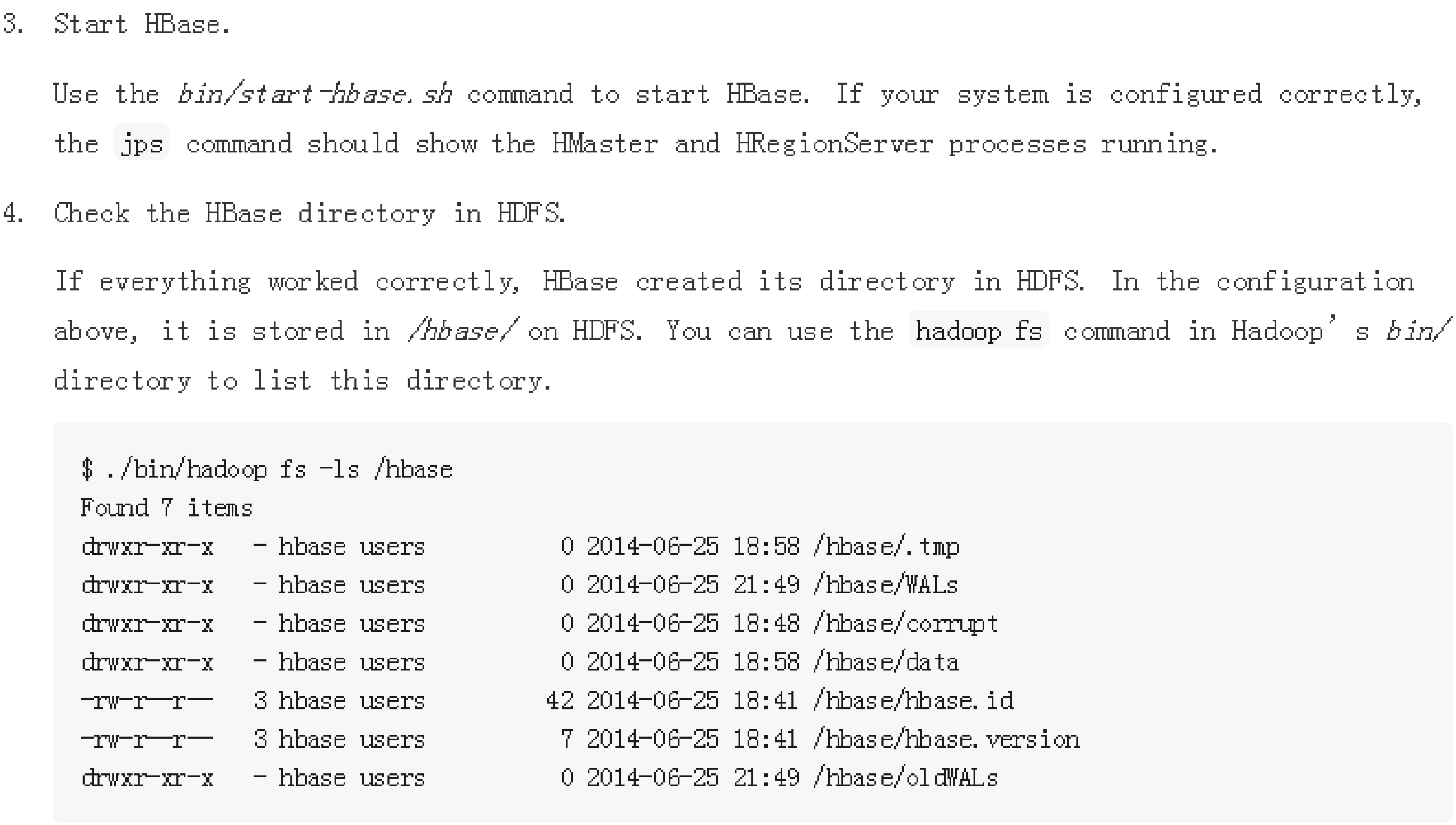
http://hbase.apache.org/book.html#quickstart

Install & Deploy



```
<configuration>
  <property>
    <name>hbase.rootdir</name>
    <value>hdfs://namenode.example.org:8020/hbase</value>
  </property>
  <property>
    <name>hbase.cluster.distributed</name>
    <value>true</value>
  </property>
  <property>
    <name>hbase.zookeeper.quorum</name>
    <value>node-a.example.com,node-b.example.com,node-c.example.com</value>
  </property>
</configuration>
```

Install & Deploy



3. Start HBase.

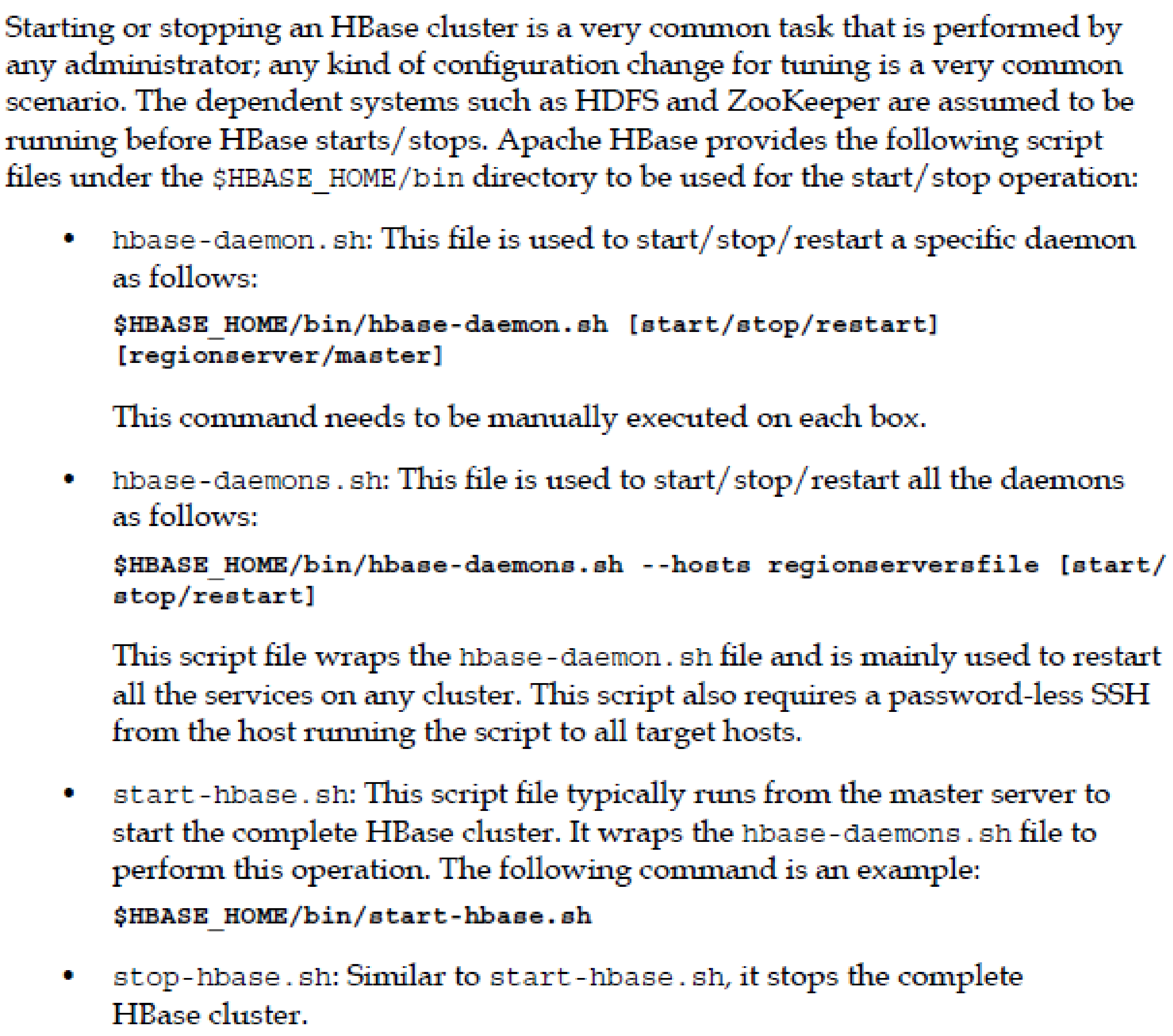
   Use the *bin/start-hbase.sh* command to start HBase. If your system is configured correctly, the `jps` command should show the HMaster and HRegionServer processes running.

