Spark for Cloudant Analytics
Hands-on-Lab (1865)

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Agenda

- Cloudant Spark
  - What is Cloudant?
  - What is Spark?
  - What are Jupyter notebooks?
- Hands on Lab
  - Instructions
  - Python notebook
  - Scala notebook

What is Cloudant? – DBaaS for Web and Mobile Applications

Cloudant delivers a fully-managed database in service to the Analytics, App, and API economy

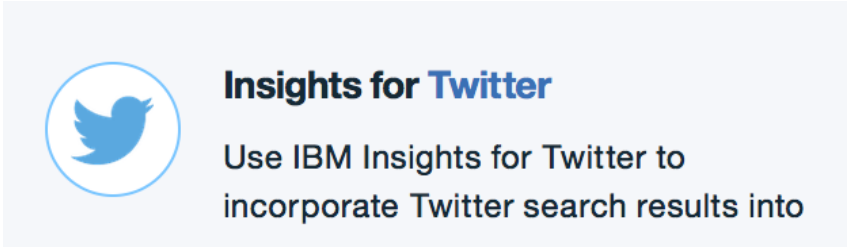
IBM **Cloudant**®

A fully-managed NoSQL database layer that can be **developed & deployed in days**

Spark Integration (Spark SQL)

- Operational NoSQL JSON store
- Master-less architecture for maximum **scalability** & **availability**
- Advanced APIs
  - REST (HTTPS) API
  - Replication & synchronization
  - Geo-load balancing
  - Incremental MapReduce indexes
  - Military-grade Geospatial indexes
  - Lucene full-text search
- Offline access to mobile apps & data
- Hybrid Cloud
  - Public | Private | Open Source | Client

JSON Documents



#Filter

- Documents are stored in the popular JSON format with a flexible schema
- A database is a logical collection of documents, with single set of access permissions
- Cluster can hold any number of databases

What is Apache spark ?

Spark is an **open** source

in-memory

computing framework for

distributed data processing and

iterative analysis

on **massive** data volumes

Key Reasons for the Interest in Spark

Performant

- In-memory architecture greatly reduces disk I/O
- Anywhere from **20-100x faster** for common tasks

Productive

- **Concise and expressive syntax**, especially compared to prior approaches
- **Single programming model** across a range of use cases and steps in data lifecycle
- **Integrated with common programming languages** – Java, Python, Scala, R
- **New tools** continually reduce skill barrier for access (e.g. SQL for analysts)

