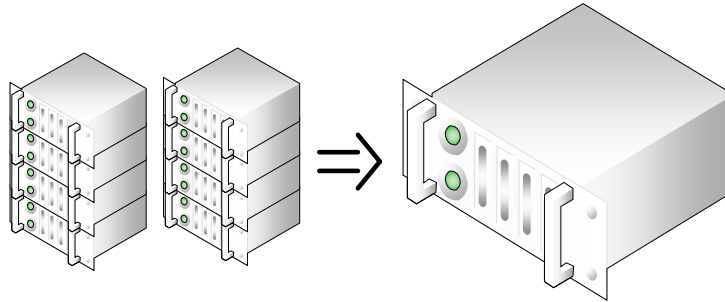


Procesamiento de datos masivos

Jesús Morán

- Varios servidores que trabajan como si fuese uno
 - Rendimiento: tareas con alta memoria, CPU, etc
 - Disponibilidad: tolerancia a fallos
 - Eficiencia: gestión de recursos y tareas
 - Escalado: vertical vs horizontal

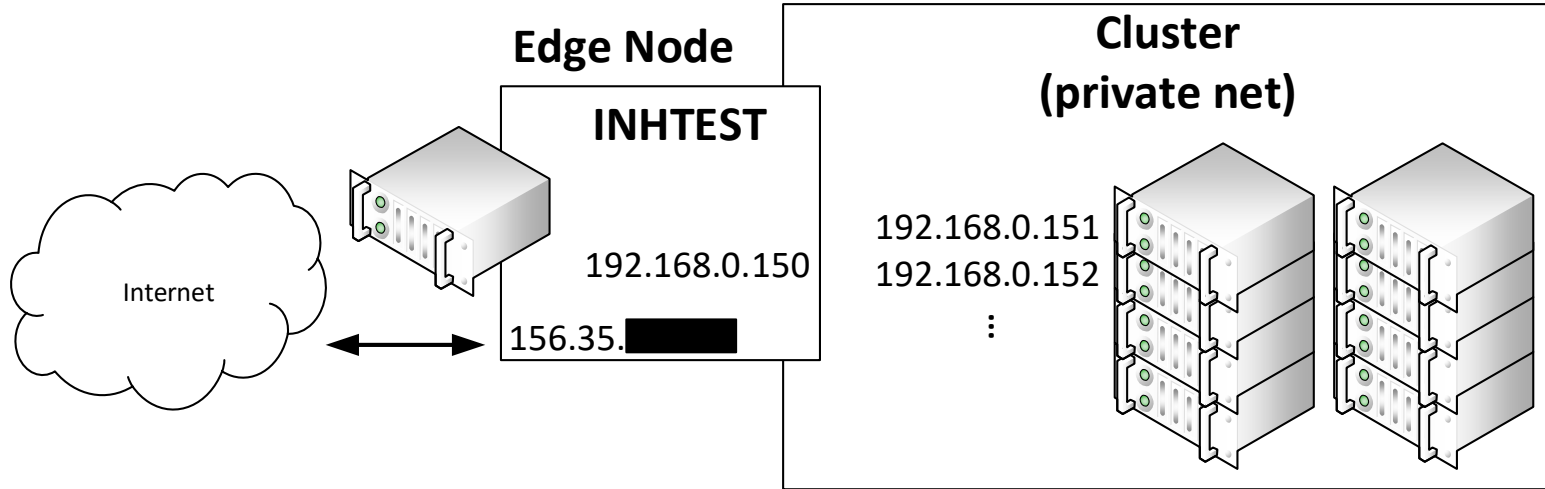


- Servidores y racks
- Red y conexiones
- Sistemas de archivos distribuidos
- Gestión de usuarios
- Permisos y seguridad
- Configuraciones y políticas de acceso
- Monitorización
- Fallos de servidores
- Recursos en caliente
- Interoperabilidad de servicios
- Balanceo de carga

- Altas prestaciones (HPC)
 - Requieren el análisis de muchos nodos
 - Paradigmas distribuidos
- Alta disponibilidad
 - Replicaciones
 - Sin puntos de fallo únicos
 - Servicio disponible (si falla se restaura)
- Balanceo de carga
 - Varios nodos corren en mismo servicio y se balancea el acceso

- **Análisis y cálculo:**
 - Bases de datos: SQL, NoSQL, newSQL
 - Procesamiento Big Data
- **Renderizado**
- **Desencriptación**
- **Simulaciones:**
 - Mecánica
 - Química
 - ...