4. Check the HBase directory in HDFS.

   If everything worked correctly, HBase created its directory in HDFS. In the configuration above, it is stored in */hbase/* on HDFS. You can use the `hadoop fs` command in Hadoop’s *bin/* directory to list this directory.

```
$ ./bin/hadoop fs -ls /hbase
Found 7 items
drwxr-xr-x   - hbase users          0 2014-06-25 18:58 /hbase/.tmp
drwxr-xr-x   - hbase users          0 2014-06-25 21:49 /hbase/WALs
drwxr-xr-x   - hbase users          0 2014-06-25 18:48 /hbase/corrupt
drwxr-xr-x   - hbase users          0 2014-06-25 18:58 /hbase/data
-rw-r--r--   3 hbase users         42 2014-06-25 18:41 /hbase/hbase.id
-rw-r--r--   3 hbase users          7 2014-06-25 18:41 /hbase/hbase.version
drwxr-xr-x   - hbase users          0 2014-06-25 21:49 /hbase/oldWALs
```

The Start/stop HBase cluster



Starting or stopping an HBase cluster is a very common task that is performed by any administrator; any kind of configuration change for tuning is a very common scenario. The dependent systems such as HDFS and ZooKeeper are assumed to be running before HBase starts/stops. Apache HBase provides the following script files under the `$HBASE_HOME/bin` directory to be used for the start/stop operation:

- `hbase-daemon.sh`: This file is used to start/stop/restart a specific daemon as follows:

  ```
  $HBASE_HOME/bin/hbase-daemon.sh [start/stop/restart]
  [regionserver/master]
  ```

  This command needs to be manually executed on each box.

- `hbase-daemons.sh`: This file is used to start/stop/restart all the daemons as follows:

  ```
  $HBASE_HOME/bin/hbase-daemons.sh --hosts regionserversfile [start/
  stop/restart]
  ```

  This script file wraps the `hbase-daemon.sh` file and is mainly used to restart all the services on any cluster. This script also requires a password-less SSH from the host running the script to all target hosts.

- `start-hbase.sh`: This script file typically runs from the master server to start the complete HBase cluster. It wraps the `hbase-daemons.sh` file to perform this operation. The following command is an example:

  ```
  $HBASE_HOME/bin/start-hbase.sh
  ```

- `stop-hbase.sh`: Similar to `start-hbase.sh`, it stops the complete HBase cluster.

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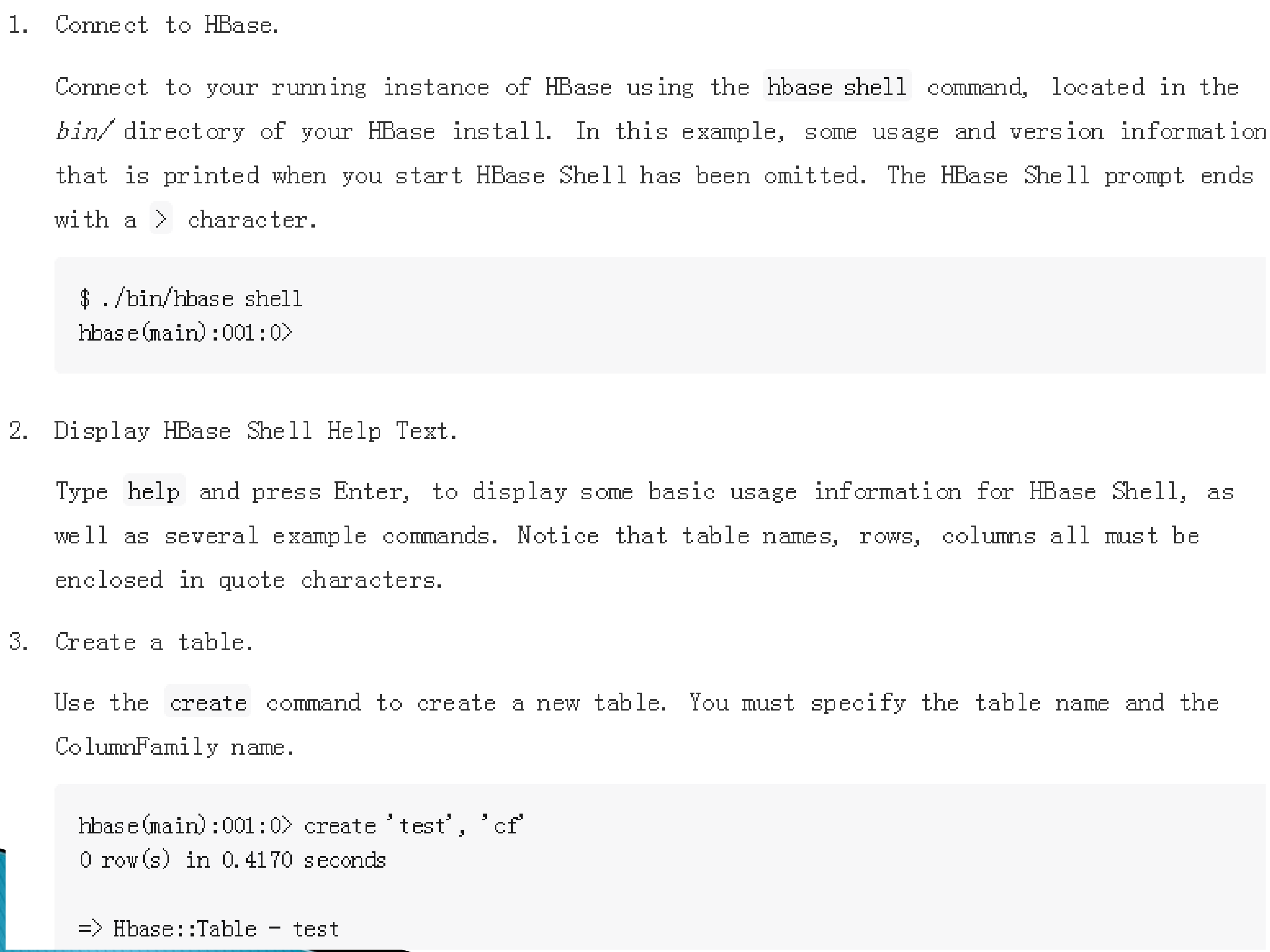
Use HBase For the First Time



1. Connect to HBase.

   Connect to your running instance of HBase using the `hbase shell` command, located in the *bin/* directory of your HBase install. In this example, some usage and version information that is printed when you start HBase Shell has been omitted. The HBase Shell prompt ends with a `>` character.