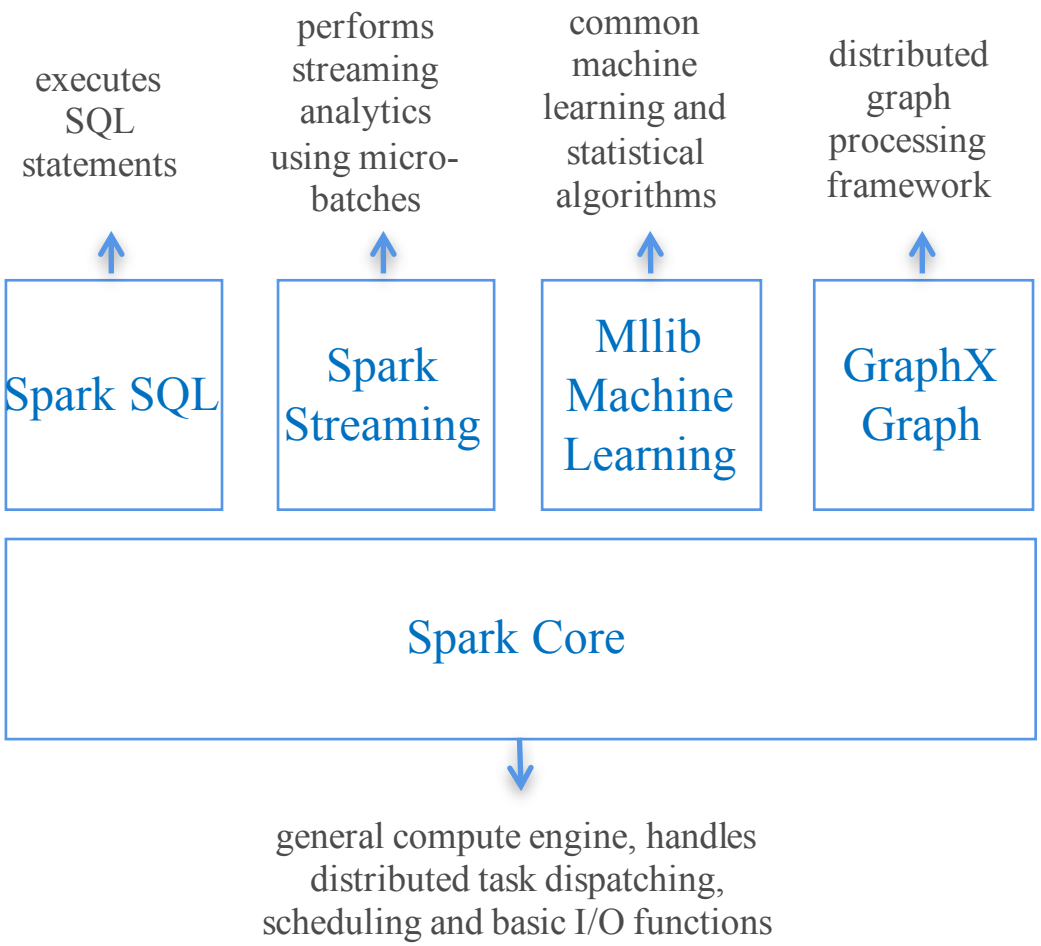
Leverages existing investments

- Works well within **existing Hadoop ecosystem**

Improves with age

- **Large and growing community** of contributors continuously improve full analytics stack and extend capabilities

Spark Core Libraries

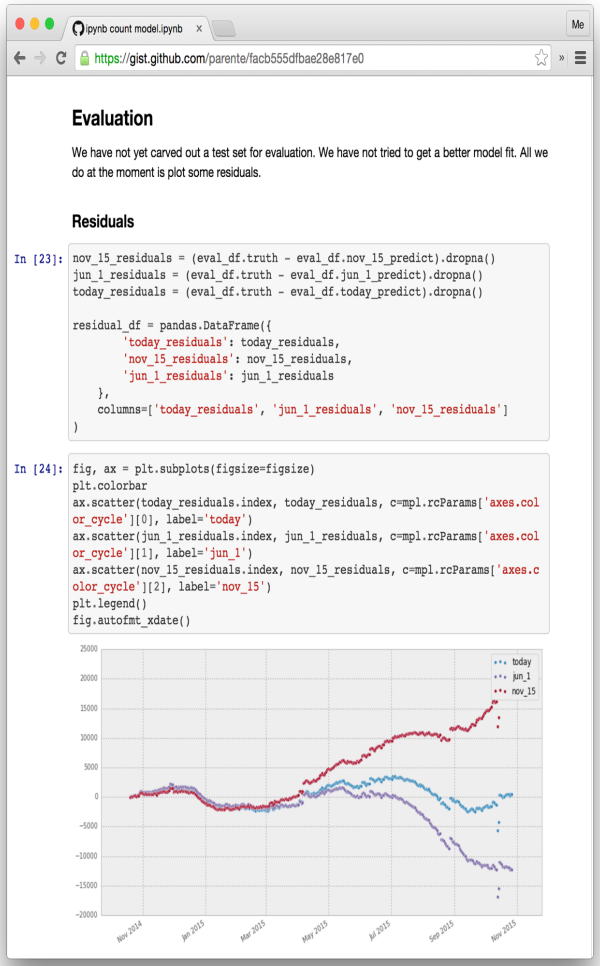


What is a Notebook?

Text, Annotations

Code, Data

Visualizations, Widgets, Output



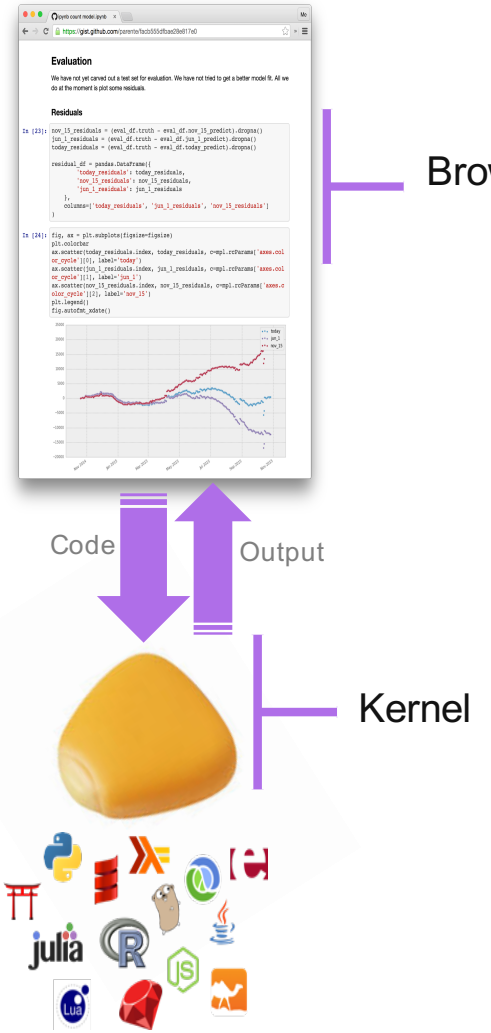
- Web based UI for running apache spark console commands
- Easy, no install spark accelerator
- Best way to start working with Spark

What is Jupyter?

with a “y”, clever ah?