Cluster a desplegar



- Operativo: CentOS (o Almalinux)
- Asignar IP (ej. DHCP)
- Instalar Java
 - Variable de entorno \$JAVA_HOME
 - Enlace simbólico:

```
alternatives --install /usr/bin/java java /usr/...
```
- Crear usuario hadmin y grupo hadoop
- Descargar Hadoop en /usr/local (ej. wget)
- Asignar a hadmin y hadoop como propietarios
- Crear carpeta de archivos temporales en /hadoopTemp

- Nombre de hosts y red

- Abrir puertos [maestro = INHTEST1]

- ☐ NameNode: 9000 y 50070 (sólo maestro)
- ☐ Secondary NameNode: 50090 (sólo maestro)
- ☐ DataNode: 50020, 50010 y 50075
- ☐ ResourceManager: 8088, 8031, 8032 y 8030 (sólo maestro)
- ☐ NodeManager: 8042, 8040 y 10200
- ☐ HistoryServer: 19888 y 10020
- ☐ Shuffle: 13562
- ☐ Hadoop ephemeral ports: 50200:51200
- ☐ Otros puertos de Spark, Flink, etc. (generalmente sólo maestro)

- Instalamos ssh
- Creamos una clave pública/privada
`ssh-keygen -t rsa -P "" -f ~/.ssh/id_rsa`
- La ponemos como clave autorizada:
`cat ~/.ssh/id_rsa.pub >>
~/.ssh/authorized_keys`
- Las copiamos a otros nodos:
`ssh-copy-id -i ~/.ssh/id_rsa.pub
hadmin@INHTEST2`

- Crear variables de entorno de Hadoop:
 - `HADOOP_HOME=/usr/local/hadoop/hadoop-x.y.0`
 - `HADOOP_MAPRED_HOME=$HADOOP_HOME`
 - `HADOOP_COMMON_HOME=$HADOOP_HOME`
 - `HADOOP_HDFS_HOME=$HADOOP_HOME`
 - `HADOOP_YARN_HOME=$HADOOP_HOME`
 - `HADOOP_CONF_DIR=$HADOOP_HOME/etc/hadoop`
 - `HADOOP_COMMON_LIB_NATIVE_DIR=$HADOOP_HOME/lib/native`
 - `export HADOOP_OPTS="-Djava.library.path=/usr/local/hadoop/hadoop-2.2.0/lib"`
- Añadir `$HADOOP_HOME/bin` al path

■ Configuramos Hadoop

□ \$HADOOP_HOME/etc/hadoop/core-site.xml

```
<configuration>
  <property>
    <name>fs.default.name</name>
    <value>hdfs://INHTEST1:9000</value>
  </property>
  <property>
    <name>hadoop.tmp.dir</name>
    <value>/hadoopTemp</value>
  </property>
</configuration>
```

■ Configuramos Hadoop

- \$HADOOP_HOME/etc/hadoop/core-site.xml

- **\$HADOOP_HOME /etc/hadoop/yarn-site.xml**

- yarn.resourcemanager.hostname: INHTEST1
- yarn.resourcemanager.address: INHTEST1:8032
- yarn.resourcemanager.resource-tracker.address: INHTEST1:8031
- yarn.resourcemanager.scheduler.address: INHTEST1:8030
- yarn.log.server.url: http://INHTEST1:19888/jobhistory/logs/
- yarn.nodemanager.aux-services: mapreduce_shuffle
- yarn.nodemanager.aux-services.mapreduce_shuffle.class: org.apache.hadoop.mapred.ShuffleHandler
- yarn.log-aggregation-enable: true

■ Configuramos Hadoop

- \$HADOOP_HOME/etc/hadoop/core-site.xml
- \$HADOOP_HOME /etc/hadoop/yarn-site.xml
- **\$HADOOP_HOME /etc/hadoop/hdfs-site.xml**
 - dfs.data.dir: file:///usr/local/hadoop/Data/Datanode
 - dfs.name.dir: file:///usr/local/hadoop/Data/Namenode
 - dfs.namenode.secondary.http-address: INHTEST1:50090
 - dfs.namenode.http-address: INHTEST1:50070
 - dfs.namenode.secondary.http-address: INHTEST1:50090
 - dfs.permissions.superusergroup: hadoop
 - dfs.replication: 3
 - dfs.permissions.enabled: true