   ```
   $ ./bin/hbase shell
   hbase(main):001:0>
   ```

2. Display HBase Shell Help Text.

   Type `help` and press Enter, to display some basic usage information for HBase Shell, as well as several example commands. Notice that table names, rows, columns all must be enclosed in quote characters.

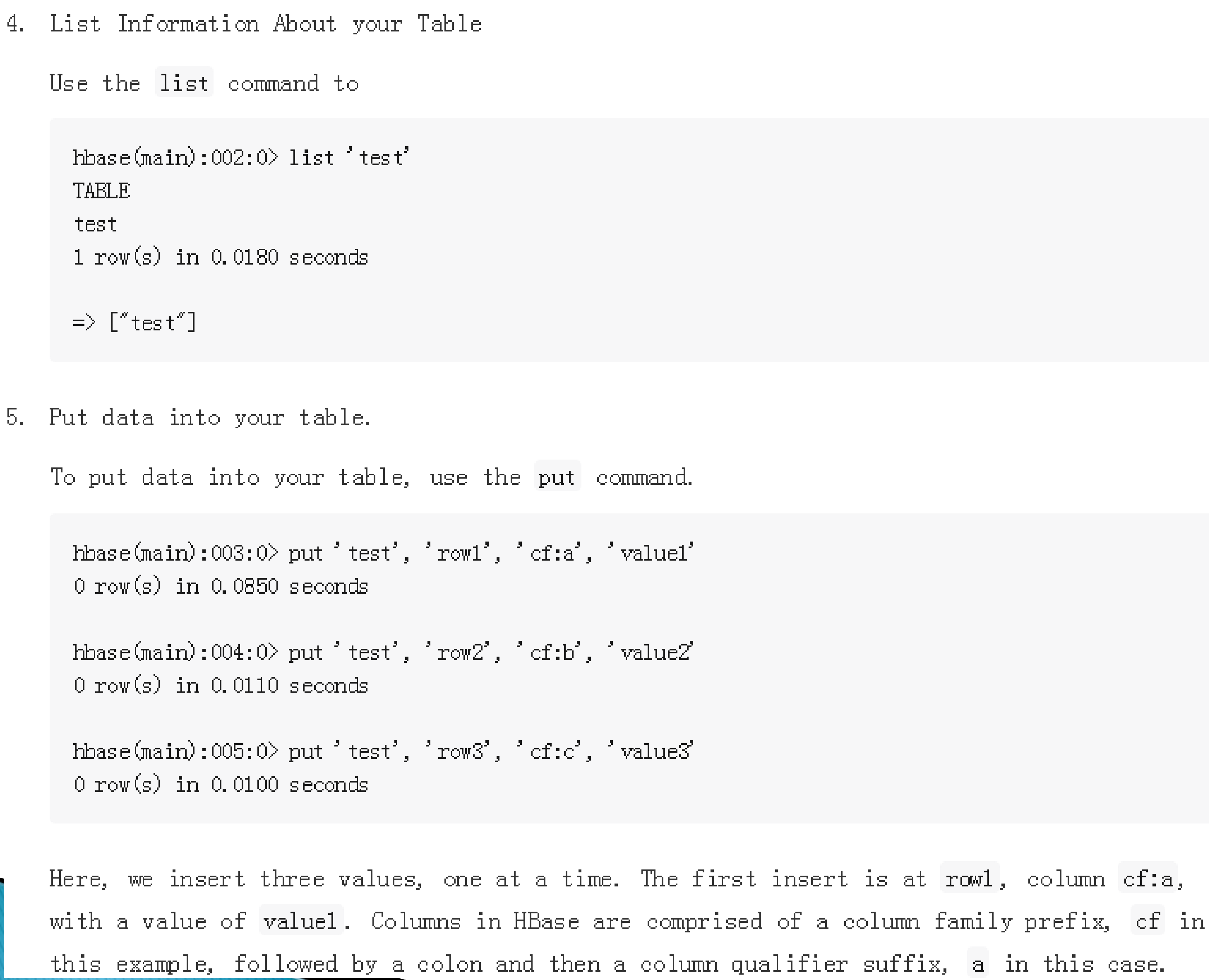
3. Create a table.

   Use the `create` command to create a new table. You must specify the table name and the ColumnFamily name.

   ```
   hbase(main):001:0> create 'test', 'cf'
   0 row(s) in 0.4170 seconds

   => Hbase::Table - test
   ```

Use HBase For the First Time



4. List Information About your Table

Use the `list` command to

```
hbase(main):002:0> list ’test’
TABLE
test
1 row(s) in 0.0180 seconds

=> [”test”]
```

5. Put data into your table.

To put data into your table, use the `put` command.

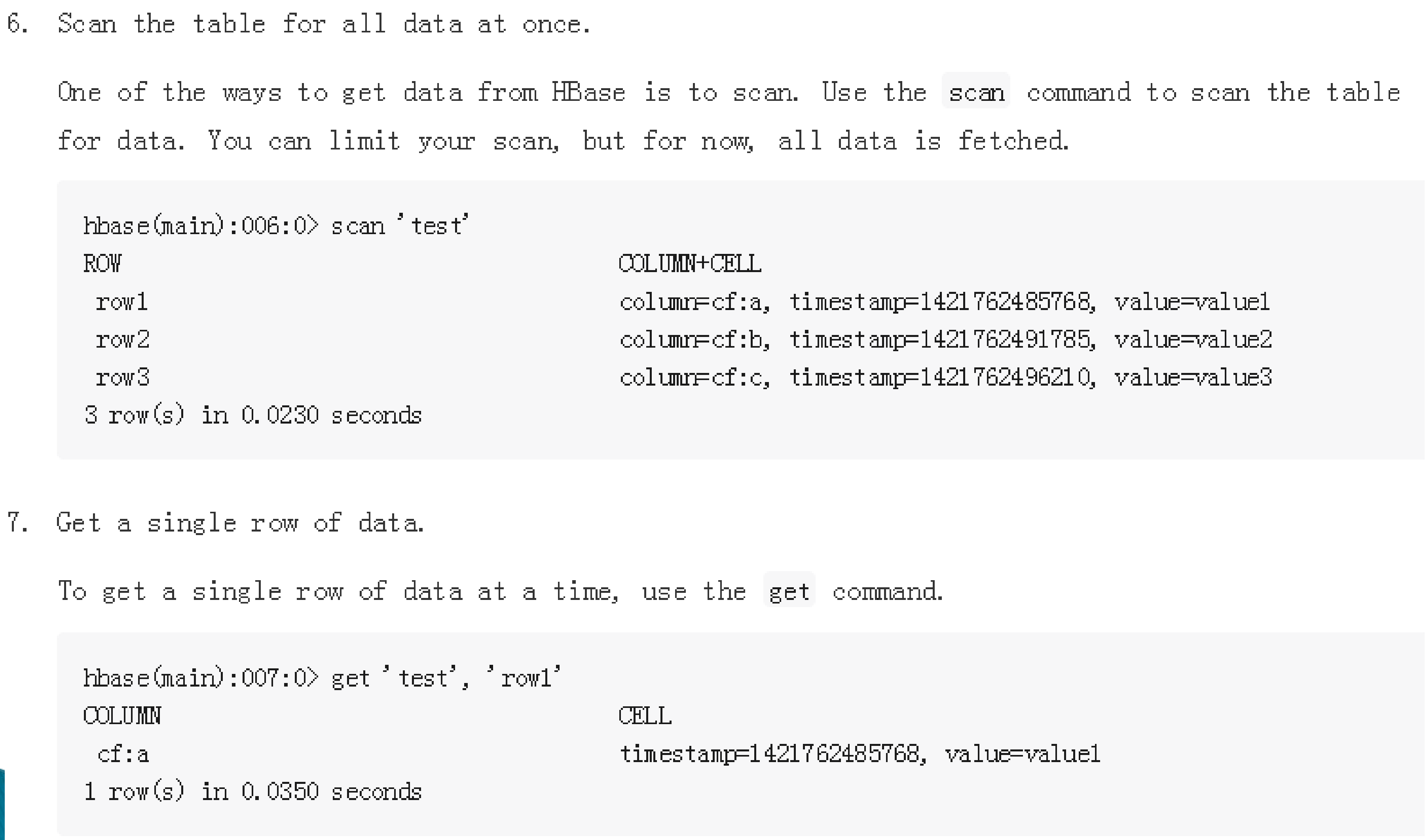
```
hbase(main):003:0> put ’test’, ’row1’, ’cf:a’, ’value1’
0 row(s) in 0.0850 seconds

hbase(main):004:0> put ’test’, ’row2’, ’cf:b’, ’value2’
0 row(s) in 0.0110 seconds

hbase(main):005:0> put ’test’, ’row3’, ’cf:c’, ’value3’
0 row(s) in 0.0100 seconds
```

