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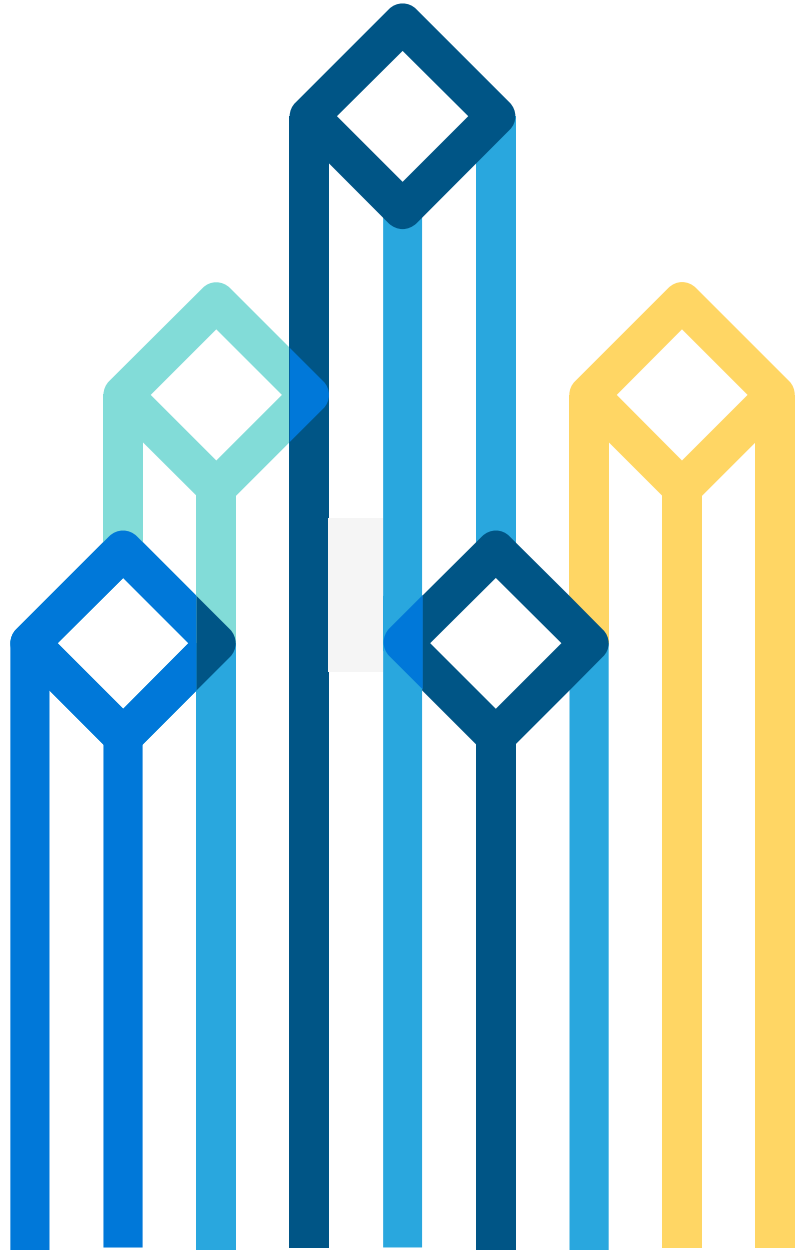
CDH6最新功能及Cloudera机器学习产品



议程

- CDH6
  - Hadoop3.0
  - C6安装重难点
  - C6升级
  - SDX
- Hadoop上的数据科学自动化

TensorFlow

Alluxio

Flink

ElasticSearch

Kudu

Hadoop3.0

ClickHouse

Spark2.4

CDSW

Kylin

Docker

Kubernetes

Hive3

HBase2

Kafka2

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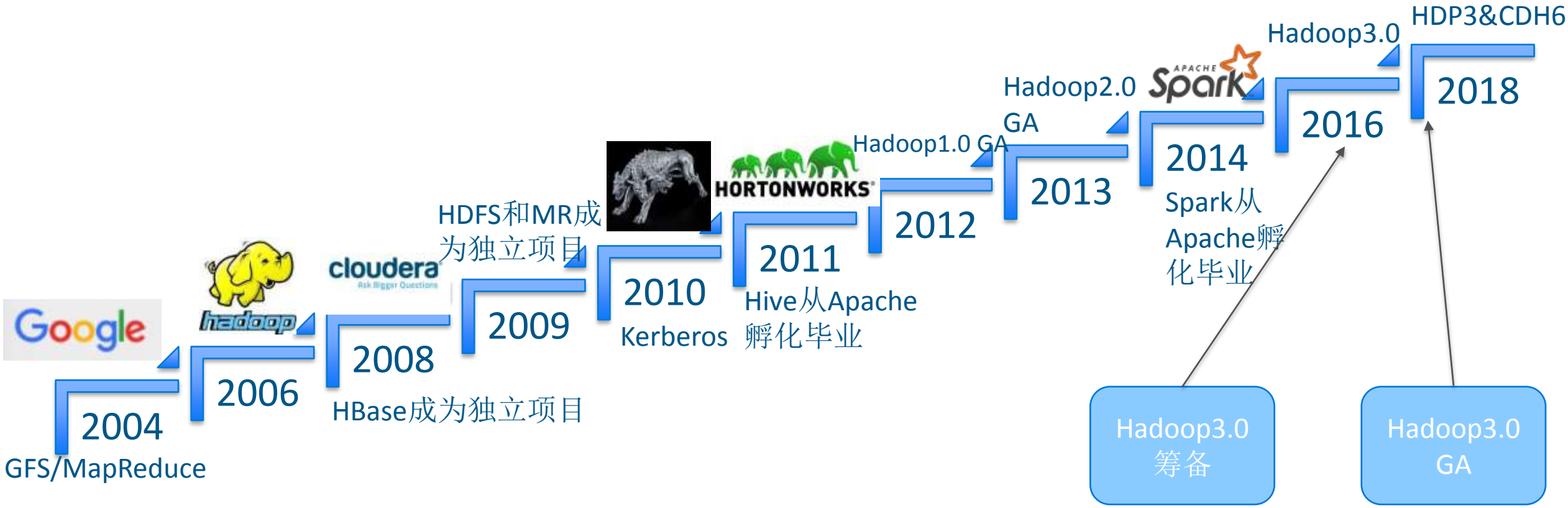
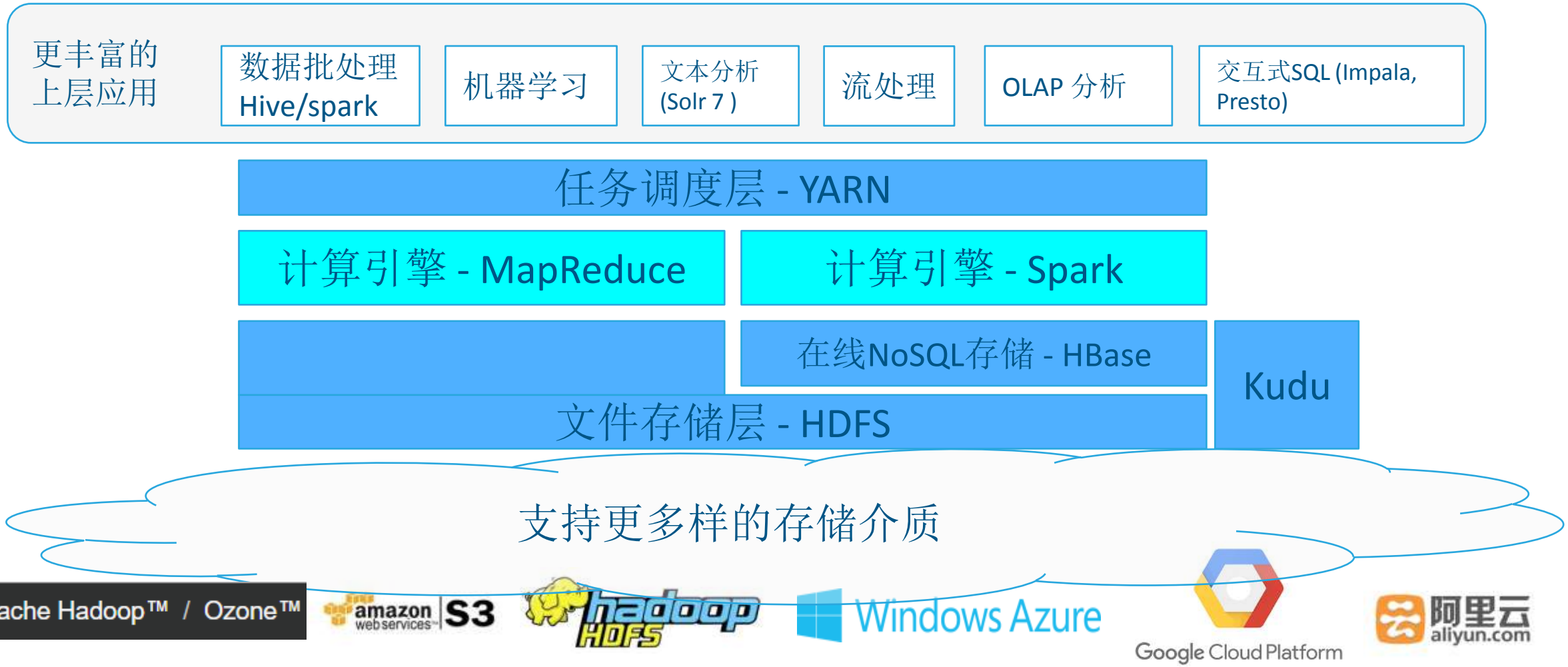
Hadoop成长历史



