WQD7007 Big Data Management

Big Data Tools
HBase

HBase

- An **open source NoSQL database** that provides random and real-time read/write (CRUD operation) access to those large datasets that runs on top of HDFS.
- HBase **scales linearly to handle huge data sets with billions of rows and millions of columns**, and it easily combines data sources that use a wide variety of different structures and schemas.
  - making it a great choice to store multi-structured or sparse data.

HBase

- These following characteristics make HBase a great choice for **storing semi-structured data like log data** and then providing that data very quickly to users or applications integrated with HBase.
- Linear scaling of Hbase:
  - Require all tables to have a primary key.
  - The key space is divided into sequential blocks that are then allotted to a region.
  - RegionServers own one or more regions, so the load is spread uniformly across the cluster.

HBase

Characteristics	Benefit
Fault tolerant	•**Replication** across the data center •**Atomic and strongly consistent** row-level operations •**High availability** through automatic failover •**Automatic sharding and load balancing**s of tables
Fast	•**Near real time lookups** •**In-memory caching** via block cache and bloom filters •**Server side processing** via filters and co-processors
Usable	•**Data model** accommodates wide range of use cases •**Metrics exports** via File and Ganglia plugins •**Easy Java API** as well as Thrift and REST gateway APIs

HBase

- Enterprises use Apache HBase's **low latency storage** for scenarios that require real-time analysis and tabular data for end user applications.
  - Example 1: One company that provides **web security services** maintains a system accepting billions of event traces and activity logs from its customer' desktops every day.
    - The company's programmers can tightly integrate their **security solutions** with HBase (to assure that the protection they provide keeps pace with **real-time changes** in the threat landscape.)

HBase

- Example 2: One company provides **stock market ticker plant data** that its **users query more than thirty thousand times per second**, with an SLA of only a few milliseconds.
  - Apache HBase provides that **super low-latency** access over an enormous, rapidly changing data store.

HBase

- Apache HBase provides high availability in several ways:
    - **Highly available cluster topology information** through production deployments with multiple HMaster and ZooKeeper instances
    - **Data distribution across many nodes** means that loss of a single node only affects data stored on that node

HBase

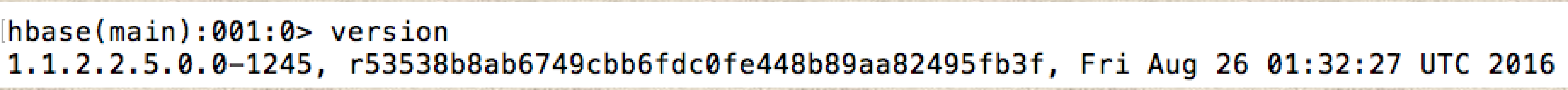
- Apache HBase provides high availability in several ways:
    - **HBase HA** allows data storage, ensuring that loss of a single node does not result in loss of data availability
    - **HFile format stores data directly in HDFS.** HFile can be read or written to by Apache Hive, Apache Pig, MapReduce, and Apache Tez, permitting deep analytics on HBase without data movement

Online reference

- https://acadgild.com/blog/apache-hbase-beginners-guide/

`Version` command

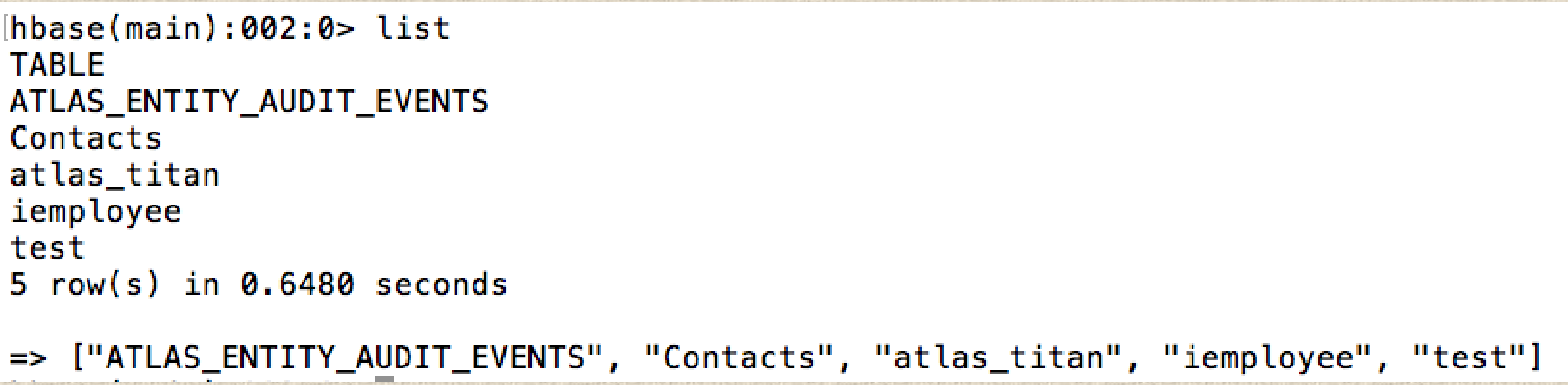
```
hbase(main):001:0> version
```



```
hbase(main):001:0> version
1.1.2.2.5.0.0-1245, r53538b8ab6749cbb6fdc0fe448b89aa82495fb3f, Fri Aug 26 01:32:27 UTC 2016
```