Here, we insert three values, one at a time. The first insert is at `row1`, column `cf:a`, with a value of `value1`. Columns in HBase are comprised of a column family prefix, `cf` in this example, followed by a colon and then a column qualifier suffix, `a` in this case.

Use HBase For the First Time



6. Scan the table for all data at once.

One of the ways to get data from HBase is to scan. Use the `scan` command to scan the table for data. You can limit your scan, but for now, all data is fetched.

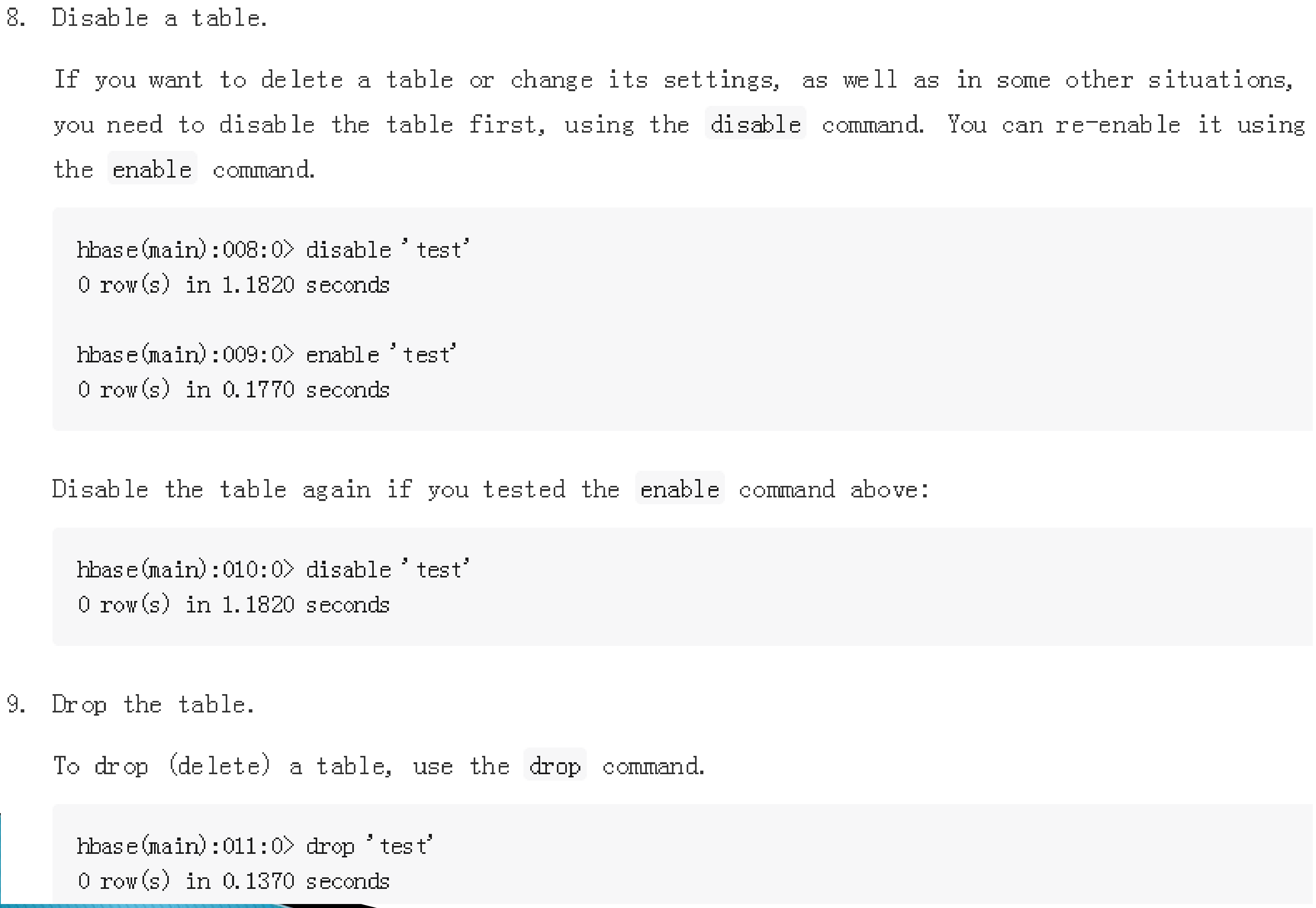
```
hbase(main):006:0> scan 'test'
ROW                                       COLUMN+CELL
 row1                                     column=cf:a, timestamp=1421762485768, value=value1
 row2                                     column=cf:b, timestamp=1421762491785, value=value2
 row3                                     column=cf:c, timestamp=1421762496210, value=value3
3 row(s) in 0.0230 seconds
```

7. Get a single row of data.

To get a single row of data at a time, use the `get` command.

```
hbase(main):007:0> get 'test', 'row1'
COLUMN                                    CELL
 cf:a                                     timestamp=1421762485768, value=value1
1 row(s) in 0.0350 seconds
```

Use HBase For the First Time



8. Disable a table.

   If you want to delete a table or change its settings, as well as in some other situations, you need to disable the table first, using the `disable` command. You can re-enable it using the `enable` command.

```
hbase(main):008:0> disable ’test’
0 row(s) in 1.1820 seconds

hbase(main):009:0> enable ’test’
0 row(s) in 0.1770 seconds
```

   Disable the table again if you tested the `enable` command above:

```
hbase(main):010:0> disable ’test’
0 row(s) in 1.1820 seconds
```

9. Drop the table.

   To drop (delete) a table, use the `drop` command.

```
hbase(main):011:0> drop ’test’
0 row(s) in 0.1370 seconds
```