Hadoop的未来走向: 适合多种**负载混合**的数据平台



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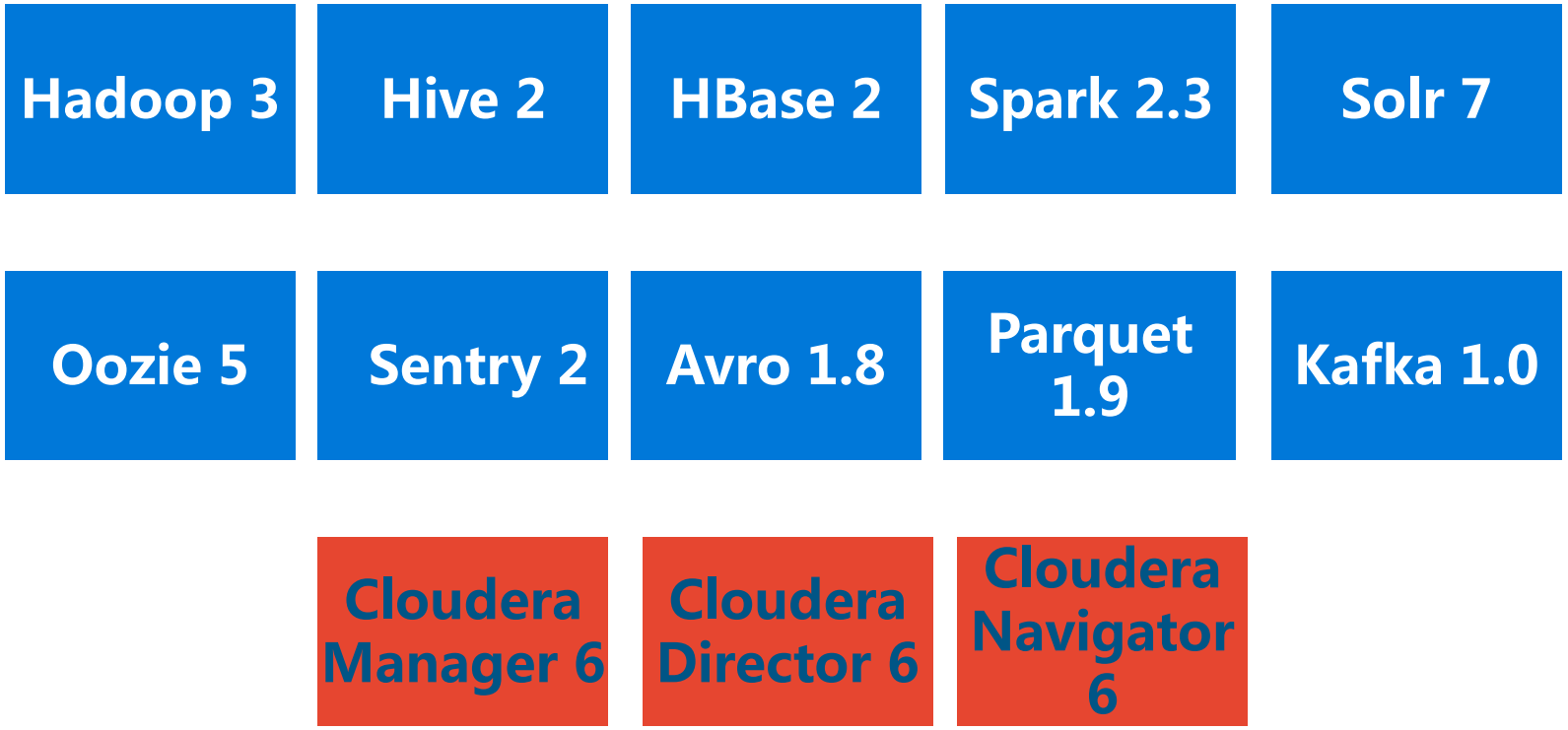
Cloudera Enterprise 6



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Hadoop 3 新功能

HDFS

- 纠删码
- 多个NameNode备机
- 对云计算平台的支持

YARN

- YARN Federation
- YARN 节点标记
- YARN Timeline Service

Common

- JDK 8+升级
- 更强的兼容性指南
- 重新实现的Shell脚本
- Classpath隔离

https://wiki.apache.org/hadoop/Roadmap

Hadoop 3.x Releases

Planned for hadoop-3.0.0

- HADOOP
  - Classpath isolation on by default HADOOP-11656
- HDFS
- YARN
- MAPREDUCE

hadoop-3.0.0-alpha1

- HADOOP
  - Move to JDK8+
  - Shell script rewrite HADOOP-9902
  - Move default ports out of ephemeral range HDFS-9427
- HDFS
  - Removal of hftp in favor of webhdfs HDFS-5570
  - Support for more than two standby NameNodes HDFS-6440
  - Support for Erasure Codes in HDFS HDFS-7285
  - Intra-datanode balancer HDFS-1312
- YARN
  - YARN Timeline Service v.2 YARN-2928
- MAPREDUCE
  - Derive heap size or mapreduce.*.memory.mb automatically MAPREDUCE-5785

