Integrating Relational Data with Hadoop and Spark

think 2018

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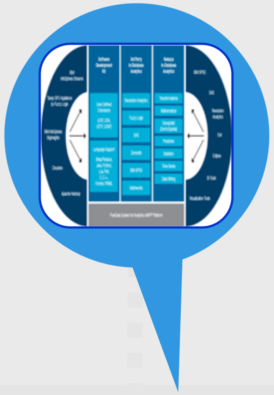
Labs

- Lab 1: Creating Tables
- Lab 2: Loading Data
- Lab 3: Executing Queries
- Lab 4: Linear Regression in SQL
- Lab 5: Linear Regression with R
- Lab 6: Linear Regression with Python
- Lab 7: Analyzing data with R in RStudio

Db2 Warehouse – Analytics Warehouse as a Service

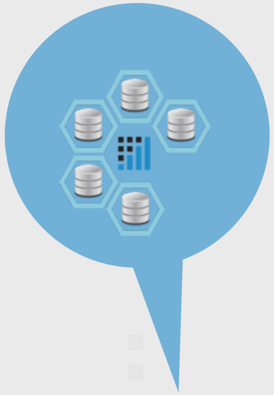
BLU Acceleration

- DB2 BLU columnar technology
- in-memory processing, data skipping, actionable compression, parallel vector processing, , “Load & Go” administration



Netezza In-Database Analytics

- Netezza predictive analytic algorithms
- fully integrated RStudio & R language



Db2 Warehouse MPP

- Massively Parallel Processing (MPP)
- Oracle compatibility
- fully-managed warehouse

Db2 Warehouse – Key Use Cases

Cloudant Analytics

- Easy synchronization of JSON to structured data
- Allows analytics via standard BI tools
- In-database predictive algorithms allow greater insight for Cloudant users than ever before

Extend or Modernize

- Extend on-premise data warehouses to the cloud
- Flexible, cost-effective growth
- Hybrid Cloud model to support ground to cloud