存储单元 Cell

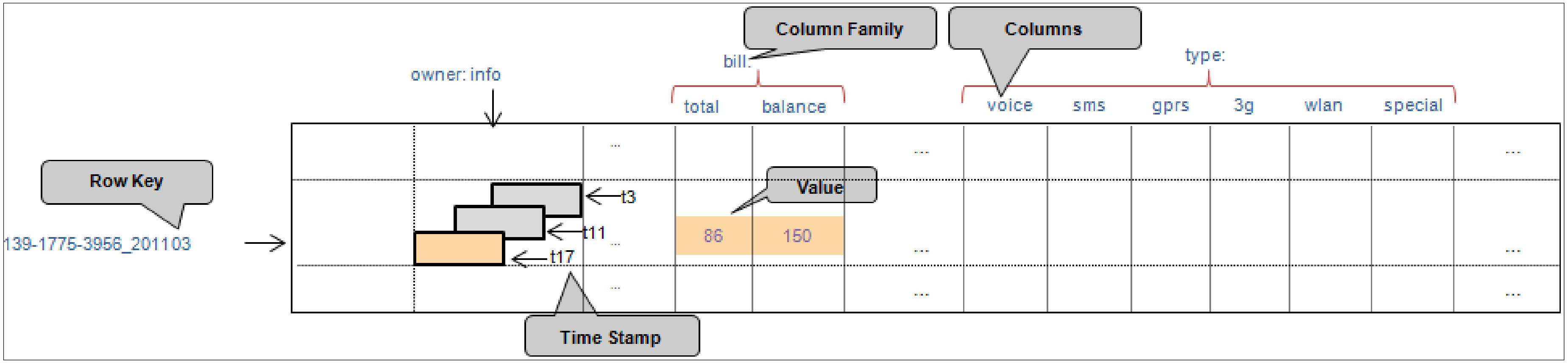
- ◆ 单元

  {row key, column(=<family> + <label>*), version}*

  - ➢ 唯一性
  - ➢ 数据是没有类型，以字节码形式存贮

存储单元 Cell

- 表：（行key，列族+列名，版本（timestamp））→ 值



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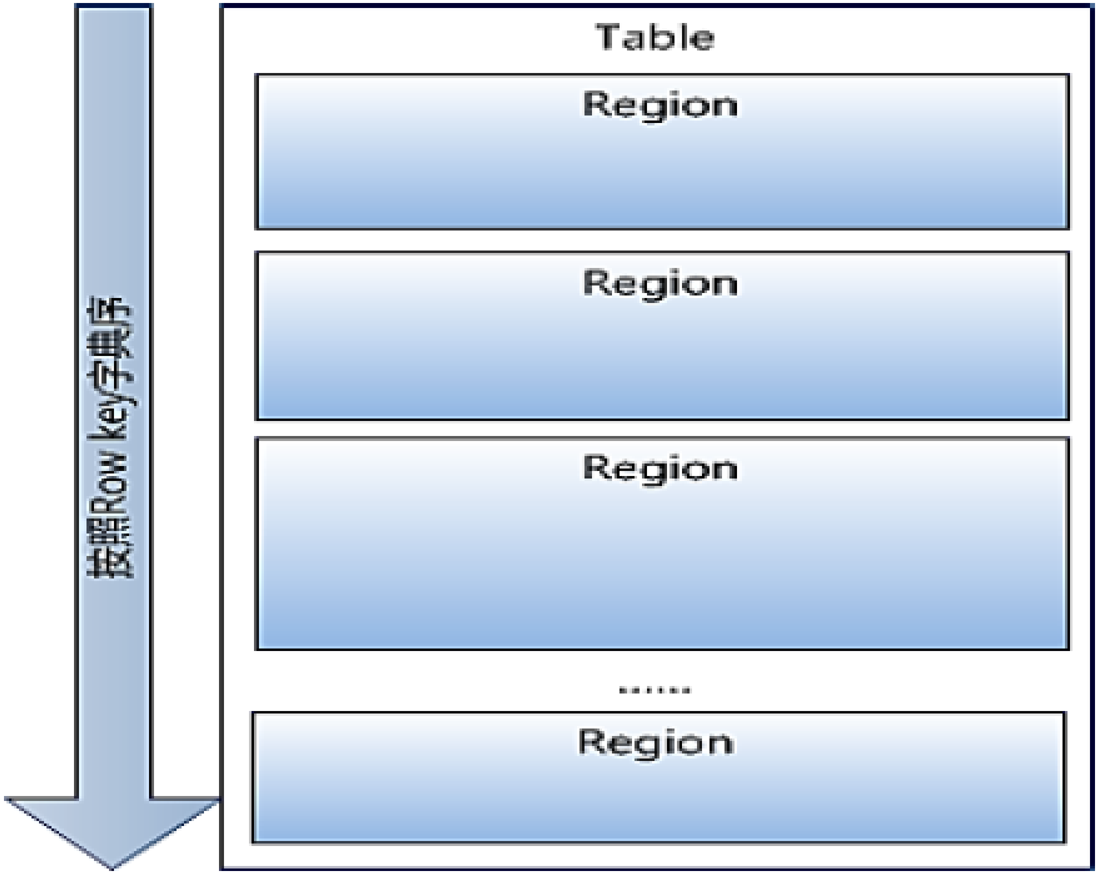
HBase 物理模型