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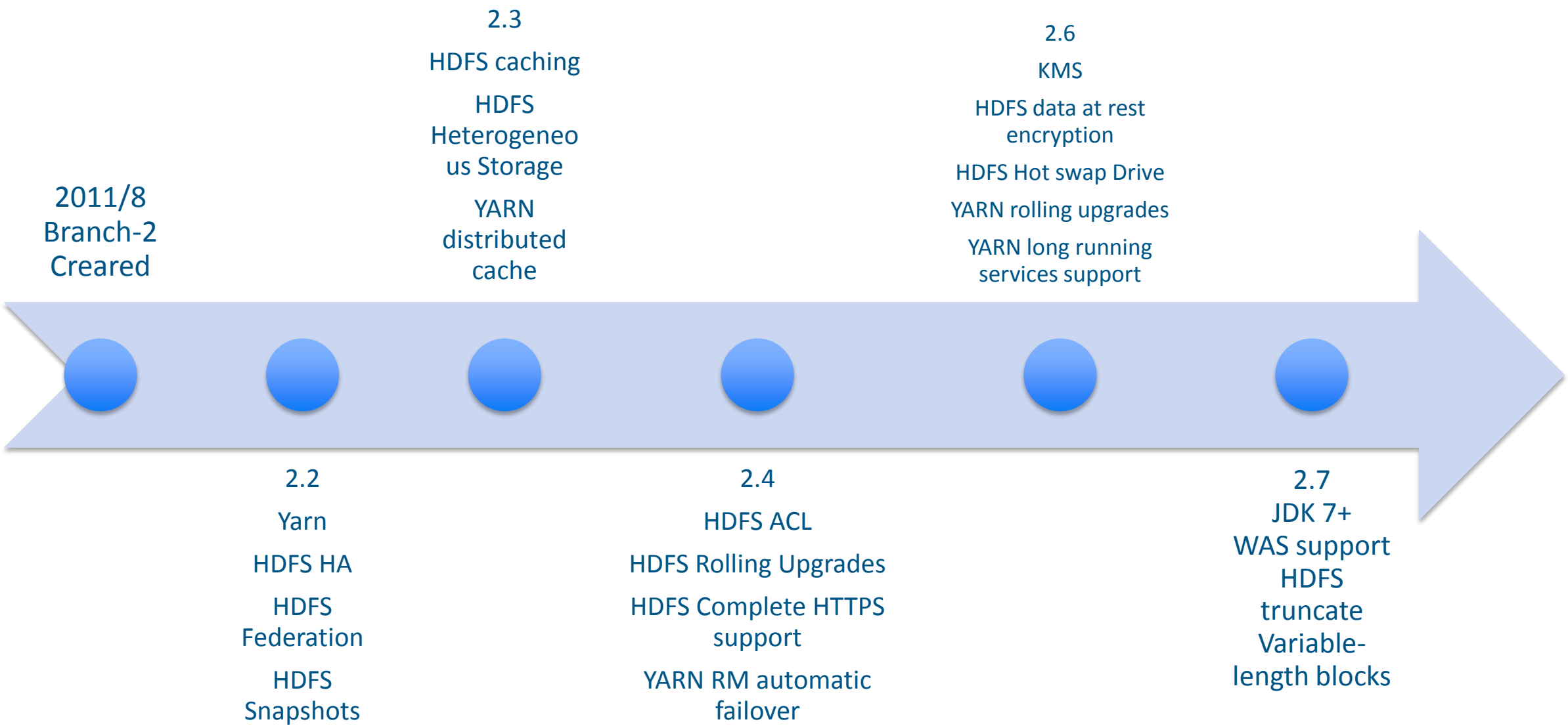
Hadoop成长历史-2.x版本



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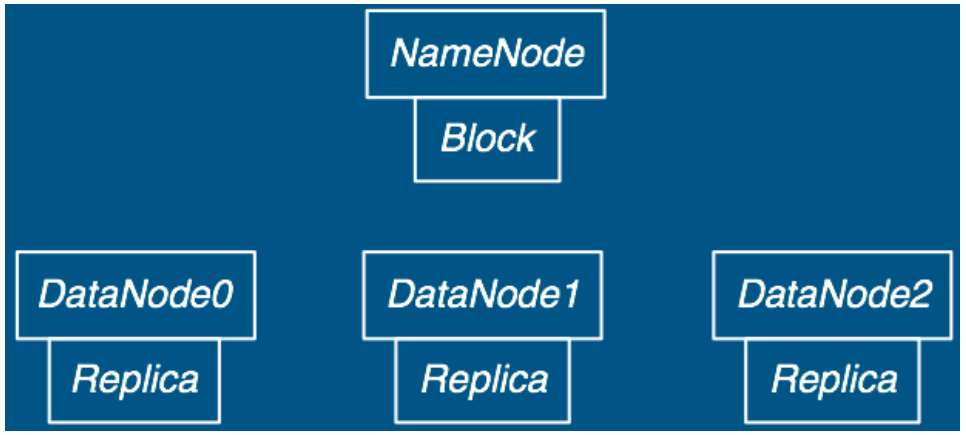
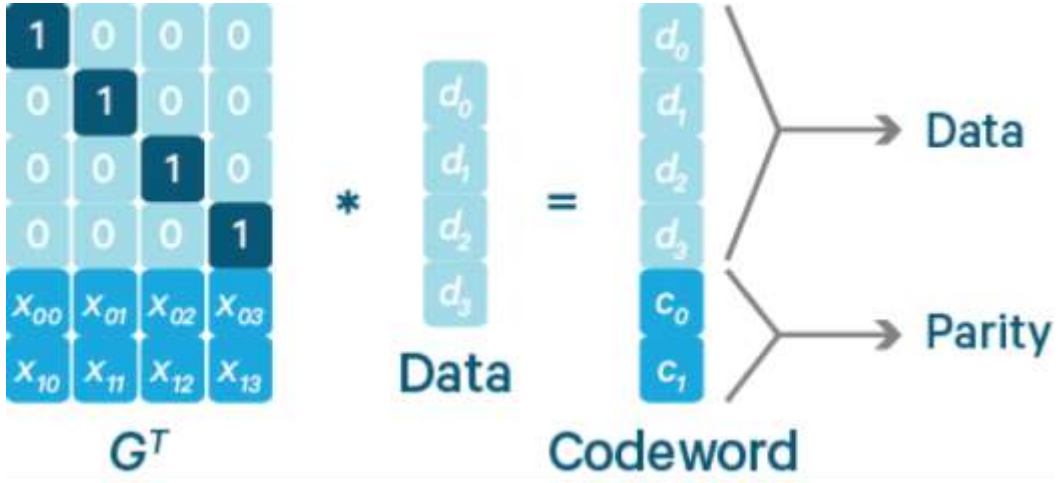
HDFS 纠删码 V2 (HDFS-7285)



现在的HDFS：1份数据，***2***份冗余副本



纠删码技术：1份数据，***0.5***份冗余校验数据(6:3)