`list` command

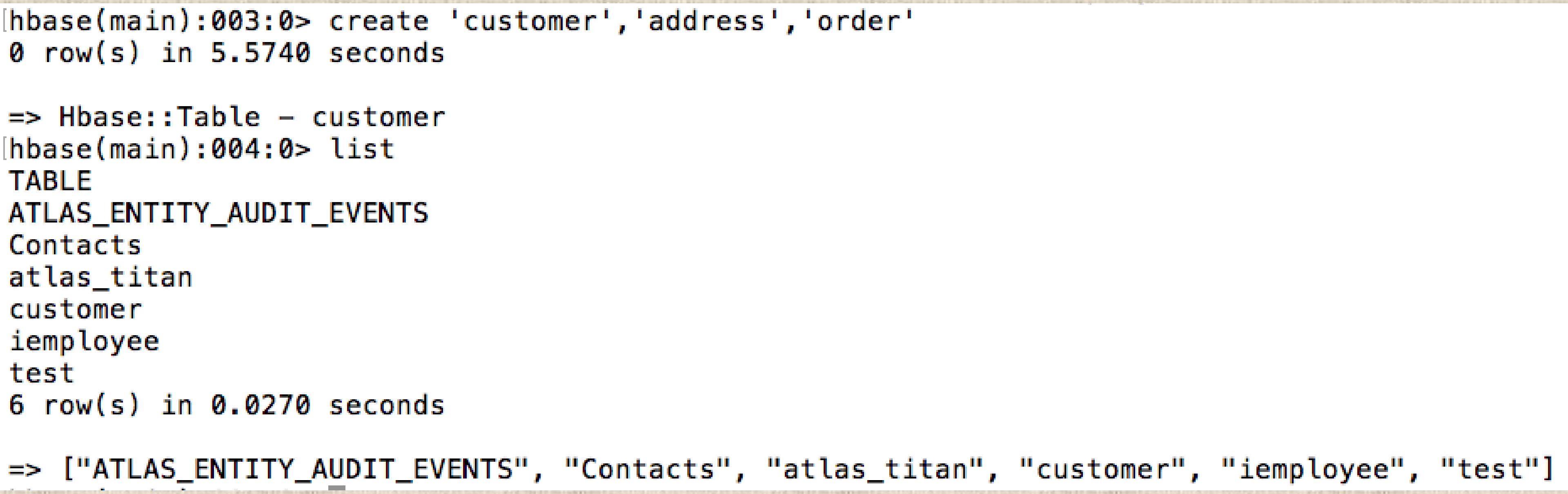
```
hbase(main):002:0> list
```



```
hbase(main):002:0> list
TABLE
ATLAS_ENTITY_AUDIT_EVENTS
Contacts
atlas_titan
iemployee
test
5 row(s) in 0.6480 seconds

=> ["ATLAS_ENTITY_AUDIT_EVENTS", "Contacts", "atlas_titan", "iemployee", "test"]
```