1、Table中的所有行都按照row key的字典序排列；

2、Table 在行的方向上分割为多个Region；



HBase 物理模型

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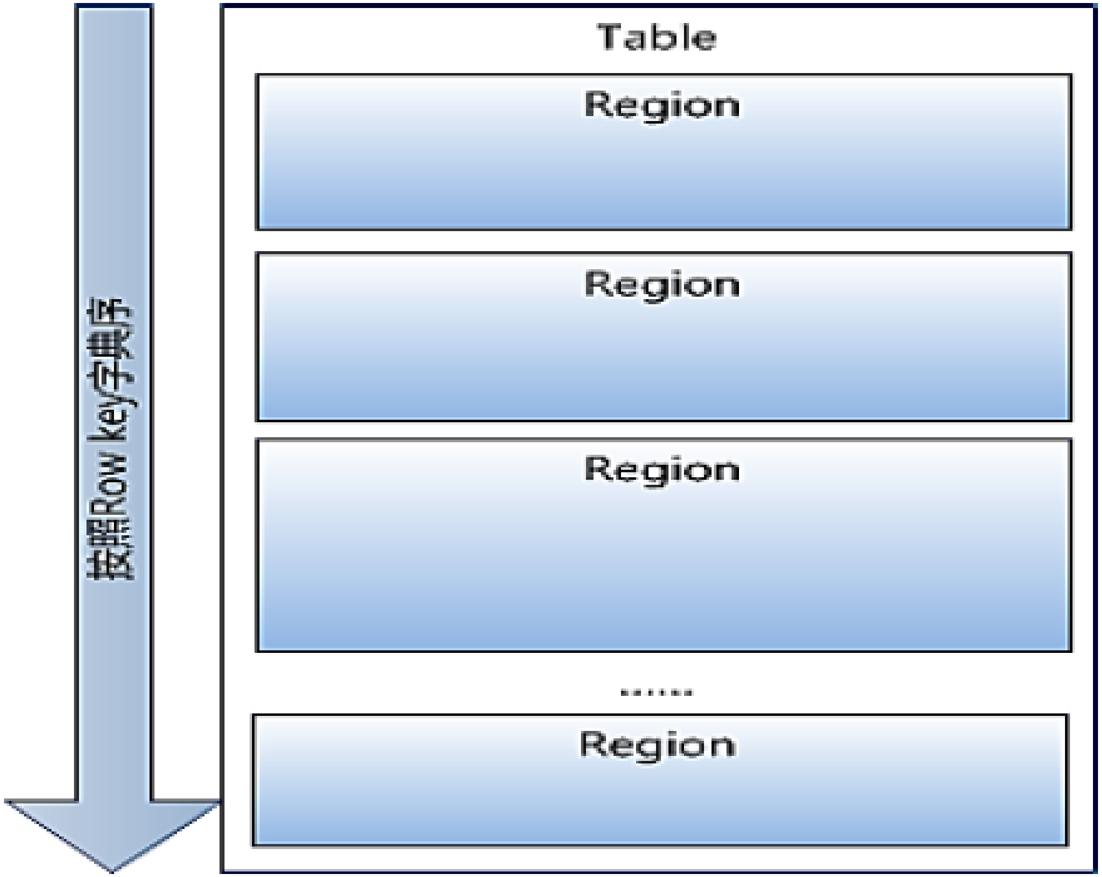
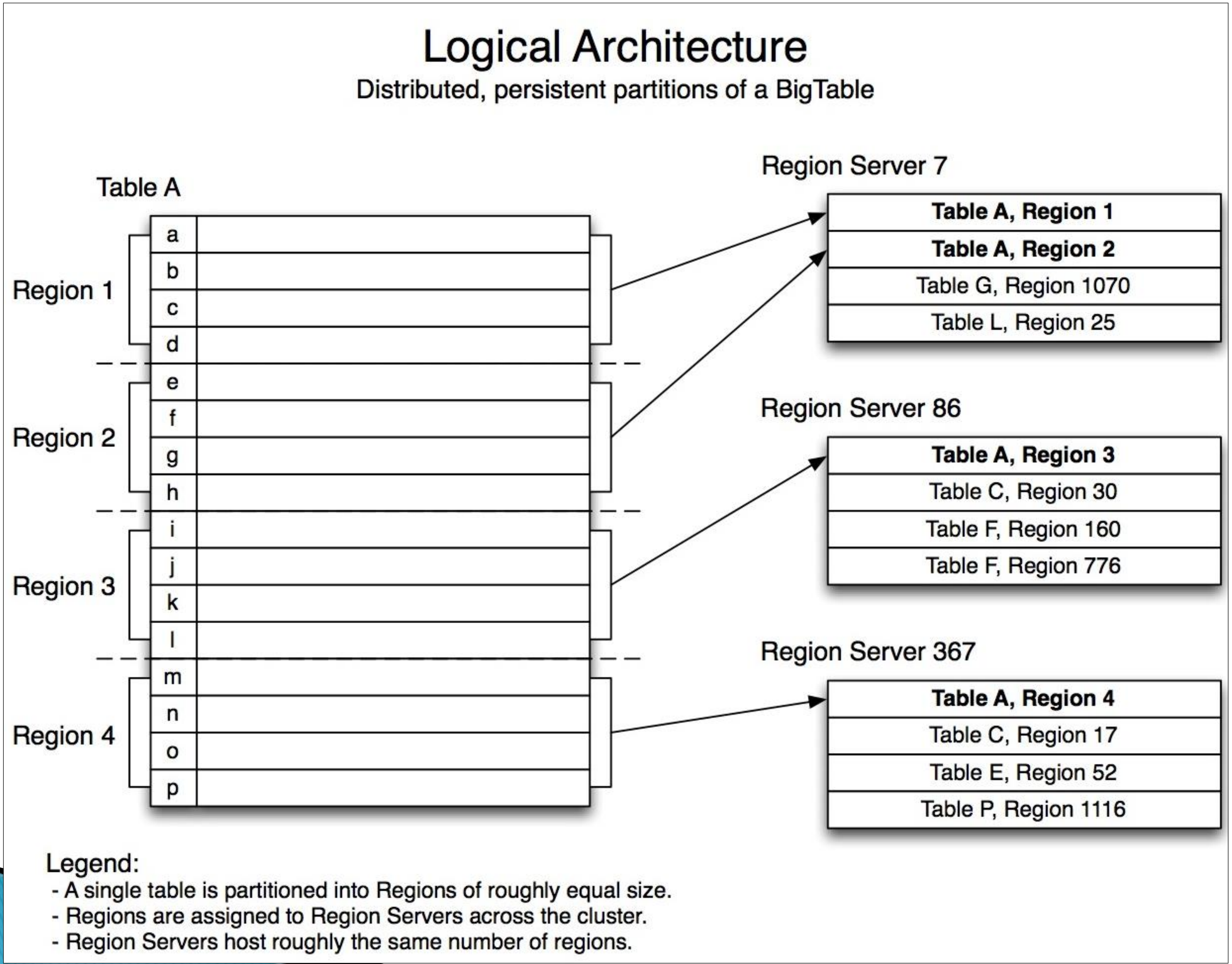


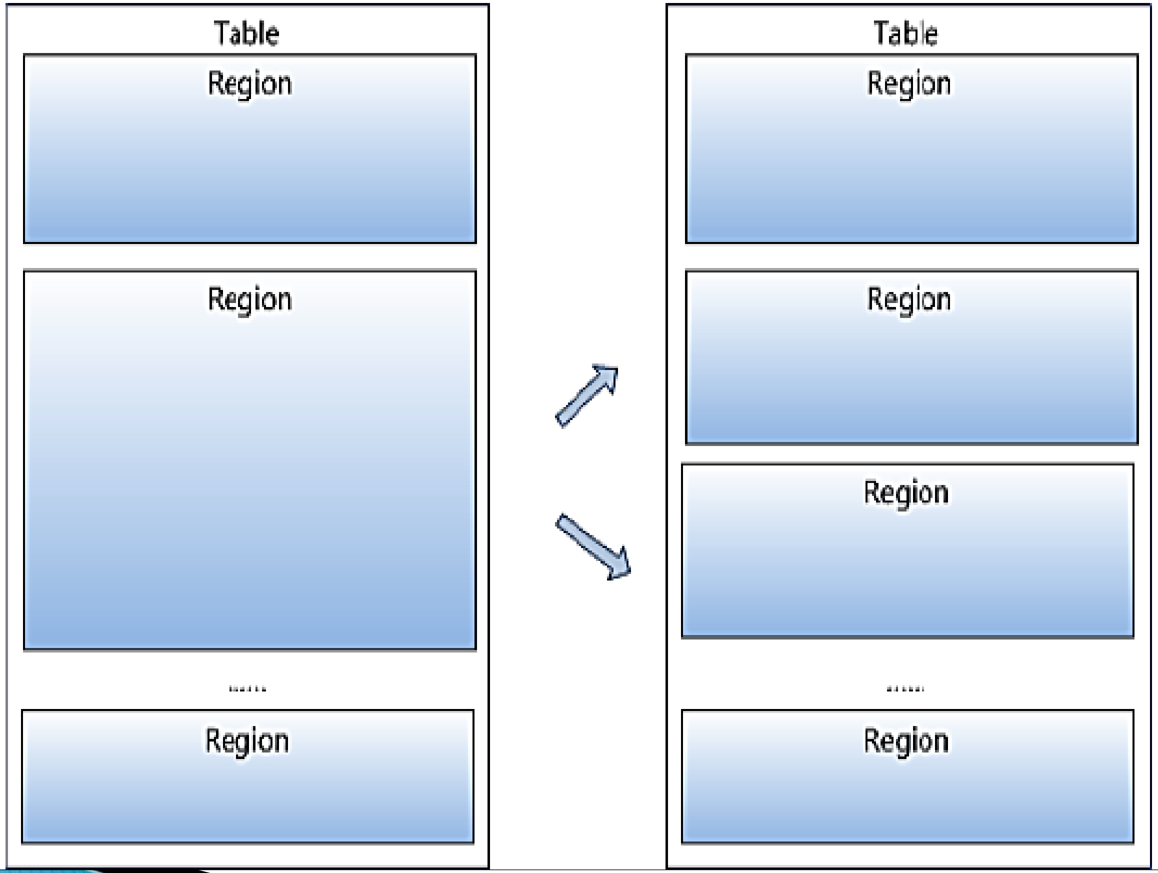
HBase 物理模型



Legend:
- A single table is partitioned into Regions of roughly equal size.
- Regions are assigned to Region Servers across the cluster.
- Region Servers host roughly the same number of regions.