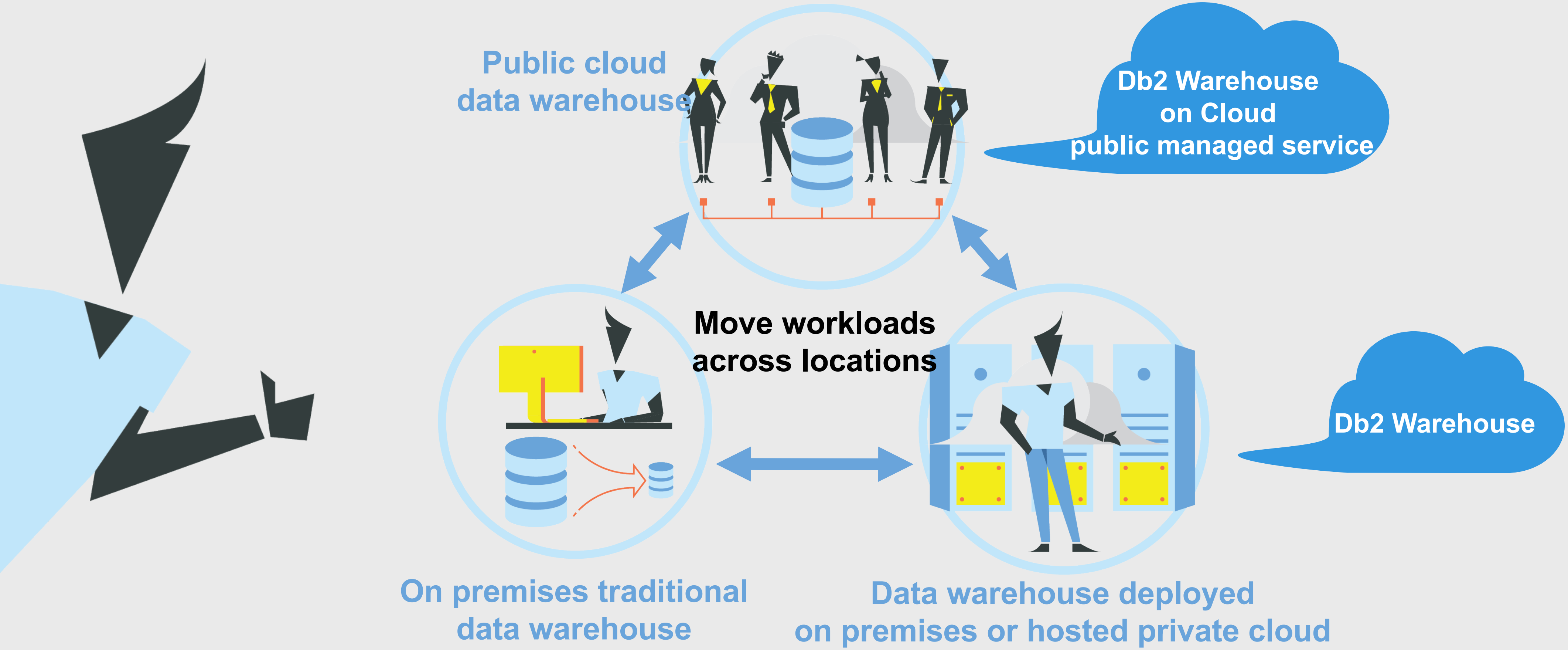
In-Database Analytics

- Robust predictive analytic algorithms
- Integrated with R (and Python/Spark)
- Watson Analytics Ready
- Analytics Ecosystem with Partners

Data Warehouse & Analytics Service

- Data Warehousing and Analytics in the Cloud
- Cloud Agility and Flexibility
- Analytics for Cloud Data, Data Marts, and development and test environments

Db2 Warehouse offerings – on cloud or local



Public cloud data warehouse

Db2 Warehouse on Cloud public managed service

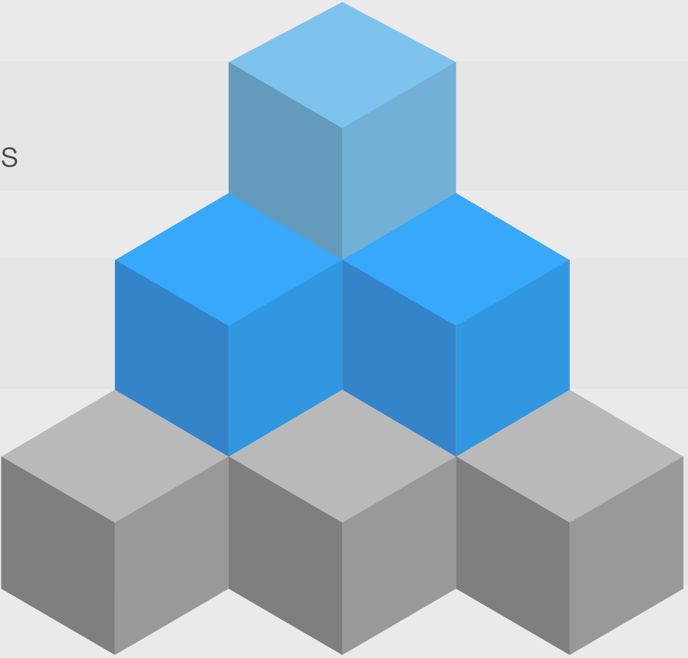
Move workloads across locations

Db2 Warehouse

On premises traditional data warehouse

Data warehouse deployed on premises or hosted private cloud

Db2 Warehouse – machine learning algorithms & geospatial



Decision Trees
Regression Trees

Naive Bayes

Linear Regression

k-Means Clustering
k-Nearest Neighbors

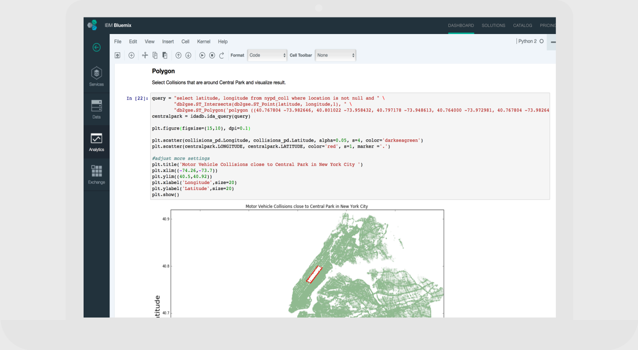
Assosiation Rules
Sequential Patters & Rules

Geospatial Extender

In-database analytics on Db2 Warehouse

Run machine learning algorithms and do geospatial analytics directly on the data in Db2 Warehouse leveraging the efficient parallel database engine.