Create table

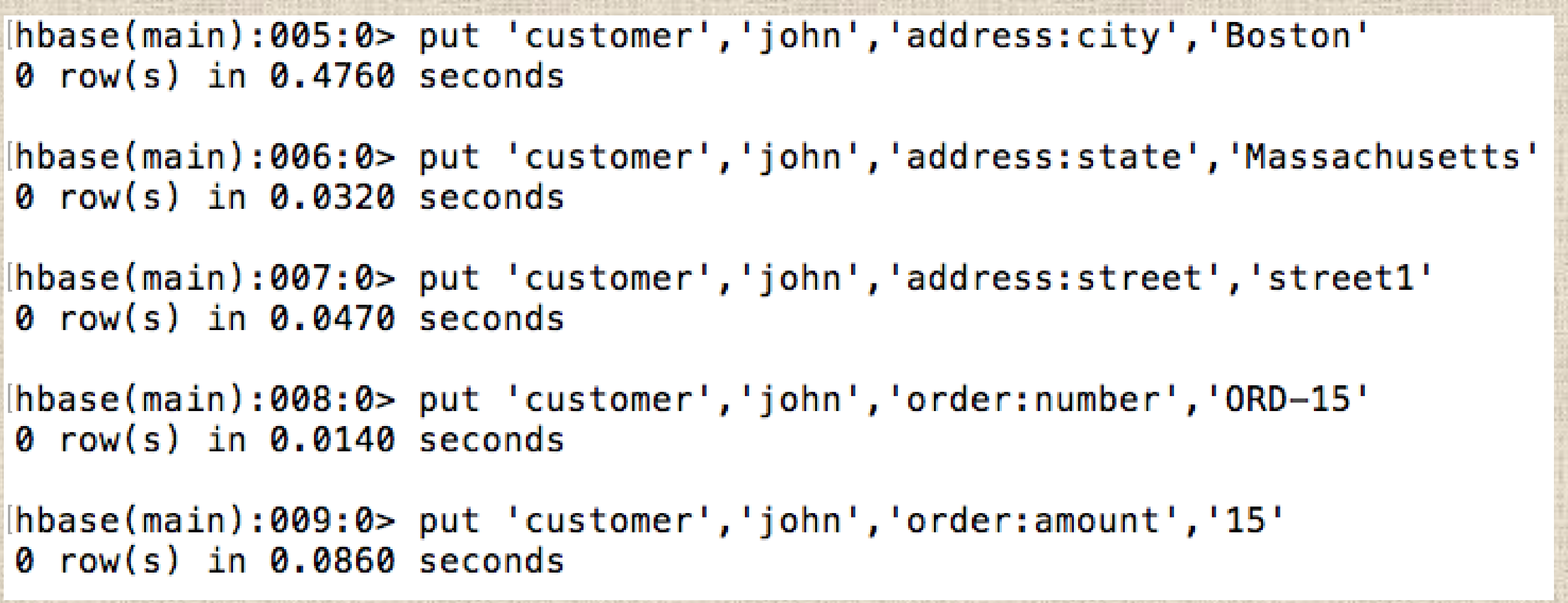
```
hbase(main):003:0> create 'customer','address','order’
hbase(main):004:0> list
```



```
hbase(main):003:0> create 'customer','address','order'
0 row(s) in 5.5740 seconds

=> Hbase::Table - customer
hbase(main):004:0> list
TABLE
ATLAS_ENTITY_AUDIT_EVENTS
Contacts
atlas_titan
customer
iemployee
test
6 row(s) in 0.0270 seconds

=> ["ATLAS_ENTITY_AUDIT_EVENTS", "Contacts", "atlas_titan", "customer", "iemployee", "test"]
```