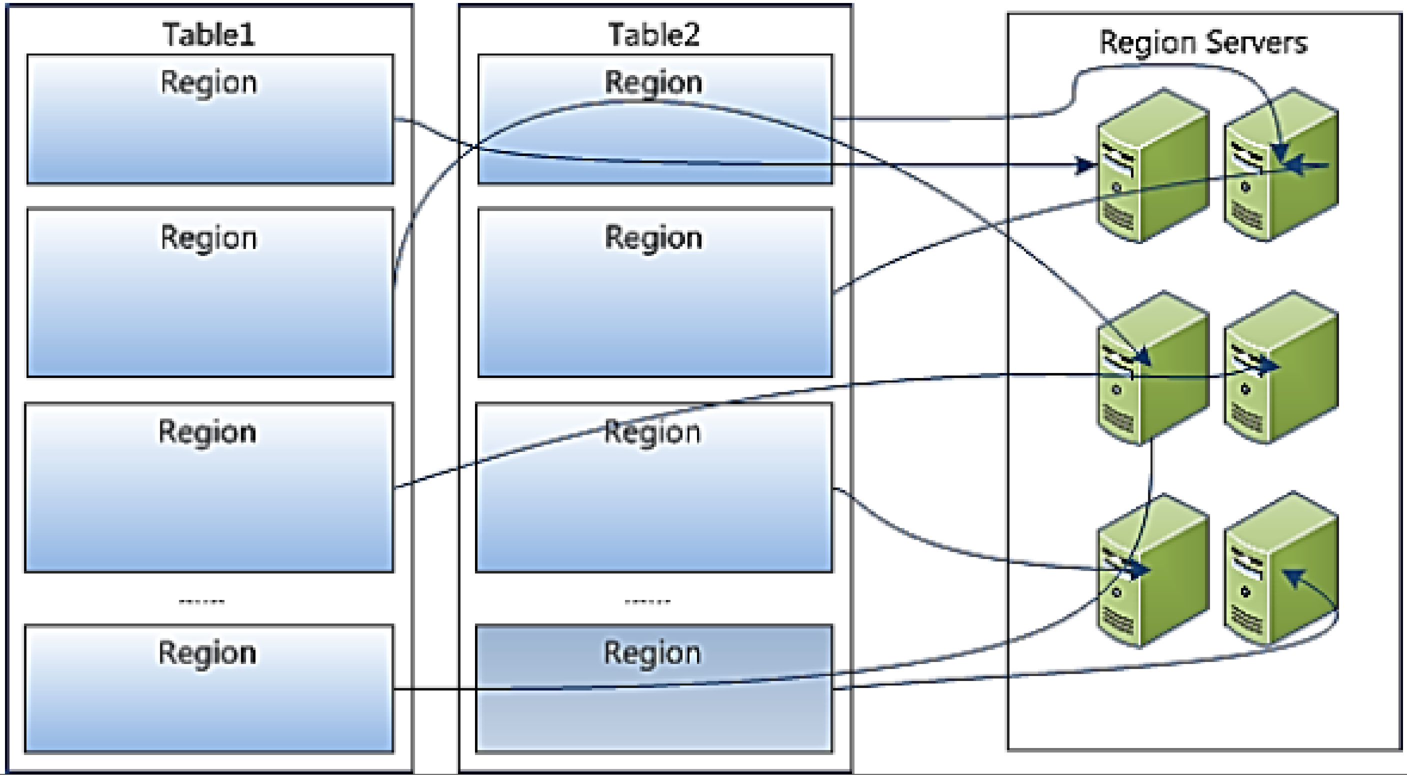
HBase 物理模型

3、Region按大小分割的，每个表开始只有一个region，随着数据增多，region不断增大，当增大到一个阀值的时候，region就会等分会两个新的region，之后会有越来越多的region；



HBase 物理模型

4、Region是HBase中分布式存储和负载均衡的最小单元。不同Region分布到不同RegionServer上；



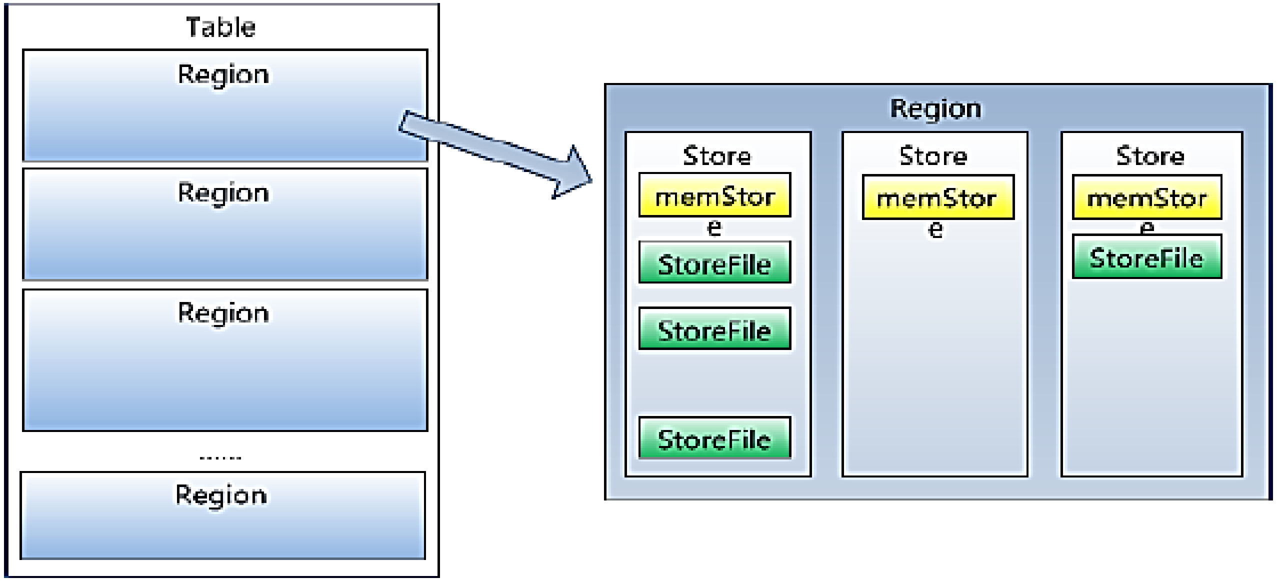
HBase 物理模型

5 、Region虽然是**分布式存储**的最小单元，但并不是**存储**的最小单元。

●Region由一个或者多个Store组成，每个store保存一个columns family；

●每个Strore又由一个memStore和0至多个StoreFile组成；

●memStore存储在内存中，StoreFile存储在HDFS上。



HBase 物理模型

- 每个column family存储在HDFS上的一个单独文件中；
- Key 和 Version number在每个 column family中均由一份；
- 空值不会被保存。