Db2 Warehouse – R and Python integration



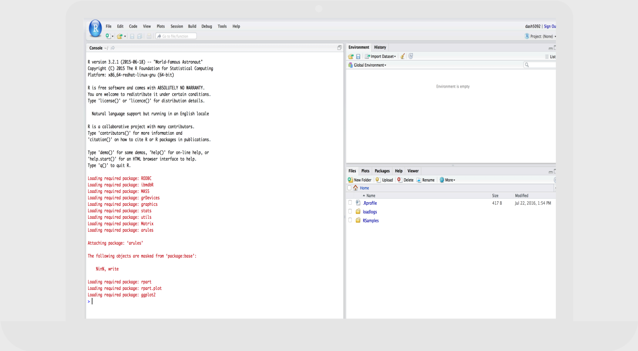
Polygon

Select Collisions that are around Central Park and visualize result.

```
In [22]: query = "select latitude, longitude from nypd_coll where location is not null and " \
                 "db2gse.ST_Intersects(db2gse.ST_Point(latitude, longitude,1), " \
                 "db2gse.ST_Polygon('polygon ((40.767804 -73.982646, 40.801022 -73.958432, 40.797178 -73.948613, 40.764000 -73.972981, 40.767804 -73.98264
         centralpark = idadb.ida_query(query)

         plt.figure(figsize=(15,10), dpi=0.1)

         plt.scatter(collisions_pd.Longitude, collisions_pd.Latitude, alpha=0.05, s=4, color='darkseagreen')
         plt.scatter(centralpark.LONGITUDE, centralpark.LATITUDE, color='red', s=1, marker ='.')

         #adjust more settings
         plt.title('Motor Vehicle Collisions close to Central Park in New York City ')
         plt.xlim((-74.26,-73.7))
         plt.ylim((40.5,40.92))
         plt.xlabel('Longitude',size=20)
         plt.ylabel('Latitude',size=20)
         plt.show()
```

Motor Vehicle Collisions close to Central Park in New York City
40.9
40.8
40.7
Latitude

- Integrated with Spark Service offering in Bluemix
- Access data in Db2 Warehouse from notebook interface in Spark Service or Data Science Experience GUI
- Run machine learning algorithms directly in database engine



```
R version 3.2.1 (2015-06-18) -- "World-Famous Astronaut"
Copyright (C) 2015 The R Foundation for Statistical Computing
Platform: x86_64-redhat-linux-gnu (64-bit)

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  Natural language support but running in an English locale

R is a collaborative project with many contributors.
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'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

Loading required package: RODBC
Loading required package: ibmdbR
Loading required package: MASS
Loading required package: grDevices
Loading required package: graphics
Loading required package: stats
Loading required package: utils
Loading required package: Matrix
Loading required package: arules

Attaching package: 'arules'

The following objects are masked from 'package:base':

    %in%, write

Loading required package: rpart
Loading required package: rpart.plot
Loading required package: ggplot2
>
```
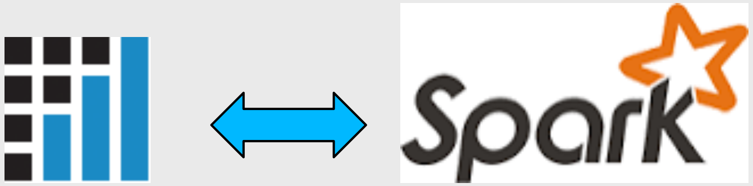

Name	Size	Modified
.Rprofile	417 B	Jul 22, 2016, 1:54 PM
loadlogs		
RSamples		

- Access data in Db2 Warehouse from RStudio environment
- RStudio hosted on Db2 Warehouse server
- Machine learning algorithms of Db2 Warehouse available via ibmdbR library
- Possibility to pushdown R code to Db2 Warehouse server