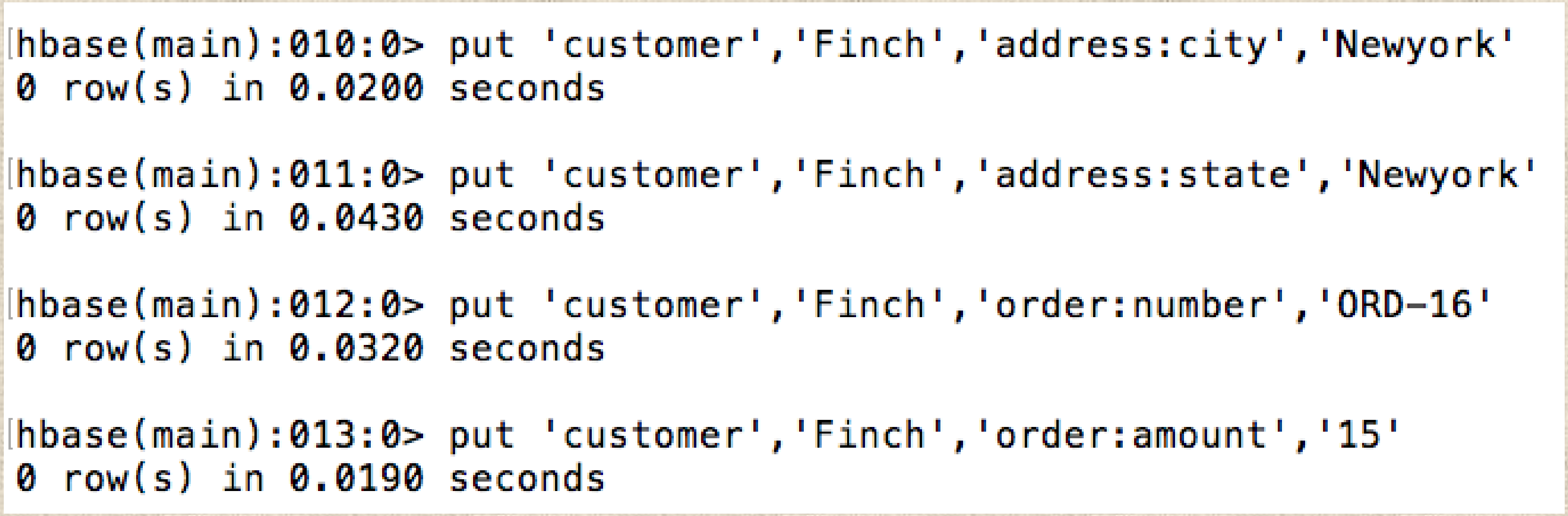
Insert entry

- hbase(main):026:0> put 'customer','john','address:city','Boston'
    - customer is the table name
    - John is the row key
    - address is the column family
    - Boston is its value.



```
[hbase(main):005:0> put 'customer','john','address:city','Boston'
0 row(s) in 0.4760 seconds

[hbase(main):006:0> put 'customer','john','address:state','Massachusetts'
0 row(s) in 0.0320 seconds

[hbase(main):007:0> put 'customer','john','address:street','street1'
0 row(s) in 0.0470 seconds

[hbase(main):008:0> put 'customer','john','order:number','ORD-15'
0 row(s) in 0.0140 seconds

[hbase(main):009:0> put 'customer','john','order:amount','15'
0 row(s) in 0.0860 seconds
```

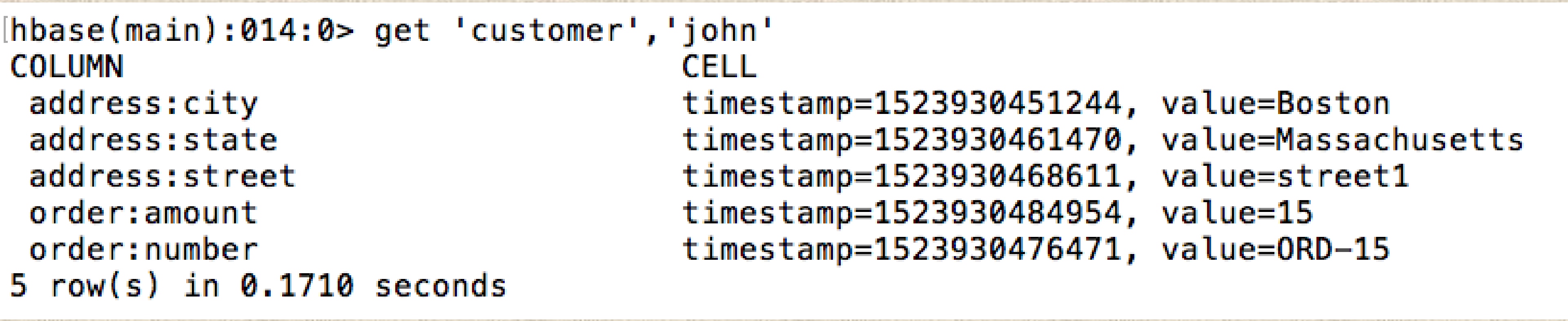
Put another record



```
[hbase(main):010:0> put 'customer','Finch','address:city','Newyork'
0 row(s) in 0.0200 seconds

[hbase(main):011:0> put 'customer','Finch','address:state','Newyork'
0 row(s) in 0.0430 seconds

[hbase(main):012:0> put 'customer','Finch','order:number','ORD-16'
0 row(s) in 0.0320 seconds

[hbase(main):013:0> put 'customer','Finch','order:amount','15'
0 row(s) in 0.0190 seconds
```