HBase 为每个值维护了多级索引，即：

<key, column family, column name, timestamp>

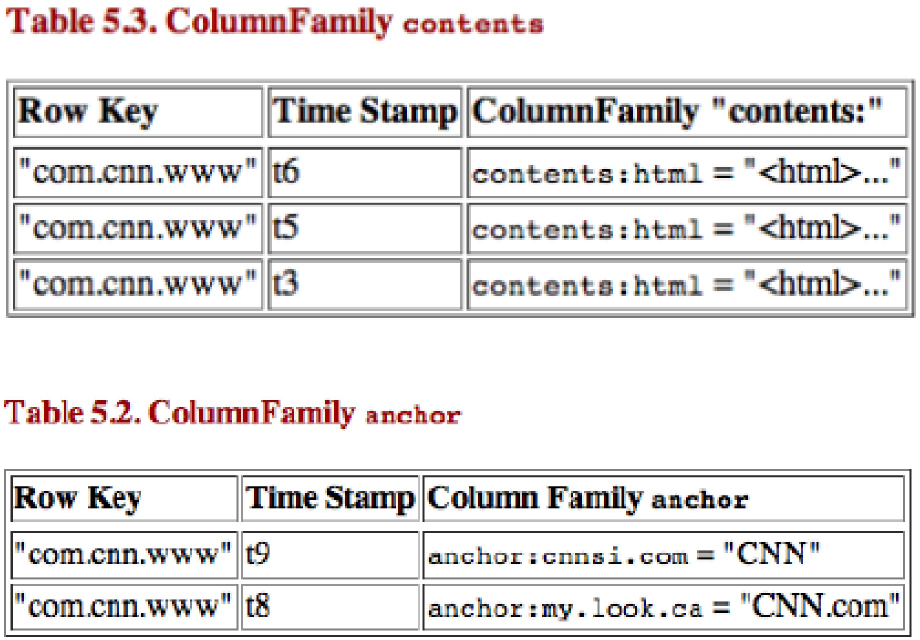


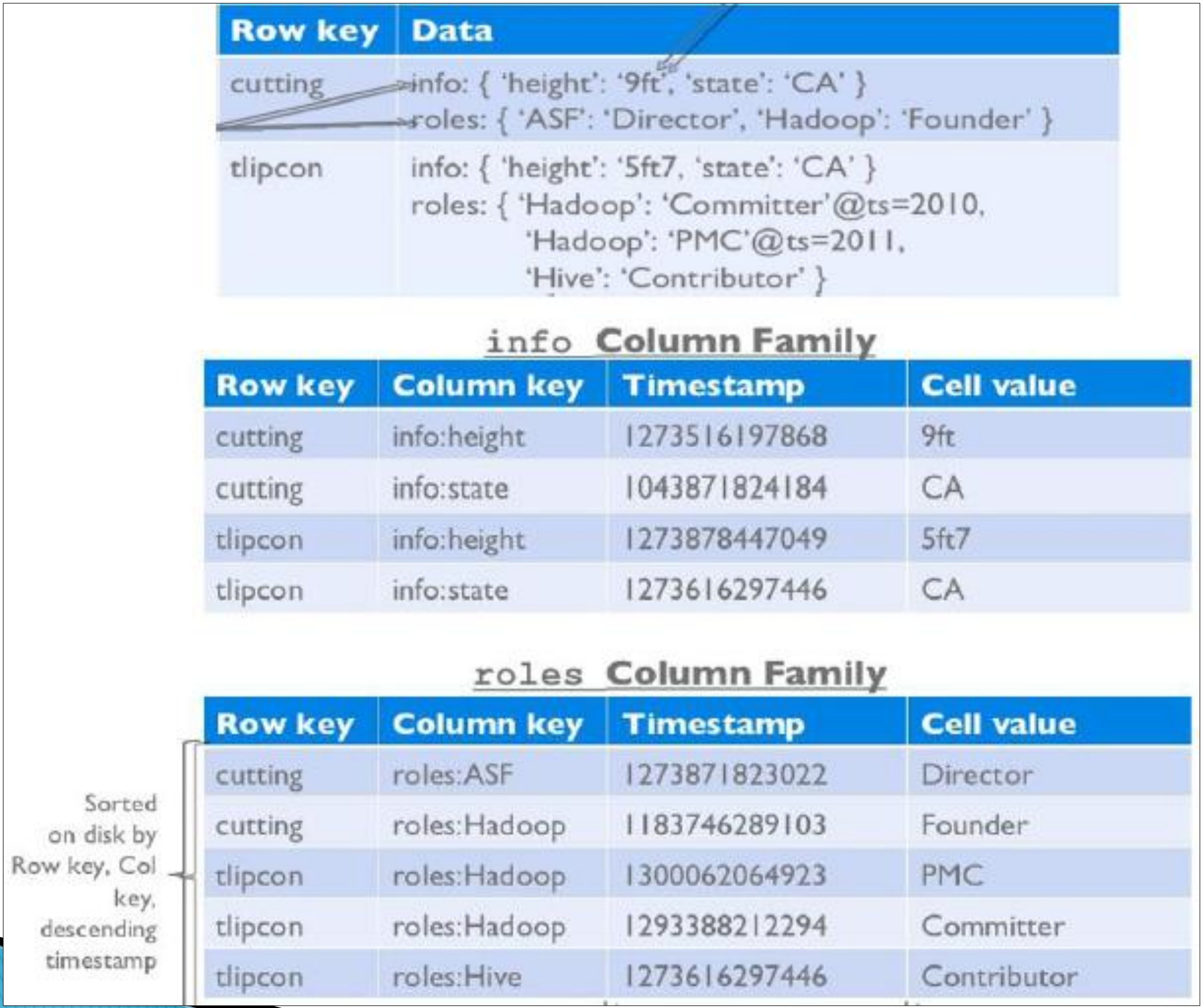
Table 5.3. ColumnFamily contents

Row Key	Time Stamp	ColumnFamily "contents:"
"com.cnn.www"	t6	contents:html = "<html>..."
"com.cnn.www"	t5	contents:html = "<html>..."
"com.cnn.www"	t3	contents:html = "<html>..."

Table 5.2. ColumnFamily anchor

Row Key	Time Stamp	Column Family anchor
"com.cnn.www"	t9	anchor:cnnsi.com = "CNN"
"com.cnn.www"	t8	anchor:my.look.ca = "CNN.com"

HBase 物理模型



Row key	Data

cutting	info: { 'height': '9ft', 'state': 'CA' }
	roles: { 'ASF': 'Director', 'Hadoop': 'Founder' }

tlipcon	info: { 'height': '5ft7, 'state': 'CA' }
	roles: { 'Hadoop': 'Committer'@ts=2010,
	'Hadoop': 'PMC'@ts=2011,
	'Hive': 'Contributor' }

info Column Family

Row key	Column key	Timestamp	Cell value
cutting	info:height	1273516197868	9ft
cutting	info:state	1043871824184	CA
tlipcon	info:height	1273878447049	5ft7
tlipcon	info:state	1273616297446	CA

roles Column Family

Row key	Column key	Timestamp	Cell value
cutting	roles:ASF	1273871823022	Director
cutting	roles:Hadoop	1183746289103	Founder
tlipcon	roles:Hadoop	1300062064923	PMC
tlipcon	roles:Hadoop	1293388212294	Committer
tlipcon	roles:Hive	1273616297446	Contributor

Sorted on disk by Row key, Col key, descending timestamp