- **由Intel与Cloudera共同研发**
- **Intel研发团队可为Cloudera客户提供直接支持**

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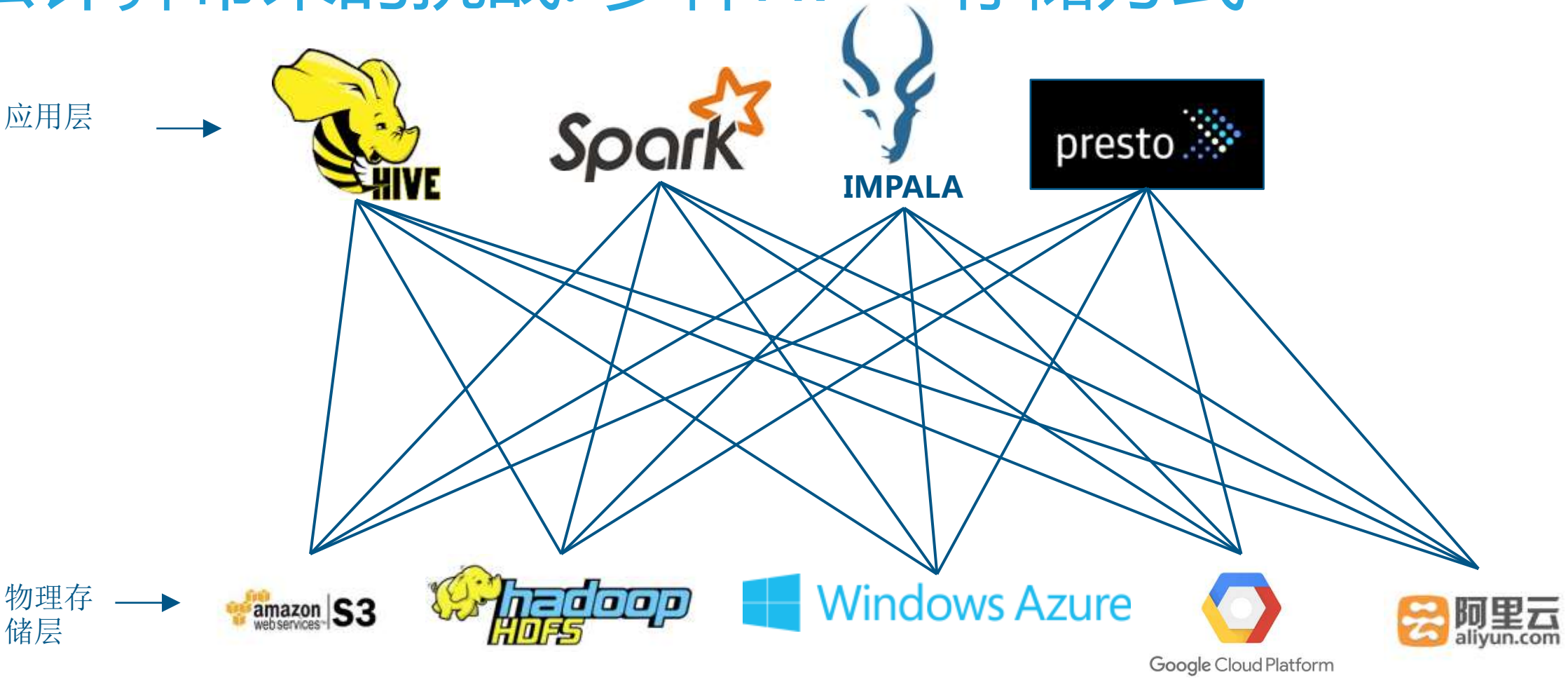
云计算带来的挑战: 多种HDFS存储方式



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云计算中的HDFS - 存储虚拟化

应用层 →

快速弹性的HDFS缓存层 (HDFS-9806)

ViewFS：多数据中心上的统一文件命名空间 `cp /s3/file.txt /hdfs/`

Hadoop兼容文件系统抽象层：统一的存储API接口 `hadoop fs -ls s3a://job/`

物理存储层 →

Cloudera是AWS、Azure等多个云平台厂商合作伙伴，提供产品化的公有云及私有云解决方案

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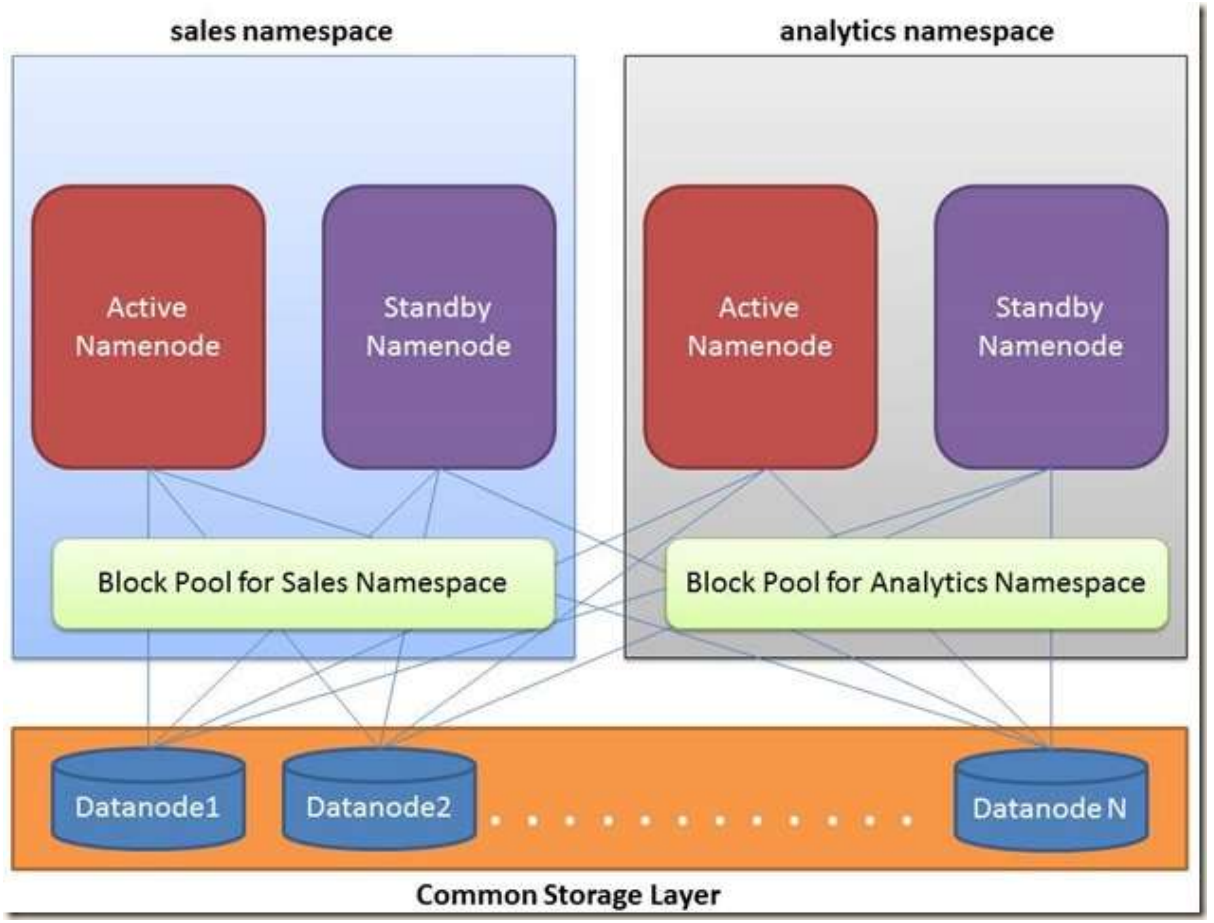
NameNode联邦



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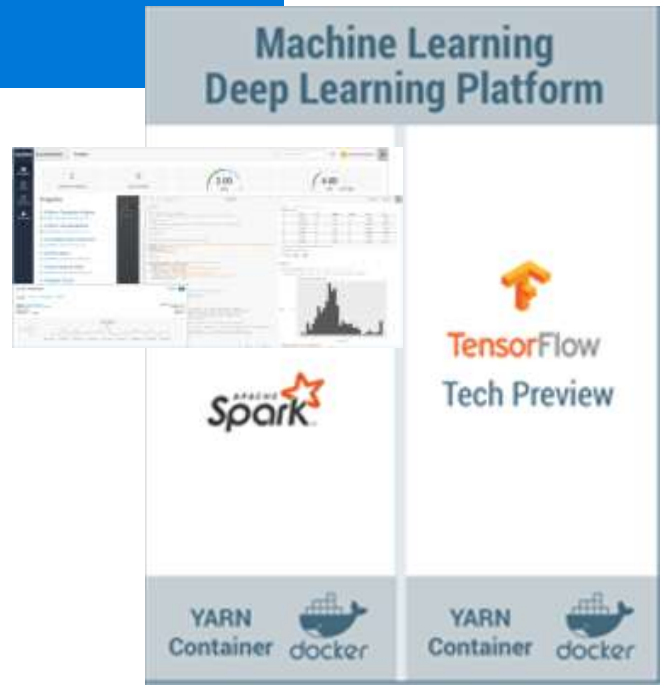
YARN的提升