"Open source, interactive data science and scientific computing"

- Formerly IPython
- Large, open, growing community and ecosystem



Cloudant Spark Connector

Built for Spark versions 1.3 – 2.0

- Tested and documented for Python and Scala
- Easy to deploy on a local Spark cluster

Implements the Spark SQL framework (http://spark.apache.org/sql/) and Spark Streaming frameworks (http://spark.apache.org/streaming/) with Cloudant specific implementations to

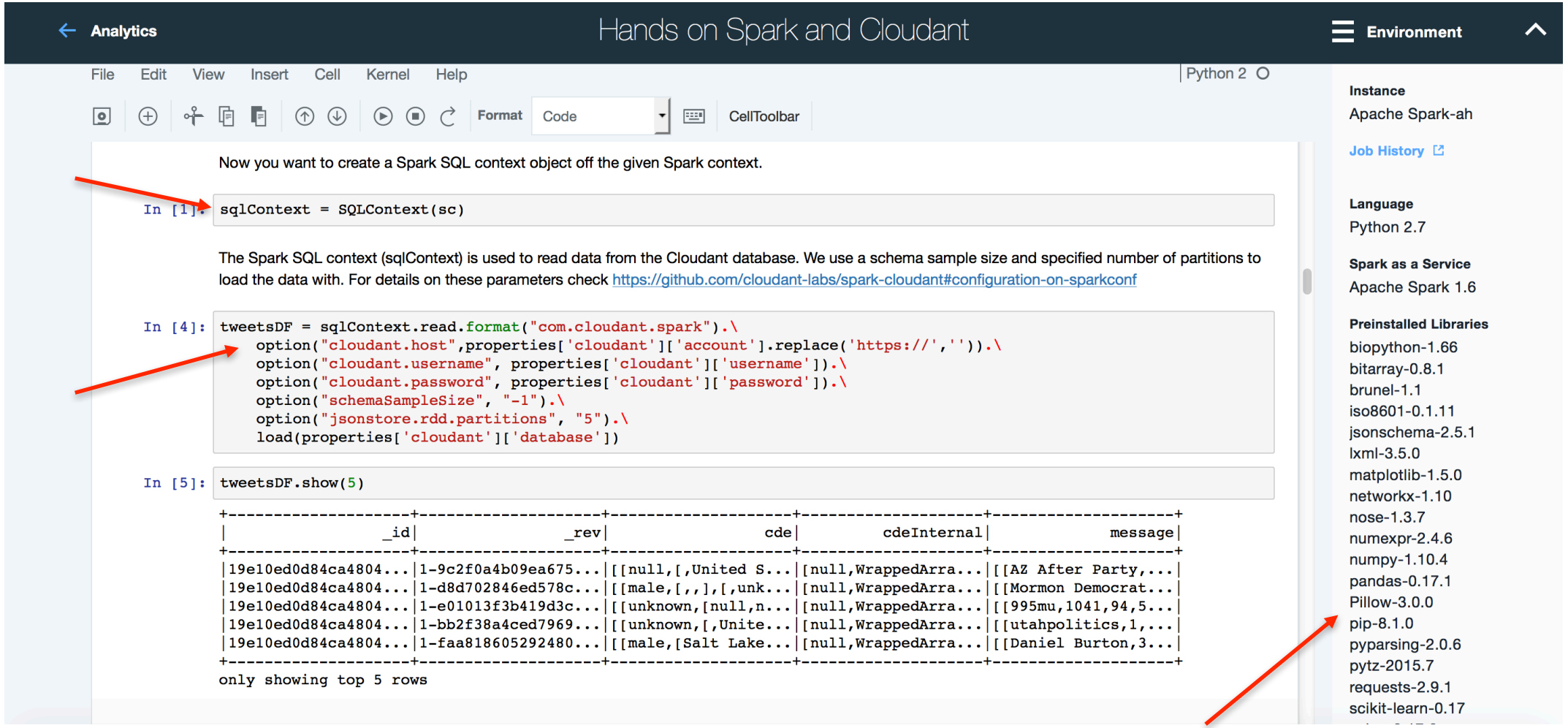
- connect to accounts
- query databases and indexes
- write to databases
- RDDs for analytics in Spark Core
- Dstreams for streaming analytics with Spark Streaming (in Scala only)

Pre-linked with the Spark-as-a-Service on Bluemix (currently at Spark version 1.6)

- available for Jupyter notebooks written in Scala and Python
- available on spark-packages.org for easy load in external Spark deployments