Get record

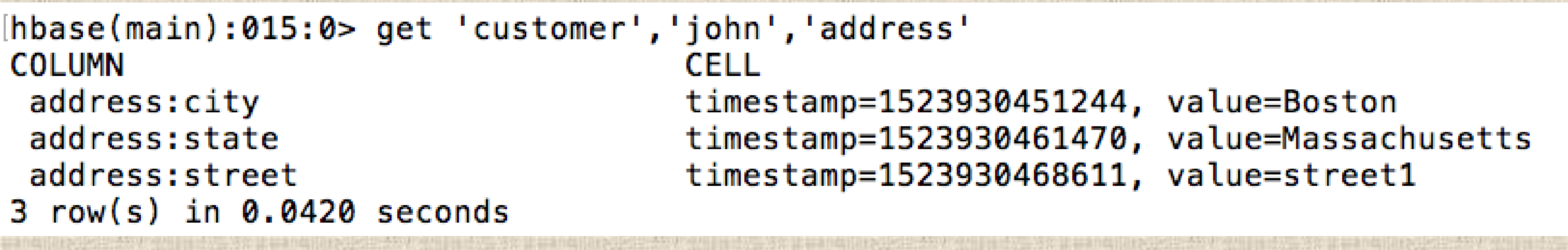
```
hbase(main):026:0> Get ‘customer’, ‘john’
```



```
hbase(main):014:0> get 'customer','john'
COLUMN                                  CELL
 address:city                           timestamp=1523930451244, value=Boston
 address:state                          timestamp=1523930461470, value=Massachusetts
 address:street                         timestamp=1523930468611, value=street1
 order:amount                           timestamp=1523930484954, value=15
 order:number                           timestamp=1523930476471, value=ORD-15
5 row(s) in 0.1710 seconds
```

Get record (2)

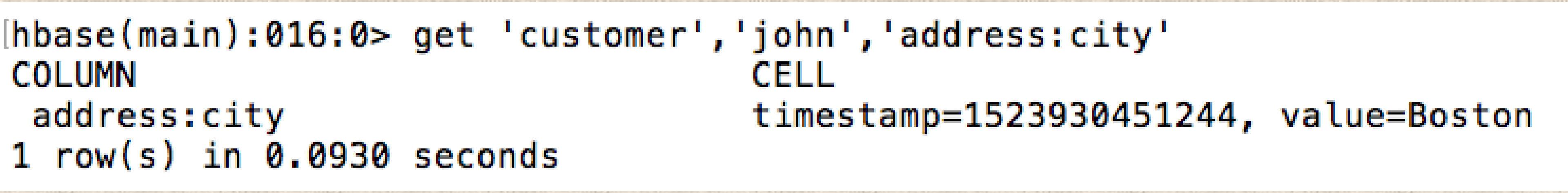
- Using get command to retrieve the address of john
  - hbase(main):044:0> **get** 'customer','john','address'



```
hbase(main):015:0> get 'customer','john','address'
COLUMN                             CELL
 address:city                      timestamp=1523930451244, value=Boston
 address:state                     timestamp=1523930461470, value=Massachusetts
 address:street                    timestamp=1523930468611, value=street1
3 row(s) in 0.0420 seconds
```

Get record (3)

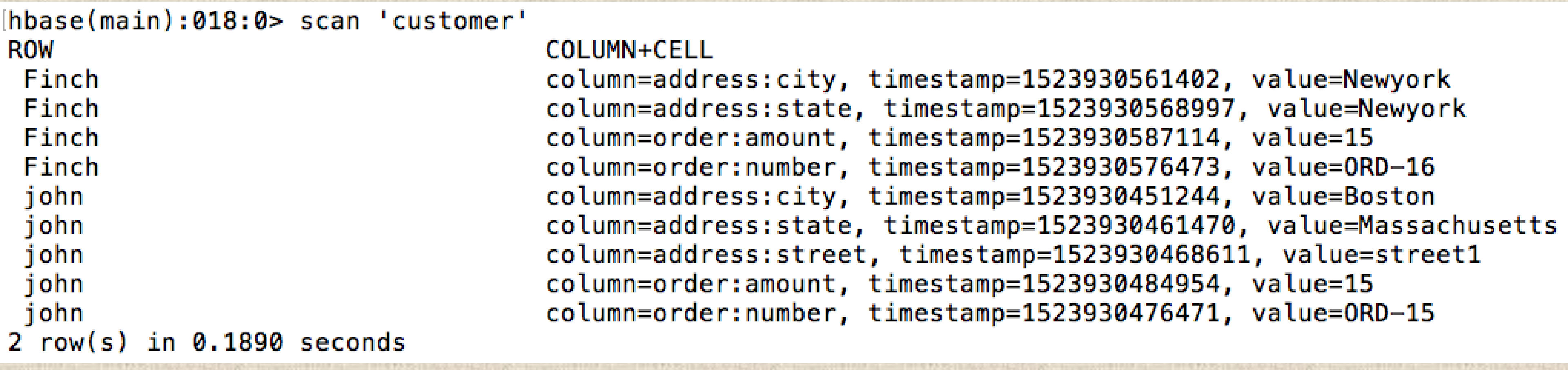
- Using get command to retrieve city of john
  - `hbase(main):045:0> **get** 'customer','john','address:city'`



```
hbase(main):016:0> get 'customer','john','address:city'
COLUMN                                CELL
 address:city                         timestamp=1523930451244, value=Boston
1 row(s) in 0.0930 seconds
```