New Resource Types

- Able to define new hardware resources (i.e. GPU)
- Ability to schedule workflows on newly defined hardware resources

Oozie YARN Application Master

- Allows the execution of Oozie workflows on YARN
- No Oozie orchestration support equals more efficient computation



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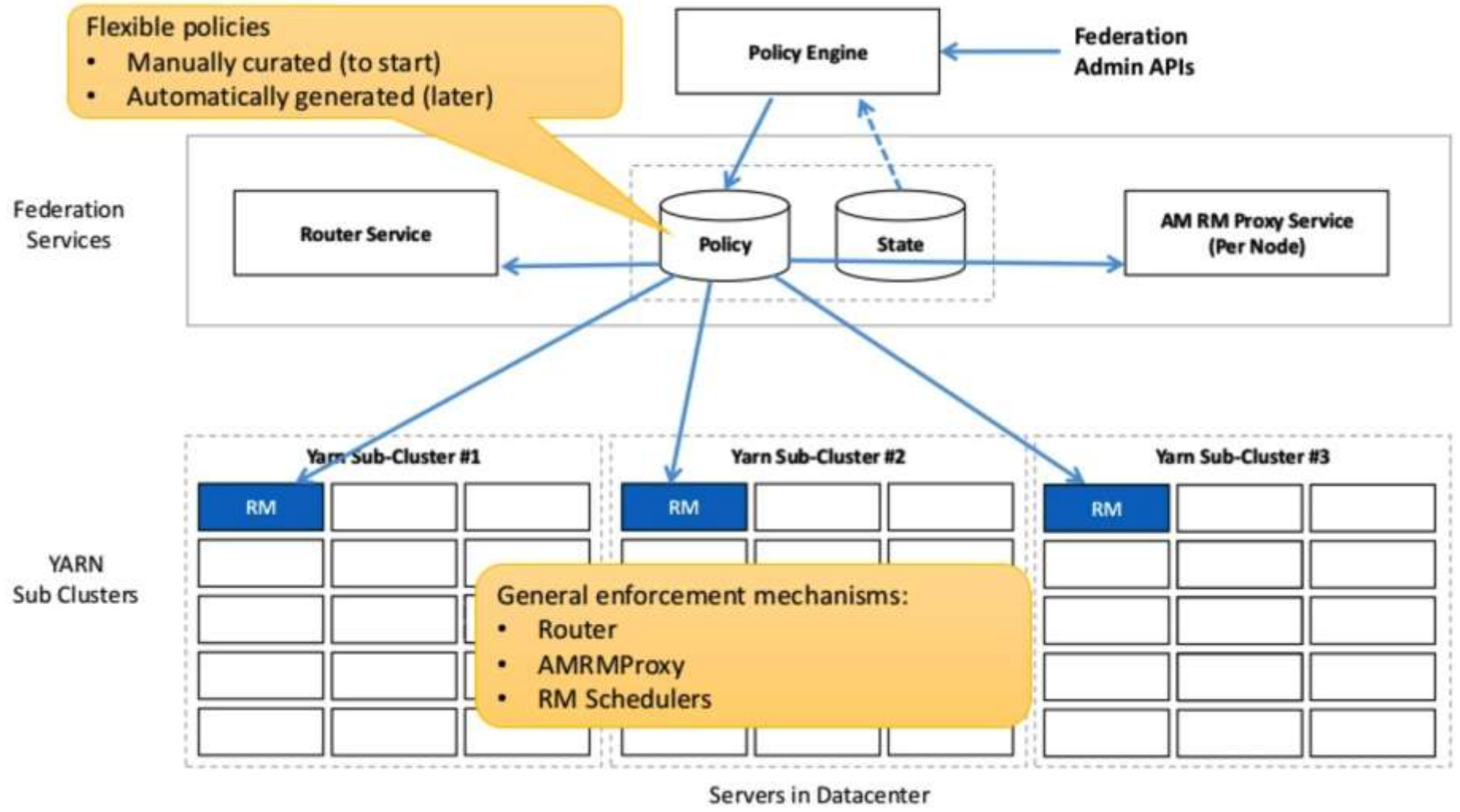
YARN Federation (YARN-2915)

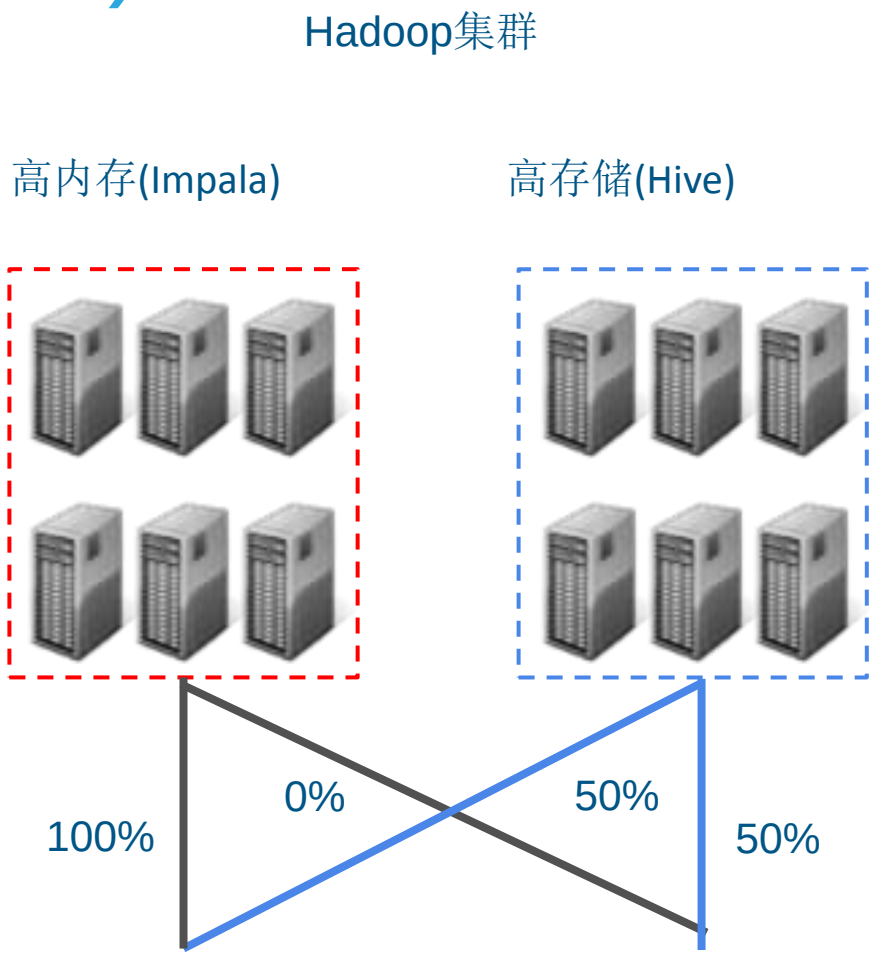


YARN 节点标记 (YARN-2492)

问题:
根据应用的资源需求，在拥有不同资源的分区运行不同任务:

- 硬件
- 任务
- 逻辑

解决方案:
YARN节点标记，标示不同分区节点的资源状态



参考:https://issues.apache.org/jira/browse/YARN-796

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C6新特性总结

HADOOP 3	HIVE 2.1	Solr 7	Spark 2.2	Hbase 2
• HDFS EC • HDFS Federation • Shell Script Rewrite • Default Ports outside ephemeral range	• Vectorization • Enhanced SQL Coverage • API Normalization	• JSON Facet API & Nested Docs • SQL Interface • Graph Query • Streaming Expressions	• Expanded SQL Support • Cache-aware Computation	• Offheap read/write paths • Compacting Memstore • New Assignment Manager

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C6新特性总结

YARN	Kafka 1.0	Pig 0.17	CM & NAV
• New Hardware Profiles • Oozie on YARN Application Master	• Scala 2.11 Support • Improved Disk Failure Tolerance • Improved Debugging Metrics	• Auto Local Mode • Hive UDF Support	• Granular Permissions • Auto TLS • Upgrade Validation framework

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弃用和移除的组件/环境

CDH Components	• Sqoop2 • MapReduce 1 • DataFu
Databases	• Oracle 11g
JDK	• JDK 1.7
3rd Party Libraries	• Tomcat
Operating Systems	• RHEL/CentOS/ Oracle Linux 5 • SLES 11 • All Debian • Ubuntu 12-14

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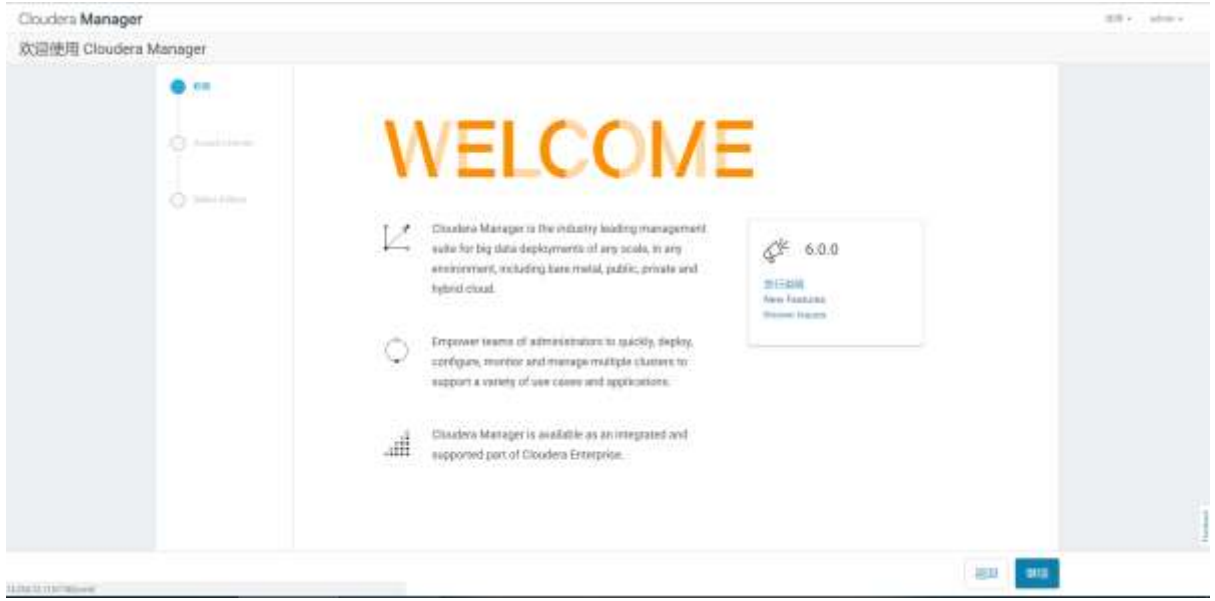
C6安装重难点

安装CDH6



注意事项1

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注意事项2


```
<IfModule mime_module>
    #
    # TypesConfig points to the file containing the list of mappings from
    # filename extension to MIME-type.
    #
    TypesConfig /etc/mime.types

    #
    # AddType allows you to add to or override the MIME configuration
    # file specified in TypesConfig for specific file types.
    #
    #AddType application/x-gzip .tgz
    #
    # AddEncoding allows you to have certain browsers uncompress
    # information on the fly. Note: Not all browsers support this.
    #
    #AddEncoding x-compress .Z
    #AddEncoding x-gzip .gz .tgz
    #
    # If the AddEncoding directives above are commented-out, then you
    # probably should define those extensions to indicate media types:
    #
    AddType application/x-compress .Z
    AddType application/x-gzip .gz .tgz .parcel
```

对于离线安装CDH6.0，分发Parcel出现hash校验失败的问题，是因为在CM6中修复了一个bug，让它不再忽略由http服务器发送的“Content-Encoding”的header信息，但是我们在Redhat中安装的httpd服务，当它传输parcel文件时，默认会错误的设置“Content-Encoding”。

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C6升级

前置条件

CDH	• CDH 5.7 and above
数据库	• MySQL 5.7 and above • MariaDB 5.7 and above • PostgreSQL 8.4 and above • Oracle 12c and above
JDK	• Oracle JDK 1.8
操作系统	• RHEL 6.8 and above • RHEL 7.2 and above • SLES 12 SP2 and above • Ubuntu 16 and above

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C6升级要求

- 从CM5升级到CM6需要重启CDH，但是可以使用滚动重启。
- 从CDH5升级到CDH6，集群必须停机。
- 如果升级失败，有文档指引如何手动回滚。
- 以后将不支持从C6到C5的降级。
- 不支持从C6 Beta到C6 GA的升级。

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C6升级: HBase例子

- 升级前
  - 最小化集群工作负载
  - 禁用coprocessors，基于C6 HBase的jar包重新编译coprocessors
  - 禁用第三方的coprocessors
  - 关闭HBase
- 升级
  - 按照文档指引使用Cloudera Manager或CLI
  - 推荐使用自动化升级工具比如Puppet或Chef

C6升级: HBase例子

- 升级后
  - 重新启用coprocessors
  - 使用新的coprocessors替换旧的coprocessors
  - 重启HBase服务

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SDX

Shared Data Experience

SDX

FEATURES	CUSTOMER BENEFITS
Unified Data Catalog across all Environments	Enhanced Data Governance
Automated Wire Encryption	Enhanced Data Security
Central Management of 1000’s of nodes	Improved Scalability