SparkPackages https://spark-packages.org/package/cloudant-labs/spark-cloudant

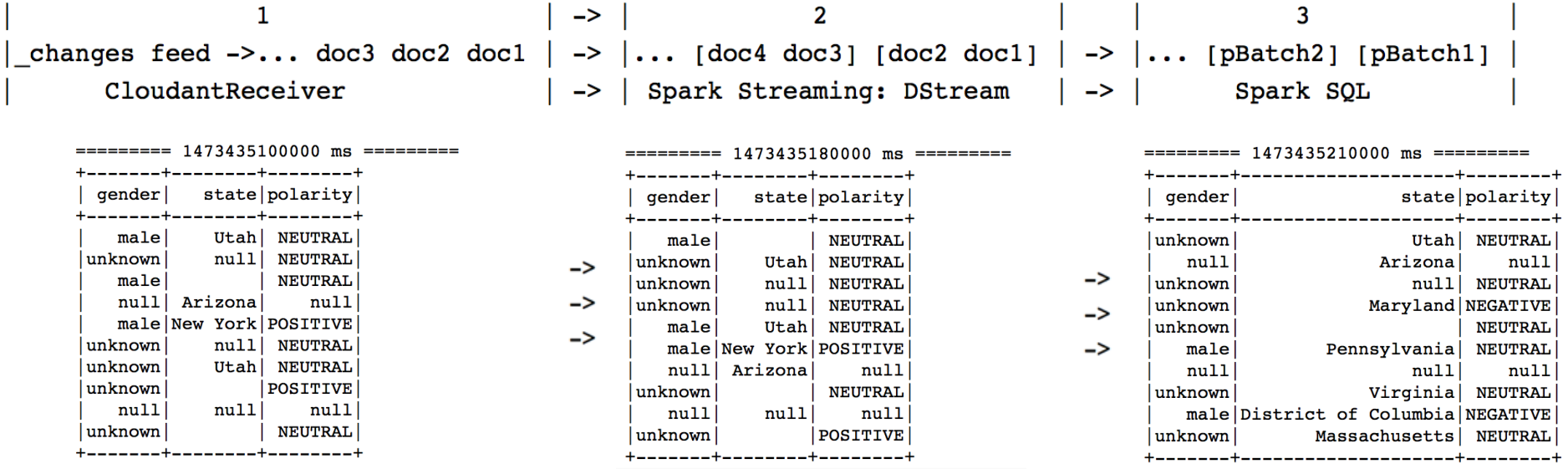
Cloudant & Spark in Jupyter notebooks



Spark Streaming through micro-batching

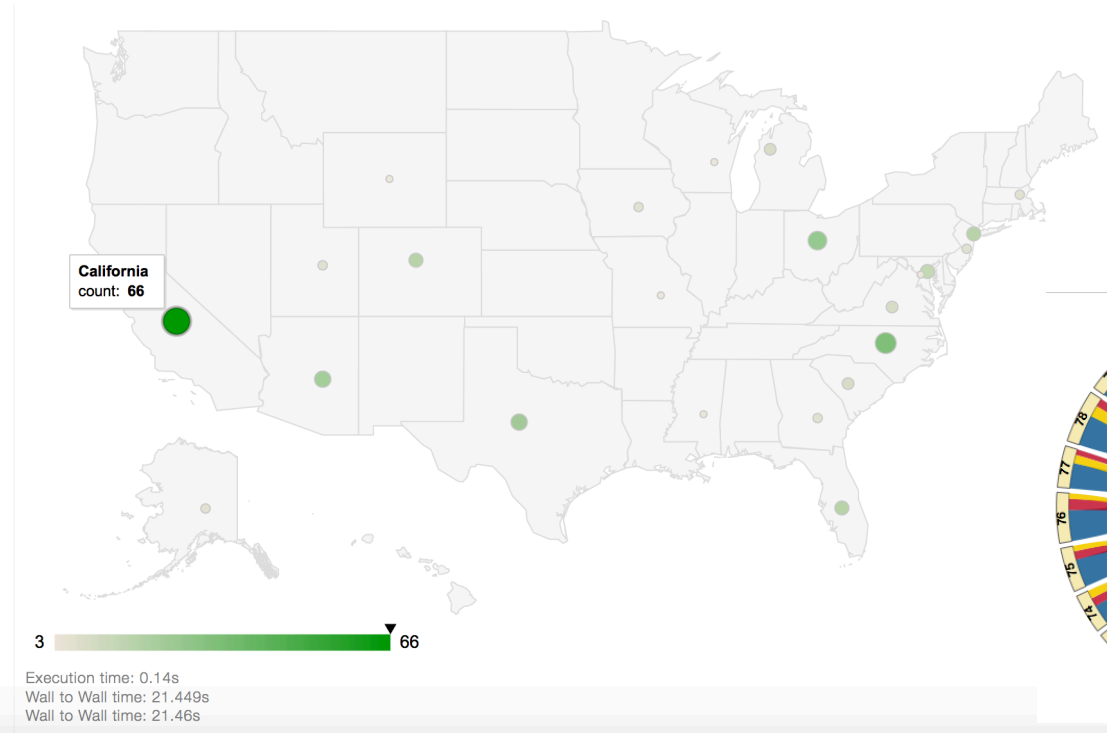
Our processing pipeline goes through three stages:

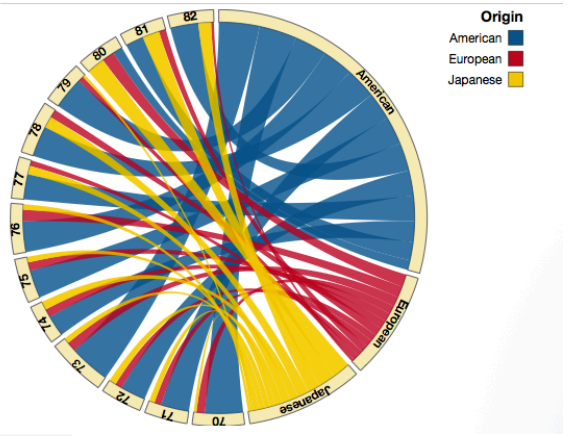
1. *_changes feed* is streamed from the given Cloudant database using `CloudantReceiver`. `CloudantReceiver` will receive _changes feed of the database, extract individual JSON documents from the feed, and store these documents in Spark's memory for processing by Spark Streaming.
2. Spark Streaming will break up this continous stream of documents into batches. Each batch is a separate RDD, and in our case represents a set of documents collected within 10 secs window. This sequence of batches, or sequence of RDDs is what is called a discretized stream or DStream.
3. Each RDD of the DStream is processed using Spark SQL.

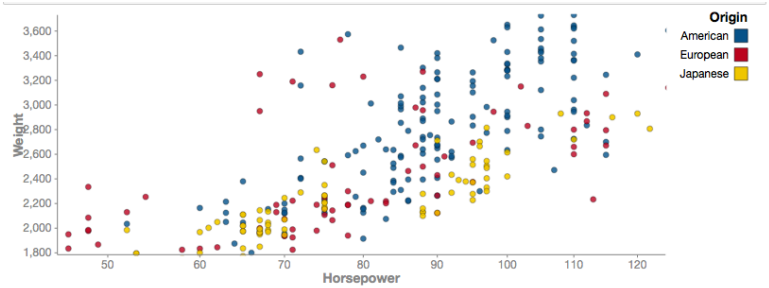


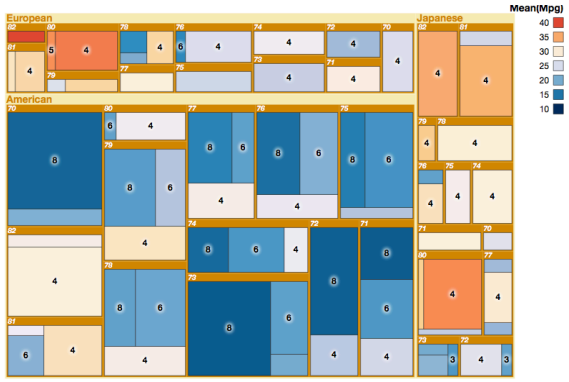
Visualization Libraries

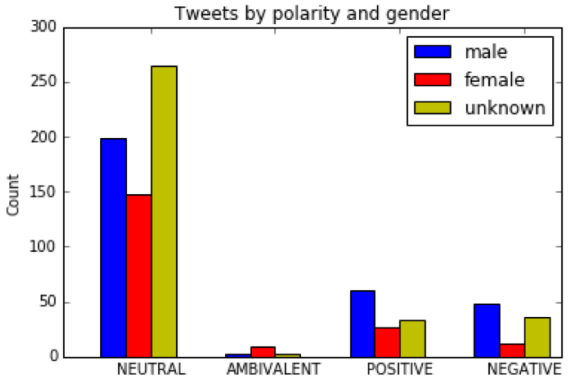
matplotlib
d3py
brunel
…











Learning Resources

Data Science Experience:

- Data Science Experience: http://datascience.ibm.com/

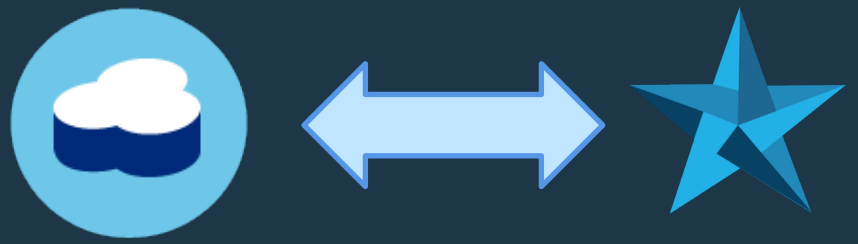
Cloudant:

- Blogs: https://cloudant.com/blog/
- Docs: https://docs.cloudant.com/
- Developer Works: http://www.ibm.com/developerworks/topics/cloudant/

Cloudant Spark

- Announcement blog: https://developer.ibm.com/clouddataservices/2016/03/09/introducing-spark-cloudant-connector/
- Scala tutorial: https://developer.ibm.com/clouddataservices/docs/cloudant/integrate/load-cloudant-data-in-apache-spark-using-scala/
- Python tutorial: https://developer.ibm.com/clouddataservices/docs/cloudant/integrate/load-cloudant-data-in-apache-spark-using-a-python-notebook/

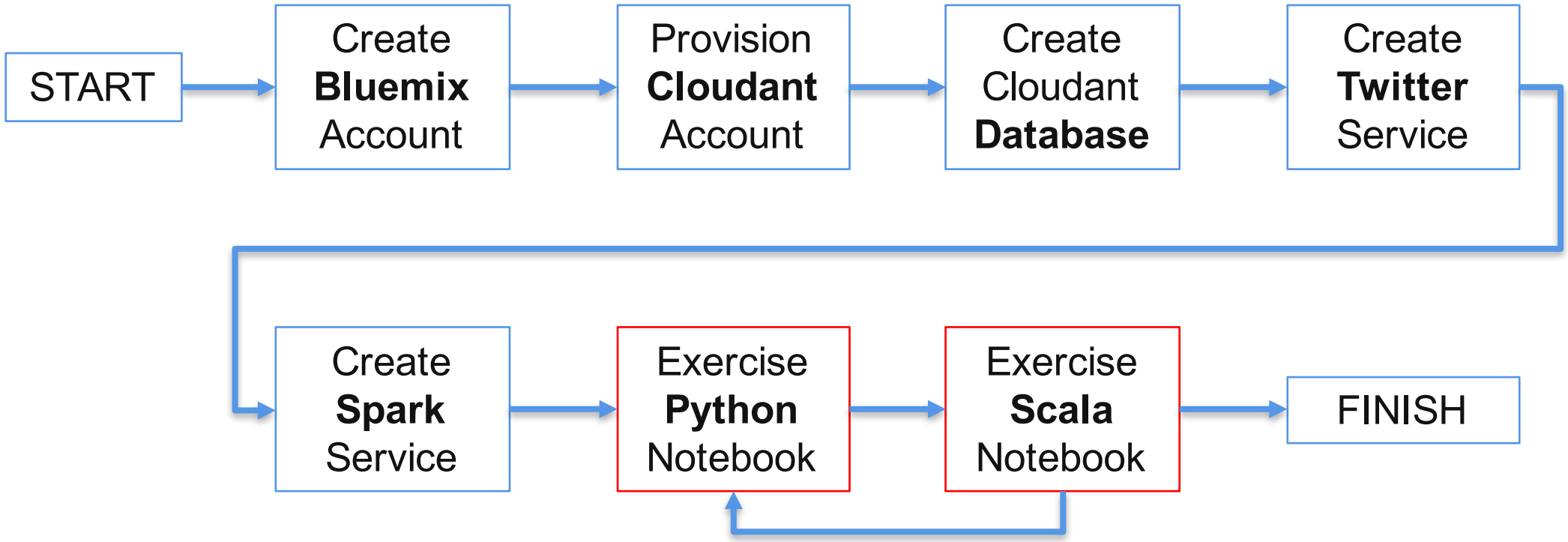
Hands on Lab



- Instructions
- Bluemix, Cloudant, Spark
- Notebooks: Python, Scala

Instructions

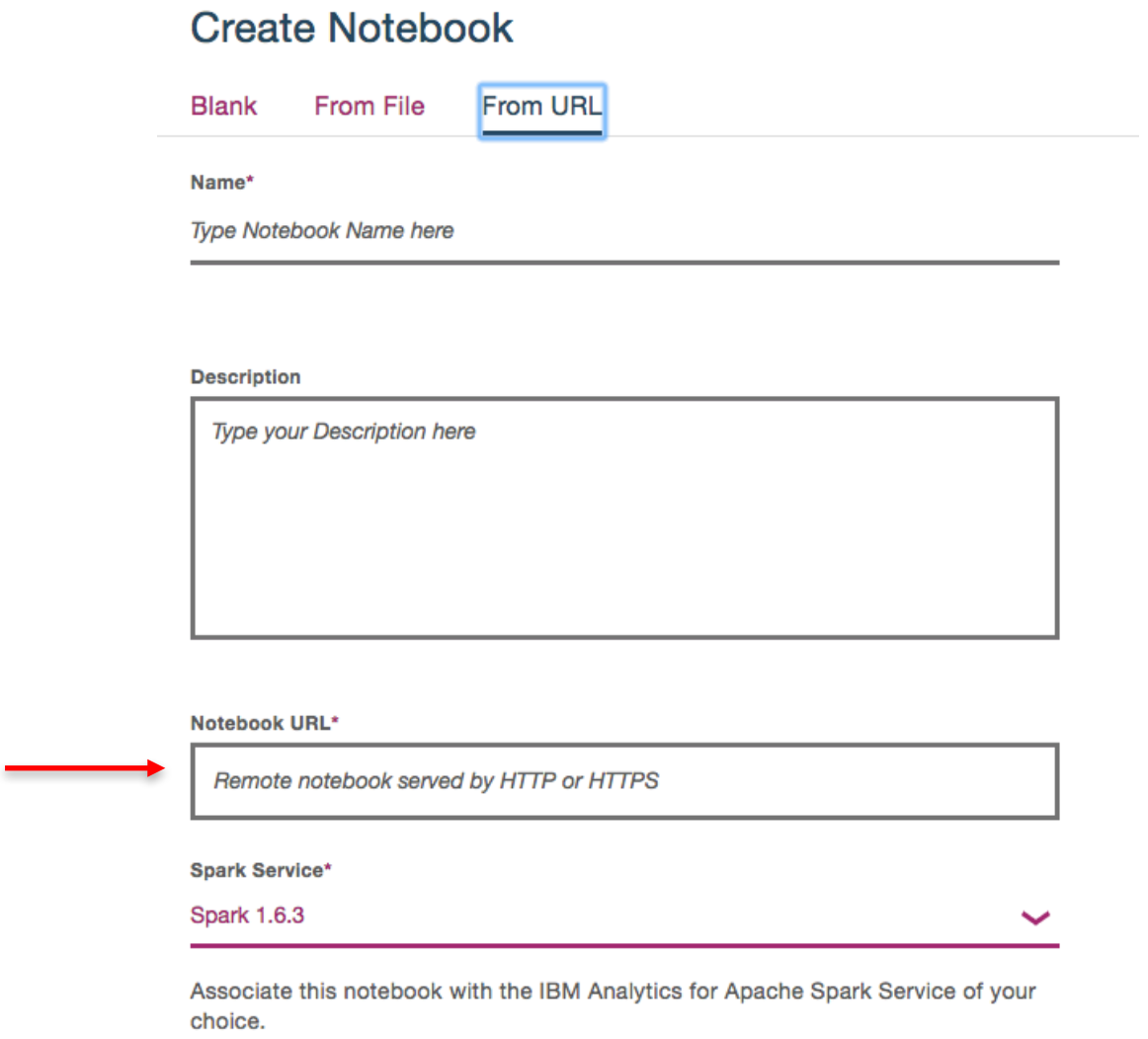
- Bring your own email ID for 30-day trial accounts
- Skip setup steps with existing accounts



Exercise Python Notebooks

This github raw file format is important!

https://raw.githubusercontent.com/cloudant-labs/spark-cloudant/master/tutorials/wowPython.ipynb



Exercise Python Notebook

```
properties = {
            'twitter': {
                'restAPI': 'https://xxx@cdeservice.mybluemix.net/api/v1/messages/search',
                'username': 'xxx',
                'password': 'xxx'
                },
            'cloudant': {
                'account':'https://xxx.cloudant.com',
                'username':'xxx',
                'password':'xxx',
                'database':'tweets'
                }
            }
```

This is for you to complete

```
query = "#election2016"
count = 300
```

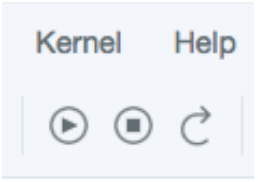
Your choice here but recommend < 3K for good performance!

```
In [6]: TtC = TwitterToCloudant()
        TtC.count = count

        TtC.query_twitter(properties, None, query, 0)
```

```
('https://5e2d04c1-cbcd-4159-901d-229e5a8d7054:JoOpVsIDMq@cdeservice.mybluemix.net/api/v1/mes
sages/search', '#election2016')
GET: Tweets from https://5e2d04c1-cbcd-4159-901d-229e5a8d7054:JoOpVsIDMq@cdeservice.mybluemi
x.net/api/v1/messages/search
Got 200 response
```

If you don't get output, restart the kernel!