Scan record

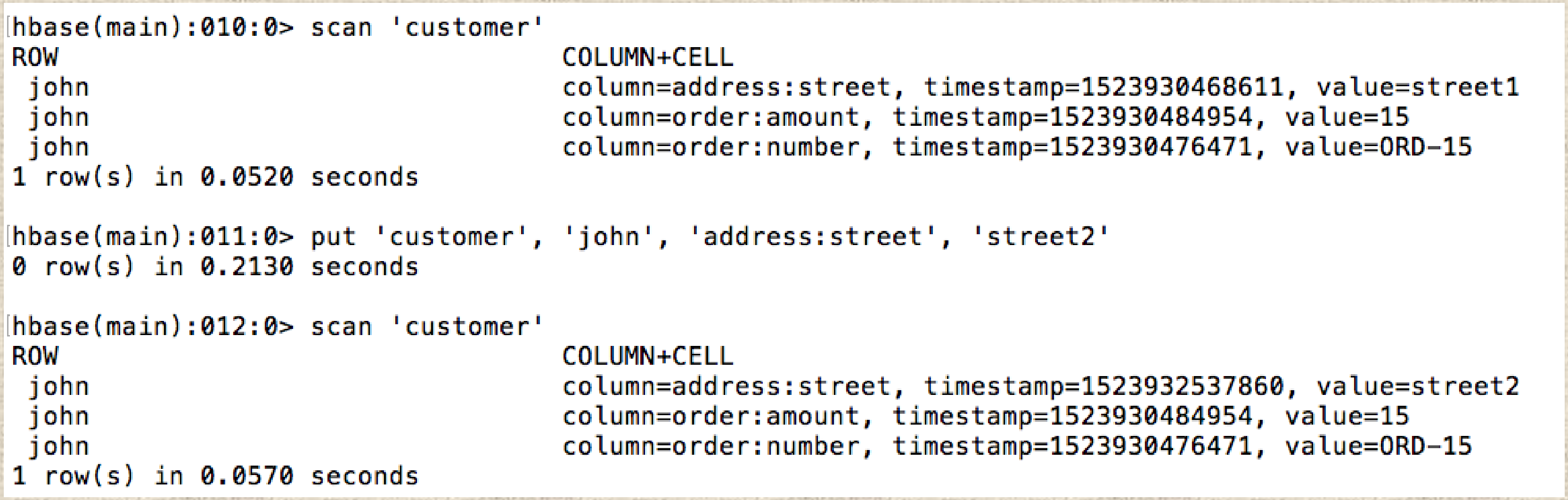
```
hbase(main):017:0> scan customer
```



```
hbase(main):018:0> scan 'customer'
ROW                                  COLUMN+CELL
 Finch                               column=address:city, timestamp=1523930561402, value=Newyork
 Finch                               column=address:state, timestamp=1523930568997, value=Newyork
 Finch                               column=order:amount, timestamp=1523930587114, value=15
 Finch                               column=order:number, timestamp=1523930576473, value=ORD-16
 john                                column=address:city, timestamp=1523930451244, value=Boston
 john                                column=address:state, timestamp=1523930461470, value=Massachusetts
 john                                column=address:street, timestamp=1523930468611, value=street1
 john                                column=order:amount, timestamp=1523930484954, value=15
 john                                column=order:number, timestamp=1523930476471, value=ORD-15
2 row(s) in 0.1890 seconds
```

