HBase

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Introduction

- **H**adoop data**Base**
- Consists of tables
- Each table is sparse, distributed, persistent, multidimensional sorted map, indexed by rowkey, column family, column, timestamp
- Can store structured, semistructured, unstructured data
- Does not care about types
- Not a relational database, does not speak SQL natively, does not enforce relationship in data
- Designed to run on a cluster of computers, scale horizontally as you add more machines to the cluster
- The main operations are: create (table), put (value into cell), get (value from cell), scan (values from cells)
- Various auxiliary operations: alter, list, describe, ...

Column families, columns, multiple versions

```
Row Key     Column Family: {Column Qualifier:Version:Value}
-------------------------------------------------------------------------
00001       CustomerName:  {'FN': 1383859182496:'John',
                            'LN': 1383859182858:'Smith',
                            'MN': 1383859183001:'Timothy',
                            'MN': 1383859182915:'T'}
            ContactInfo:   {'EA': 1383859183030:'John.Smith@xyz.com',
                           'SA': 1383859183073:'1 Hadoop Lane, NY 11111'}
00002       CustomerName:  {'FN': 1383859183103:'Jane',
                            'LN': 1383859183163:'Doe',
            ContactInfo:   {'SA': 1383859185577:'7 HBase Ave, CA 22222'}
```

- Internally HBase table is stored in HFiles - different set of files for different column families
- HFiles for the same column family are periodically merged together or split and distributed among the nodes to maintain high performance and fault-taulerance
- On top of HDFS
- One can specify how many latest versions of data to keep in HBase table or to query versions in a particular date-time range

HBase shell

```
$ hbase shell

> create 'CustomerContactInfo', 'CustomerName', 'ContactInfo'
> put 'CustomerContactInfo', '00001', 'CustomerName:FN', 'John'
> put 'CustomerContactInfo', '00001', 'CustomerName:LN', 'Smith'
> put 'CustomerContactInfo', '00001', 'CustomerName:MN', 'T'
> put 'CustomerContactInfo', '00001', 'ContactInfo:EA', 'John.Smith@xyz.com'
> put 'CustomerContactInfo', '00001', 'ContactInfo:SA', '1 Hadoop Lane, NY 11111'
> put 'CustomerContactInfo', '00002', 'CustomerName:FN', 'Jane'
> put 'CustomerContactInfo', '00002', 'CustomerName:LN', 'Doe'
> put 'CustomerContactInfo', '00002', 'ContactInfo:SA', '7 HBase Ave, CA 22222'
>list
=> ["CustomerContactInfo"]
>describe 'CustomerContactInfo'
Table CustomerContactInfo is ENABLED
CustomerContactInfo
COLUMN FAMILIES DESCRIPTION
{NAME => 'ContactInfo', DATA_BLOCK_ENCODING => 'NONE', BLOOMFILTER => 'ROW',
REPLICATION_SCOPE => '0', VERSIONS => '1', COMPRESSION => 'NONE',
MIN_VERSIONS => '0', TTL => 'FOREVER', KEEP_DELETED_CELLS => 'FALSE',
BLOCKSIZE => '65536', IN_MEMORY => 'false', BLOCKCACHE => 'true'}
{NAME => 'CustomerName', DATA_BLOCK_ENCODING => 'NONE', BLOOMFILTER => 'ROW',
REPLICATION_SCOPE => '0', VERSIONS => '1', COMPRESSION => 'NONE', MIN_VERSIONS => '0',
TTL => 'FOREVER', KEEP_DELETED_CELLS => 'FALSE', BLOCKSIZE => '65536',
IN_MEMORY => 'false', BLOCKCACHE => 'true'}
```

HBase shell

```
> alter 'CustomerContactInfo', NAME => 'CustomerName', VERSIONS => 5
> describe 'CustomerContactInfo'
Table CustomerContactInfo is ENABLED
CustomerContactInfo
COLUMN FAMILIES DESCRIPTION
{NAME => 'ContactInfo', DATA_BLOCK_ENCODING => 'NONE', BLOOMFILTER => 'ROW',
REPLICATION_SCOPE => '0', VERSIONS => '1', COMPRESSION => 'NONE',
MIN_VERSIONS => '0', TTL => 'FOREVER', KEEP_DELETED_CELLS => 'FALSE',
BLOCKSIZE => '65536', IN_MEMORY => 'false', BLOCKCACHE => 'true'}
{NAME => 'CustomerName', DATA_BLOCK_ENCODING => 'NONE', BLOOMFILTER => 'ROW',
REPLICATION_SCOPE => '0', VERSIONS => '5', COMPRESSION => 'NONE',
MIN_VERSIONS => '0', TTL => 'FOREVER', KEEP_DELETED_CELLS => 'FALSE',
BLOCKSIZE => '65536', IN_MEMORY => 'false', BLOCKCACHE => 'true'}
> put 'CustomerContactInfo', '00001', 'CustomerName:MN', 'Timothy'
> scan 'CustomerContactInfo', {VERSIONS => 2}
ROW        COLUMN+CELL
00001      column=ContactInfo:EA, timestamp=1471196578957, value=John.Smith@xyz.com
00001      column=ContactInfo:SA, timestamp=1471196578988, value=1 Hadoop Lane, NY 11111
00001      column=CustomerName:FN, timestamp=1471196578805, value=John
00001      column=CustomerName:LN, timestamp=1471196578859, value=Smith
00001      column=CustomerName:MN, timestamp=1471197270641, value=Timothy
00001      column=CustomerName:MN, timestamp=1471196578901, value=T
00002      column=ContactInfo:SA, timestamp=1471196579070, value=7 HBase Ave, CA 22222
00002      column=CustomerName:FN, timestamp=1471196579016, value=Jane
00002      column=CustomerName:LN, timestamp=1471196579042, value=Doe
```

HBase shell

```
> get 'CustomerContactInfo', '00001'
COLUMN                  CELL
 ContactInfo:EA         timestamp=1471196578957, value=John.Smith@xyz.com
 ContactInfo:SA         timestamp=1471196578988, value=1 Hadoop Lane, NY 11111
 CustomerName:FN        timestamp=1471196578805, value=John
 CustomerName:LN        timestamp=1471196578859, value=Smith
 CustomerName:MN        timestamp=1471197270641, value=Timothy
> get 'CustomerContactInfo', '00001', {COLUMN => 'CustomerName:MN'}
COLUMN                  CELL
 CustomerName:MN        timestamp=1471197270641, value=Timothy
> disable 'CustomerContactInfo'
> drop 'CustomerContactInfo'
> quit
```

HBase: clients

Besides HBase shell, one can use HBase with

- MapReduce JavaAPI
- Hive
- Pig
- Spark
- Impala

HBase applications

- For what applications is HBase good for?
  - Huge amount of (semi-)structured data: most records have the same columns but some might have extra columns
  - The need for random and real time access to data
  - The need to store multiple versions of records
  - No support for relational features
  - No support for transactions
- Example applications:
  - Mozilla stores crash data in HBase
  - Facebook uses HBase to store real-time messages