Exercise Scala Notebook

Again, github raw file URL!

https://raw.githubusercontent.com/cloudant-labs/spark-cloudant/master/tutorials/wowScala.ipynb

```
val properties = Map(
    "cloudant.host"-> "ACCOUNT.cloudant.com",
    "cloudant.username"-> "USERNAME",
    "cloudant.password"-> "PASSWORD",
    "database"-> "election2016"
)
```

Configuration section

Process runs for 300 sec (that is 5 min :-))

```
ssc.start()
Thread.sleep(300000L)
ssc.stop(true)
```

Trigger a load from Twitter using the Python notebook during that time!

Results

https://github.com/cloudant-labs/spark-cloudant/master/tutorials/wowPython_RESULT.ipynb

https://github.com/cloudant-labs/spark-cloudant/master/tutorials/wowScala_RESULT.ipynb

```
In [35]: trending_pd.head(5)
```

Out[35]:

	CNT	TAG
0	1965	Election2016
1	965	TNTweeters
2	337	CIR
3	336	GOP
4	329	AINF

The hast tag cloud is visualized using the Brunel cloud graph.

```
In [36]: %brunel data('trending_pd') cloud color(cnt) size(cnt) label(tag) :: width=900, height=600
```


```
In [4]: ssc.start()
        Thread.sleep(300000L)
        ssc.stop(true)
```

```
========= 1473700520000 ms =========
+--------------------+--------------------+--------------------+--------------------+--------------------+
|                 _id|                _rev|                 cde|         cdeInternal|             message|
+--------------------+--------------------+--------------------+--------------------+--------------------+
|19e10ed0d84ca4804...|1-e01013f3b419d3c...|[[unknown,[null,n...|[null,WrappedArra...|[[995mu,1041,94,5...|
|19e10ed0d84ca4804...|1-faa818605292480...|[[male,[Salt Lake...|[null,WrappedArra...|[[Daniel Burton,3...|
|19e10ed0d84ca4804...|1-ef96819a7a98d1b...|[[male,[Monticell...|[null,WrappedArra...|[[Steven Kurlande...|
|19e10ed0d84ca4804...|1-9c2f0a4b09ea675...|[[null,[,United S...|[null,WrappedArra...|[[AZ After Party,...|
|19e10ed0d84ca4804...|1-d8d702846ed578c...|[[male,[,,],[,unk...|[null,WrappedArra...|[[Mormon Democrat...|
|19e10ed0d84ca4804...|1-bb2f38a4ced7969...|[[unknown,[,Unite...|[null,WrappedArra...|[[utahpolitics,1,...|
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|19e10ed0d84ca4804...|1-85dfdf787bc125e...|[[unknown,[Köln,G...|[null,WrappedArra...|[[Awale Howle,162...|
|19e10ed0d84ca4804...|1-643e24d6fbda555...|[[male,[BELLE,Uni...|[null,WrappedArra...|[[DR.BROWN-DEAN,3...|
|19e10ed0d84ca4804...|1-020f864315fe3d6...|[[male,[Elizabeth...|[[true,null,false...|[[Mr. Huesken,164...|
+--------------------+--------------------+--------------------+--------------------+--------------------+
only showing top 10 rows

+-------+---------------+---------+
| gender|          state|polarity|
+-------+---------------+---------+
|unknown|           null| NEUTRAL|
|   male|           Utah| NEUTRAL|
|   male|       New York|POSITIVE|
|   null|        Arizona|     null|
|   male|               | NEUTRAL|
|unknown|           Utah| NEUTRAL|
|unknown|South Australia|NEGATIVE|
|unknown|               |POSITIVE|
|   male|       Missouri|NEGATIVE|
|   male|   Pennsylvania| NEUTRAL|
+-------+---------------+---------+
only showing top 10 rows

Current total count:1200
========= 1473700530000 ms =========
========= 1473700540000 ms =========
========= 1473700550000 ms =========
+--------------------+--------------------+--------------------+--------------------+--------------------+
|                 _id|                _rev|                 cde|         cdeInternal|             message|
+--------------------+--------------------+--------------------+--------------------+--------------------+
|39fb4703881bd46a4...|1-9f0eb0d3e8309ac...|[[unknown,[null,n...|[null,WrappedArra...|[[ekajoyce,179,25...|
|39fb4703881bd46a4...|1-d8d702846ed578c...|[[male,[,,],[,unk...|[null,WrappedArra...|[[Mormon Democrat...|
|39fb4703881bd46a4...|1-9c2f0a4b09ea675...|[[null,[,United S...|[null,WrappedArra...|[[AZ After Party,...|
|39fb4703881bd46a4...|1-bb2f38a4ced7969...|[[unknown,[,Unite...|[null,WrappedArra...|[[utahpolitics,1,...|
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only showing top 10 rows
```

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