Update record

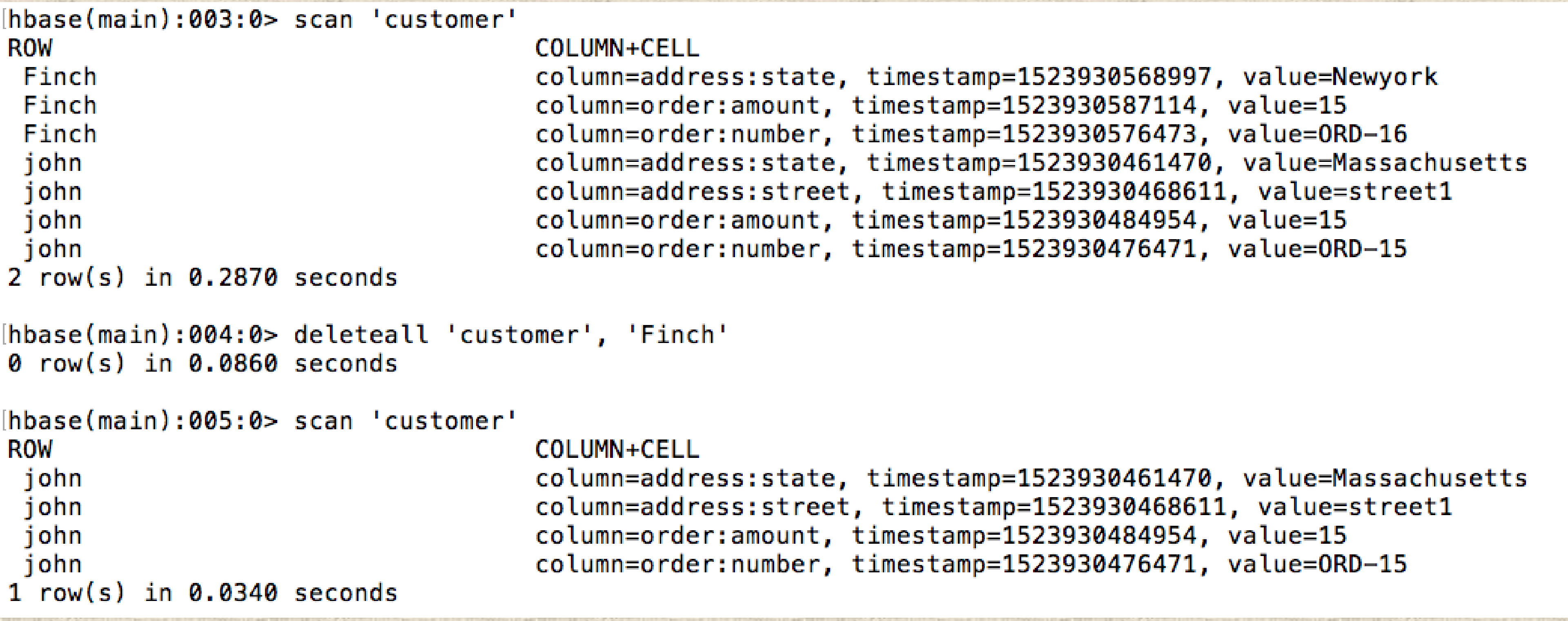
```
hbase(main):011:0>
put 'customer', 'john', 'address:street', 'street2'
```



```
hbase(main):010:0> scan 'customer'
ROW                              COLUMN+CELL
 john                            column=address:street, timestamp=1523930468611, value=street1
 john                            column=order:amount, timestamp=1523930484954, value=15
 john                            column=order:number, timestamp=1523930476471, value=ORD-15
1 row(s) in 0.0520 seconds

hbase(main):011:0> put 'customer', 'john', 'address:street', 'street2'
0 row(s) in 0.2130 seconds

hbase(main):012:0> scan 'customer'
ROW                              COLUMN+CELL
 john                            column=address:street, timestamp=1523932537860, value=street2
 john                            column=order:amount, timestamp=1523930484954, value=15
 john                            column=order:number, timestamp=1523930476471, value=ORD-15
1 row(s) in 0.0570 seconds
```