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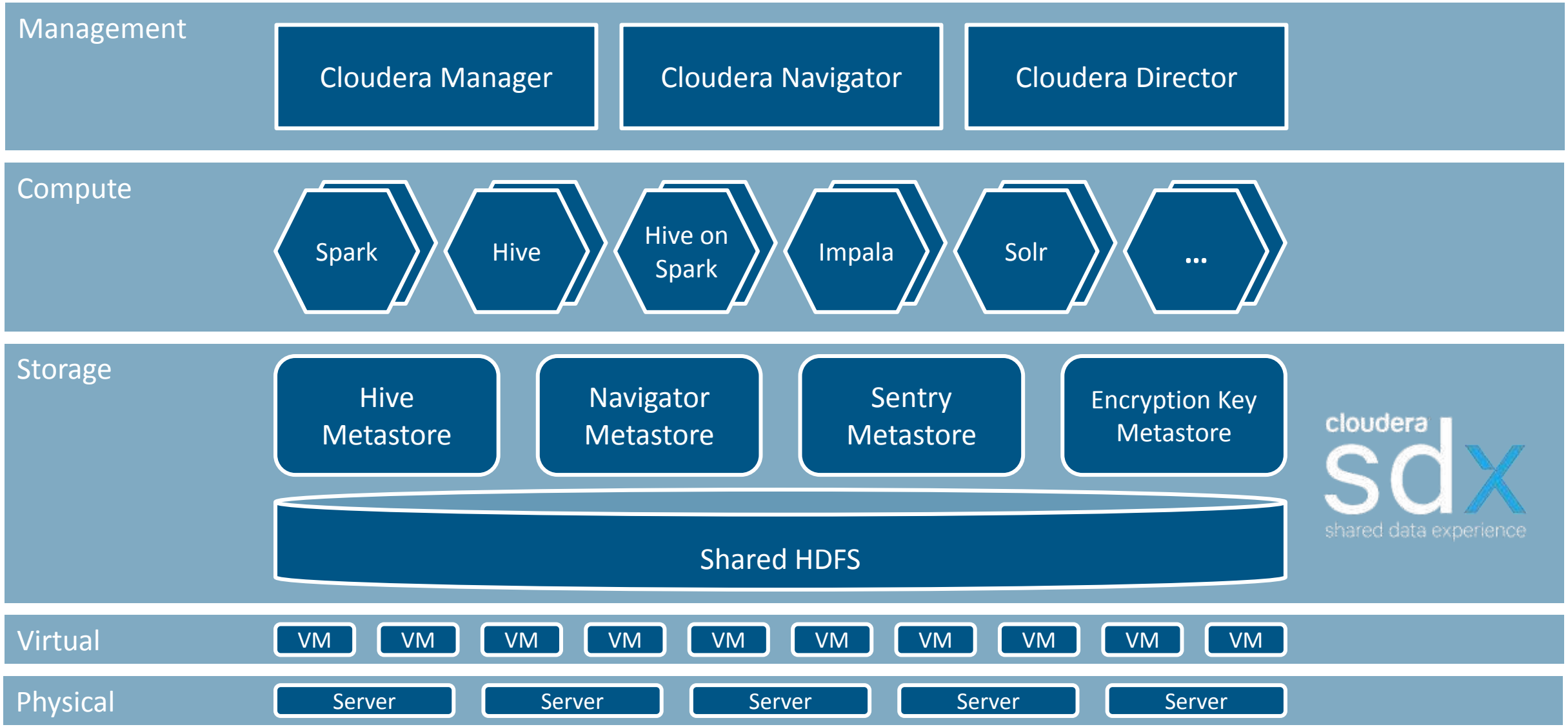
Private Cloud Architecture



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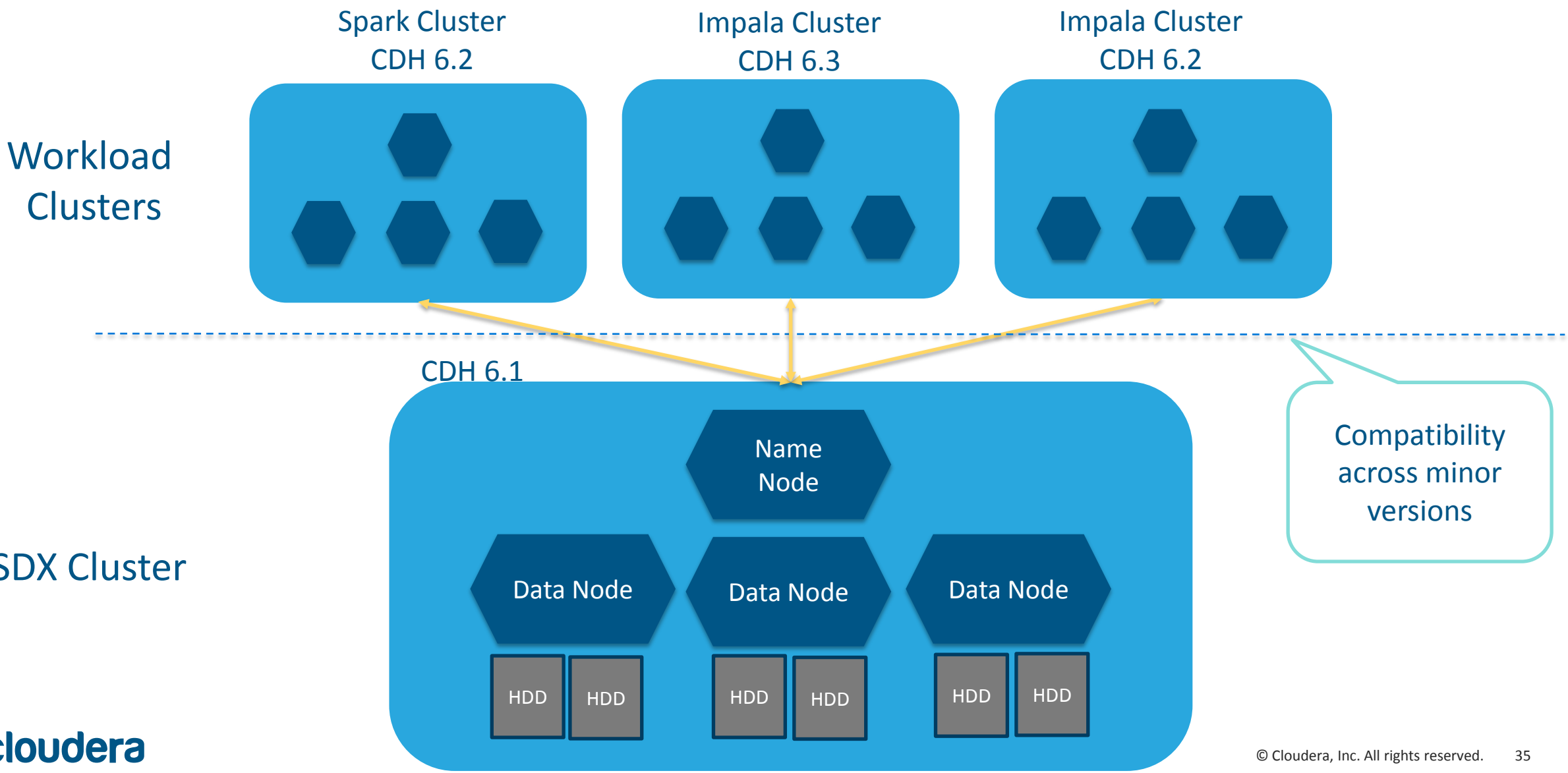
Another View



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Key architectural benefits and tradeoffs

Faster to deploy

- Easy to spin up a new workload that taps into an existing shared data experience within minutes

Better scalability

- Easy to scale stateless elements (workloads) independently from stateful elements (data, data context)

Better tenant isolation

- Easy to firewall resources between tenants

CDH version independence

- Easy to upgrade workload clusters and storage clusters independently, instead of all or nothing upgrade

Greater elasticity and utilization

- Easy to provide elastic compute for transient workloads

Fewer environments to manage

- Easy to consolidate separately managed Cloudera environments by leveraging stronger isolation and authorization controls

Higher network capacity

- Higher network capacity required to separate storage and compute

May not be suitable for all applications

- Latency sensitive workloads (HBase) may not perform well enough on remote storage