■ Configuramos Hadoop

- \$HADOOP_HOME/etc/hadoop/core-site.xml
- \$HADOOP_HOME /etc/hadoop/yarn-site.xml
- \$HADOOP_HOME /etc/hadoop/hdfs-site.xml
- **\$HADOOP_HOME /etc/hadoop/mapred-site.xml**
 - mapreduce.jobtracker.http.address: INHTEST1:50030
 - mapreduce.jobhistory.address: INHTEST1:10020
 - mapreduce.jobhistory.webapp.address: INHTEST1:19888
 - yarn.app.mapreduce.am.job.client.port-range: 50200-51200
 - mapreduce.framework.name: yarn
 - mapreduce.jobtracker.staging.root.dir: /user

- Indicar los esclavos:
`$HADOOP_HOME/etc/hadoop/slaves`
- Formateamos el sistema de archivos distribuido:
`hadoop namenode -format`
 - Formatea los metadatos del namenode ~ formatear sistema de archivos
- Arrancar los servicios:
`$HADOOP_HOME/sbin/start-all.sh`
- Crear las carpetas de usuario:
`hadoop fs -mkdir /user`
`hadoop fs -mkdir /user/hadmin`

- Tiene que ser un Edge node
- Instalar:
 - Java
 - Hadoop (configuración de Hadoop)
 - ssh
- Crear usuario
 - Creamos usuario local con grupo hadoop
 - Crear carpeta en sistema de archivos distribuido
`hadoop fs -mkdir /user/cristian/`
 - Ponerlo como propietario
`hadoop fs -chown -R cristian:hadoop /user/cristian/`

- Sistema de archivos distribuido: HDFS (maestro y esclavos)
- Gestor de recursos: YARN (maestros y esclavos)
- Motores de procesamiento: Hadoop, Spark,...
- Otros:
 - Servidores web del cluster
 - Historial
 - Logs distribuidos

- Ganglia: monitorizar el uso de recursos
- Nagios: alertar de problemas en el cluster
- Kerberos: autenticación integrada con Hadoop
- Squid:
 - Proxy transparente para actualizar los operativos
 - SSL BUMP man-in-the-middle para otras instalaciones
- Otros frameworks/librerías de cálculo:
 - R (para utilizar SparkR)
 - Zeppelin: notebook Big Data
 - ...

The screenshot displays the Zeppelin Notebook web interface. The browser's address bar shows the URL `http://192.168.1.100:8080/`. The Zeppelin logo and "Notebook" tab are visible in the top navigation bar. The main content area is titled "Tutorial SparkR Uniovi" and features a "Contents" sidebar on the left. The sidebar lists various topics, including "Dimensiones del dataset", "Selección de columnas", and "Operaciones básicas de Spark". The main panel shows three code blocks:

- Block 1:** Contains the code `%spark.r` and `nrow(myDF)`. The output is `[1] 15542579`. The status is "FINISHED".
- Block 2:** Contains the code `%spark.r` and `ncol(myDF)`. The output is `[1] 24`. The status is "FINISHED".
- Block 3:** Titled "3.4 Seleccionar columnas", it explains that the `$` operator is used for column selection in R. The code `%spark.r` and `head(select(myDF, "Bottle Volume (ml)"))` is shown. The output displays the first row of the "Bottle Volume (ml)" column with a value of 600. The status is "FINISHED".

Otros servicios

History Server - Mozilla Firefox

Universidad de Oviedo - Inicio x History Server x +

← → ↻ 🏠 ⓘ inhtest1:18080 90% ... 📧 ☆ 🔍 Buscar

Más visitados 🌐 JobHistory

2.1.2 History Server

Event log directory: hdfs://inhtest1:9000/tmp/spark-logs

Last updated: 26/2/2019, 18:02:36

Show 20 entries Search:

App ID	App Name	Attempt ID	Started	Completed	Duration	Spark User	Last Updated	Event Log
application_1523705380604_0242	Zeppelin		2019-02-18 22:31:46	2019-02-21 19:21:23	68.8 h	hadmin	2019-02-21 19:21:23	Download
application_1523705380604_0236	Zeppelin		2019-02-17 09:23:06	2019-02-18 22:12:05	36.8 h	hadmin	2019-02-18 22:12:05	Download
application_1523705380604_0241	example dapply		2019-02-18 17:03:06	2019-02-18 17:06:31	3.4 min	hadmin	2019-02-18 17:06:31	Download
application_1523705380604_0240	example dapply		2019-02-18 16:29:49	2019-02-18 16:36:09	6.3 min	hadmin	2019-02-18 16:36:09	Download
application_1523705380604_0238	my SparkR example		2019-02-17 20:33:00	2019-02-17 20:56:52	24 min	hadmin	2019-02-17 20:56:53	Download
application_1523705380604_0235	Zeppelin		2019-02-16 18:20:11	2019-02-17 09:22:18	15.0 h	hadmin	2019-02-17 09:22:18	Download
application_1523705380604_0234	my SparkR example		2019-02-14 23:07:46	2019-02-14 23:08:27	41 s	hadmin	2019-02-14 23:08:27	Download
application_1523705380604_0233	Zeppelin		2019-02-12 16:39:05	2019-02-12 16:42:02	3.0 min	hadmin	2019-02-12 16:42:02	Download
application_1523705380604_0232	Zeppelin		2019-02-12 16:00:33	2019-02-12 16:05:11	4.6 min	hadmin	2019-02-12 16:05:11	Download
local-1549987136877	Zeppelin		2019-02-12 15:58:54	2019-02-12 16:00:12	1.3 min	hadmin	2019-02-12 16:00:12	Download
application_1523705380604_0231	my SparkR example		2019-02-12 15:40:55	2019-02-12 15:41:35	40 s	hadmin	2019-02-12 15:41:36	Download
application_1523705380604_0230	Zeppelin		2019-02-12 15:19:10	2019-02-12 15:24:39	5.5 min	hadmin	2019-02-12 15:24:39	Download
application_1523705380604_0229	Zeppelin		2019-02-12 13:16:14	2019-02-12 15:18:50	2.0 h	hadmin	2019-02-12 15:18:50	Download
application_1523705380604_0227	Zeppelin		2019-02-12 12:32:18	2019-02-12 13:14:59	43 min	hadmin	2019-02-12 13:14:59	Download
application_1523705380604_0228	my SparkR example		2019-02-12 12:33:32	2019-02-12 12:34:59	1.4 min	hadmin	2019-02-12 12:34:59	Download

Zeppelin - Details for Stage 20 (Attempt 0) - Mozilla Firefox

Universidad de Oviedo - Inicio Zeppelin - Details for Stage 20 (Attempt 0)

inhtest1:18080/history/application_18080_150275013 90% Buscar

Más visitados JobHistory

spark 2.1.2 Jobs Stages Storage Environment Executors SQL Zeppelin application UI

Details for Stage 20 (Attempt 0)

Total Time Across All Tasks: 19 min

Locality Level Summary: Node local: 32

Input Size / Records: 3.9 GB / 15542579

Shuffle Write: 38.3 KB / 32

- DAG Visualization
- Show Additional Metrics
- Event Timeline

Summary Metrics for 32 Completed Tasks

Metric	Min	25th percentile	Median	75th percentile	Max
Duration	17 s	36 s	36 s	37 s	40 s
GC Time	0,2 s	0,3 s	0,3 s	0,3 s	0,3 s
Input Size / Records	59.2 MB / 228060	128.0 MB / 492773	128.0 MB / 492818	128.0 MB / 494118	128.0 MB / 500576
Shuffle Write Size / Records	1189.0 B / 1	1215.0 B / 1	1227.0 B / 1	1238.0 B / 1	1262.0 B / 1

Aggregated Metrics by Executor

Executor ID	Address	Task Time	Total Tasks	Failed Tasks	Killed Tasks	Succeeded Tasks	Input Size / Records	Shuffle Write Size / Records
1	stdout stderr INHTEST3:50555	9,7 min	16	0	0	16	2.0 GB / 7902264	19.1 KB / 16
2	stdout stderr INHTEST3:50616	9,5 min	16	0	0	16	1979.2 MB / 7640315	19.2 KB / 16

Tasks (32)

Job Id (Job Group)	Description	Submitted	Duration	Stages: Succeeded/Total	Tasks (for all stages): Succeeded/Total
18 (zeppelin-2E3PDKKPK-20190209-135527_150275013)	+Started by: admin describe at NativeMethodAccessorImpl.java:0	2019/02/16 19:34:18	9,7 min	2/2	33/33

Gracias