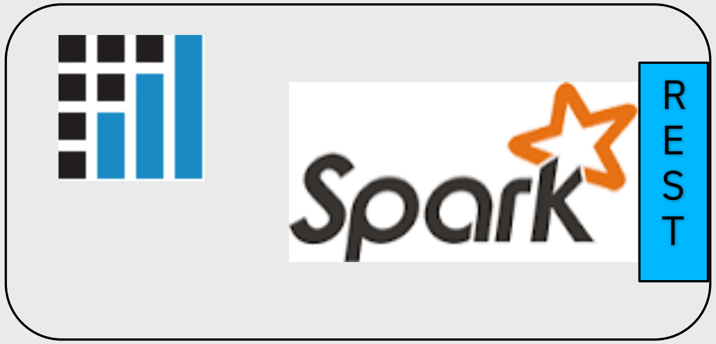
Db2 Warehouse – Spark Integration

Communication



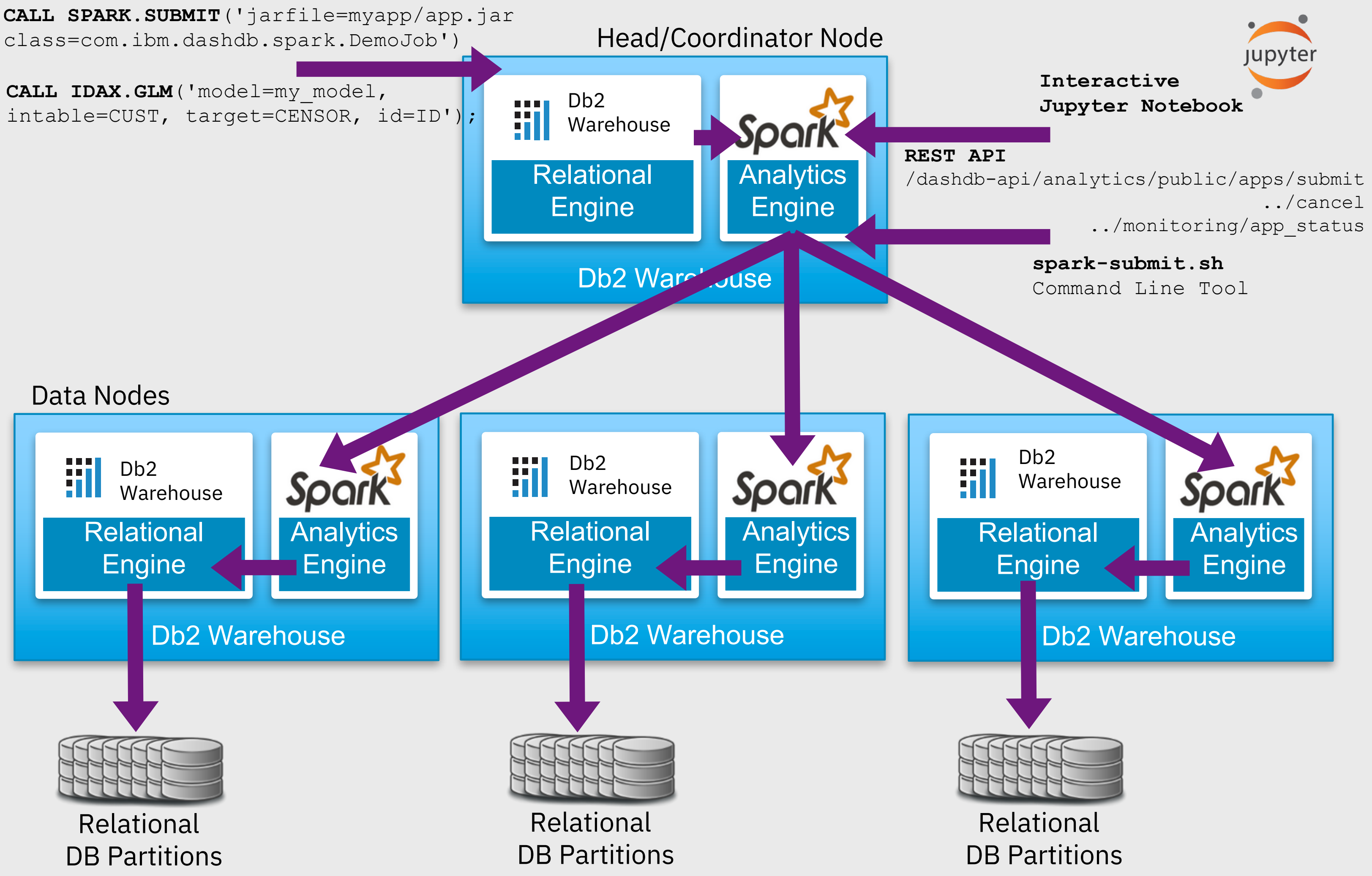
- Spark reading and writing Db2 Warehouse tables

Administration



- Administration of Spark code via
  - •REST interface
- Monitoring of Spark via
  - •Db2 Warehouse Web Console or
  - •REST Interface

Db2 Warehouse Spark Integration Examples



```
CALL SPARK.SUBMIT('jarfile=myapp/app.jar
class=com.ibm.dashdb.spark.DemoJob')

CALL IDAX.GLM('model=my_model,
intable=CUST, target=CENSOR, id=ID');
```

Interactive Jupyter Notebook

REST API

```
/dashdb-api/analytics/public/apps/submit
                                ../cancel
                    ../monitoring/app_status
```

spark-submit.sh
Command Line Tool

Some hints for executing the labs

- Start with starting everything as described in in Appendix I
- Check with

  ```
  docker exec Db2wh status
  ```

  whether Db2 Warehouse is running
- Remove the directory Advanced-Analytics in the home directory of user ibmuser with

  ```
  rm –rf Advanced-Analytics
  ```
- Only after that execute the `git clone` command
- The Jupyter notebooks can be found in the subdirectory Advanced-Analytics/notebooks

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Thank you

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