Delete entire record

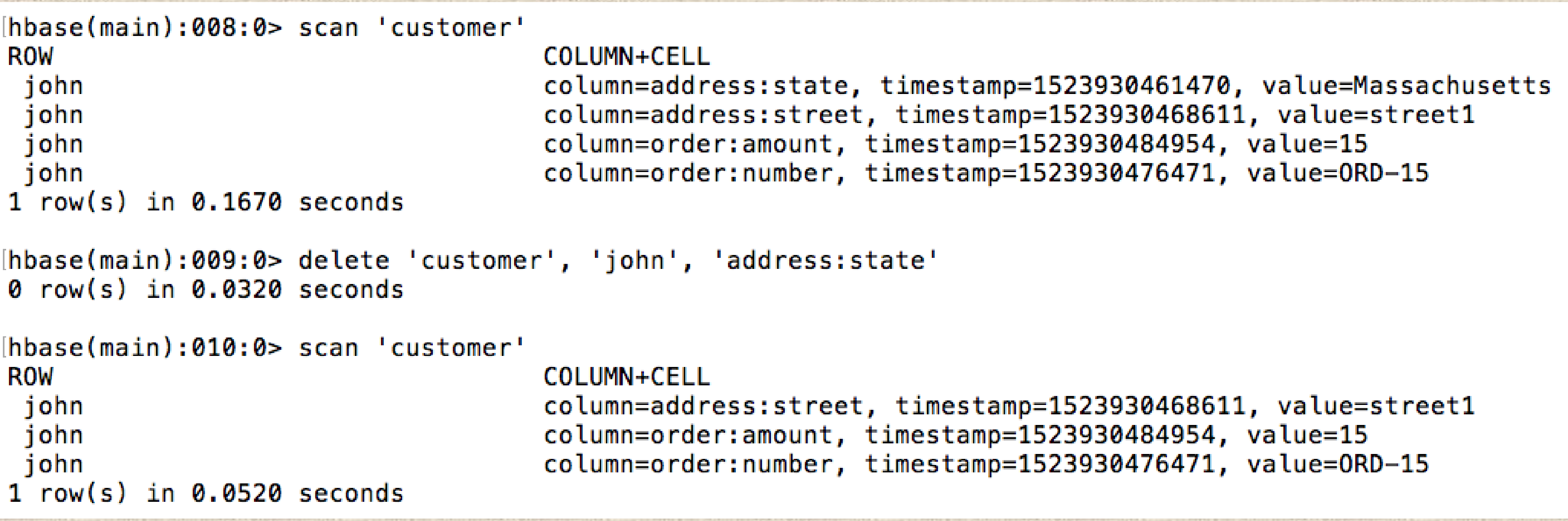
hbase(main):019:0> **deleteall** 'customer','Finch'



```
hbase(main):003:0> scan 'customer'
ROW                                COLUMN+CELL
 Finch                             column=address:state, timestamp=1523930568997, value=Newyork
 Finch                             column=order:amount, timestamp=1523930587114, value=15
 Finch                             column=order:number, timestamp=1523930576473, value=ORD-16
 john                              column=address:state, timestamp=1523930461470, value=Massachusetts
 john                              column=address:street, timestamp=1523930468611, value=street1
 john                              column=order:amount, timestamp=1523930484954, value=15
 john                              column=order:number, timestamp=1523930476471, value=ORD-15
2 row(s) in 0.2870 seconds

hbase(main):004:0> deleteall 'customer', 'Finch'
0 row(s) in 0.0860 seconds

hbase(main):005:0> scan 'customer'
ROW                                COLUMN+CELL
 john                              column=address:state, timestamp=1523930461470, value=Massachusetts
 john                              column=address:street, timestamp=1523930468611, value=street1
 john                              column=order:amount, timestamp=1523930484954, value=15
 john                              column=order:number, timestamp=1523930476471, value=ORD-15
1 row(s) in 0.0340 seconds
```

Delete specific column

- hbase(main):046:0> **delete** 'customer',john,'address:state'



```
[hbase(main):008:0> scan 'customer'
ROW                                COLUMN+CELL
 john                              column=address:state, timestamp=1523930461470, value=Massachusetts
 john                              column=address:street, timestamp=1523930468611, value=street1
 john                              column=order:amount, timestamp=1523930484954, value=15
 john                              column=order:number, timestamp=1523930476471, value=ORD-15
1 row(s) in 0.1670 seconds

[hbase(main):009:0> delete 'customer', 'john', 'address:state'
0 row(s) in 0.0320 seconds

[hbase(main):010:0> scan 'customer'
ROW                                COLUMN+CELL
 john                              column=address:street, timestamp=1523930468611, value=street1
 john                              column=order:amount, timestamp=1523930484954, value=15
 john                              column=order:number, timestamp=1523930476471, value=ORD-15
1 row(s) in 0.0520 seconds
```

Other commands

- `count ‘customer’`
- `disable ‘customer’`
- `drop ‘customer’`