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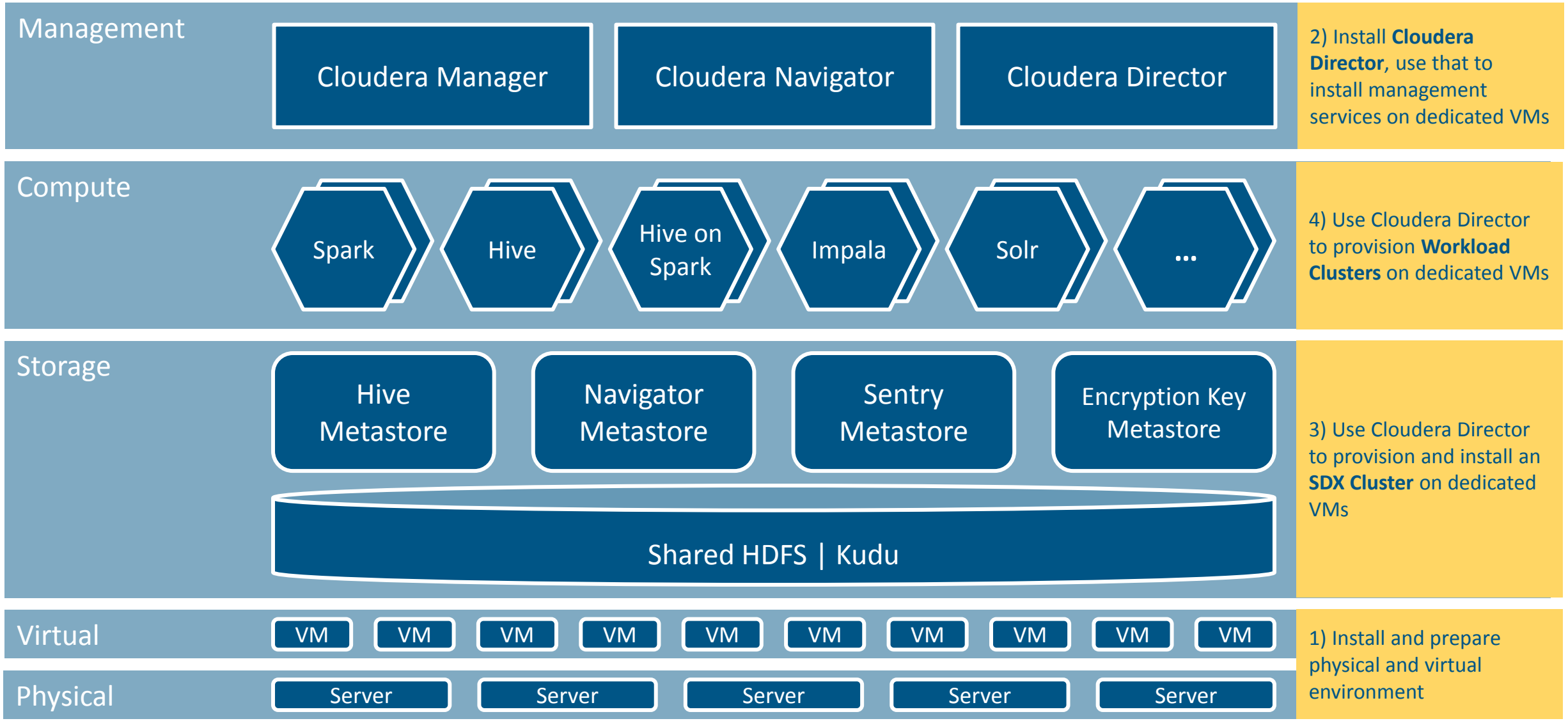
How it is constructed



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Hadoop上的数据科学自动化

Cloudera Data Science Workbench (CDSW) on CDH

主流数据科学开源框架

库名	发布者	支持语言	支持系统
TensorFlow	Google	Python/C++/ Java/Go	Linux/Mac OS/Android/iOS
Caffe	UC Berkeley	Python/C++/ Matlab	Linux/Mac OS/Windows
CNTK	Microsoft	Python/C++/ BrainScript	Linux/Windows
MXNet	DMLC (分布式机器学习社区)	Python/C++/Matlab/ Julia/Go/R/Scala	Linux/Mac OS/ Windows/Android/iOS
Torch	Facebook	C/Lua/	Linux/Mac OS/ Windows/Android/iOS
Theano	蒙特利尔大学	Python	Linux/Mac OS/Windows
Neon	Intel	Python	Linux

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主流数据科学开源框架

库名	学习材料丰富程度	CNN建模能力	RNN建模能力	易用程度	运行速度	多GPU支持程度
TensorFlow	★★★	★★★	★★	★★★	★★	★★
Caffe	★	★★	★	★	★	★
CNTK	★	★★★	★★	★	★★	★
MXNet	★★	★★	★	★★	★★	★★★
Torch	★	★★★	★★	★★	★★★	★★
Theano	★★	★★	★★	★	★★	★★
Neon	★	★★	★	★	★★	★★

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企业中的数据科学和机器学习 – 与互联网巨头不同

Required Capabilities:

扩展企业现有的数据平台

- 充分利用现有非结构化数据和外部获取的新数据
- 整合历史数据和实时流数据

更高性能的模型训练和测试

- 缩短模型验证的迭代周期

更广范围的数据治理

- 数据的”语义”和特征相关, 数据科学家需要参与数据质量标准定义和治理过程

尽量使用企业用户熟悉的工具

- Increase developer productivity with familiar API’s

“Cloudera, using complex machine learning algorithms, analyzes large amounts of data in real time and allows personalization of game interaction with players through recommendations.,”

“Machine learning and big data is like a marriage made in heaven. I mean it works really well with some other tooling that's already there on the stack. It used to take time. It was cumbersome.”

“CDSW + Spark is perfect combination for machine learning on Hadoop. It simplified our work and save the cost of our data industry.”

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传统依赖“科学家”的方式，效率太低！

Business Analytics Leader

- **Cares about**: : 更快的模型训练、更快投产、“在线”决策、自动演进、深度学习；“自动化程度更高？”—通过Hadoop上的全量数据和机器学习来取代传统的人工过程

Data Scientist (User)

- **Cares about**: 全量数据、高性能的计算能力、自动化工具
- **Needs**: 专注于模型和算法，减少其它事情的时间

IT Data Team Manager

- **Cares about**: 分散的数据环境、多个角色的协调、性能的优化、投产的自动化、数据集中后的安全隔离、灵活的资源调度....
- **Needs**: 能否基于Hadoop实现一套自动化、自助式的数据科学协同平台？

Data Scientist

Pain Points

- Poor Data Access
- Notebooks Don’t Scale
- Poor Management of Dependencies

IT Exec

Pain Points

- Lag in Moving Models to Production
- Purpose-built DS Environments
- Poor Security for OSS Tools

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基于开源框架建立企业的数据科学平台

Open Ecosystem for Enterprise

AI-as-a-Services

数据科学的产能: 从实验室到产品化

Improving decisions vs. improving production

Data Science "Lab"
(实验环境中模拟决策的"科学")

- **User:** 数据分析人员+数据挖掘
- **Data:** 采样数据，小规模
- **Environment:** 单机、小规模沙箱集群
- **Tools:** R, Python, SAS/SPSS, SQL; notebooks; data wrangling/discovery tools, …
- **Goal:** 理解数据，建模和优化模型，模型产生作用需要重新修改应用和重新部署，周期较长，效果依赖经验
- **Production:** 预测性指标和决策仿真
- **End State:** Reports, dashboards, PDF, MS Office

Data Product Line
(实时作用的数据产线)

- **User:** 数据科学家+数据工程师
- **Data:** 全量数据，包括新的和变化的数据
- **Environment:** Hadoop生产集群
- **Tools:** Rhadoop, PySpark, SAS HPA, Java/Scala, C++; IDEs; continuous integration, source control, …
- **Goal:** 构建数据生产线、质量标准、生产配方和工艺规范，管理和控制模型的变化，评估和优化算法的性价比
- **Production:** 各类实时反馈的在线应用，比如在线信用评分、产品实时推荐、关系定价、智能决策
- **End State:** Online/production applications

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数据科学的产能的三个环节

Data Preparation

Data Modeling

Model Deployment

(maybe)

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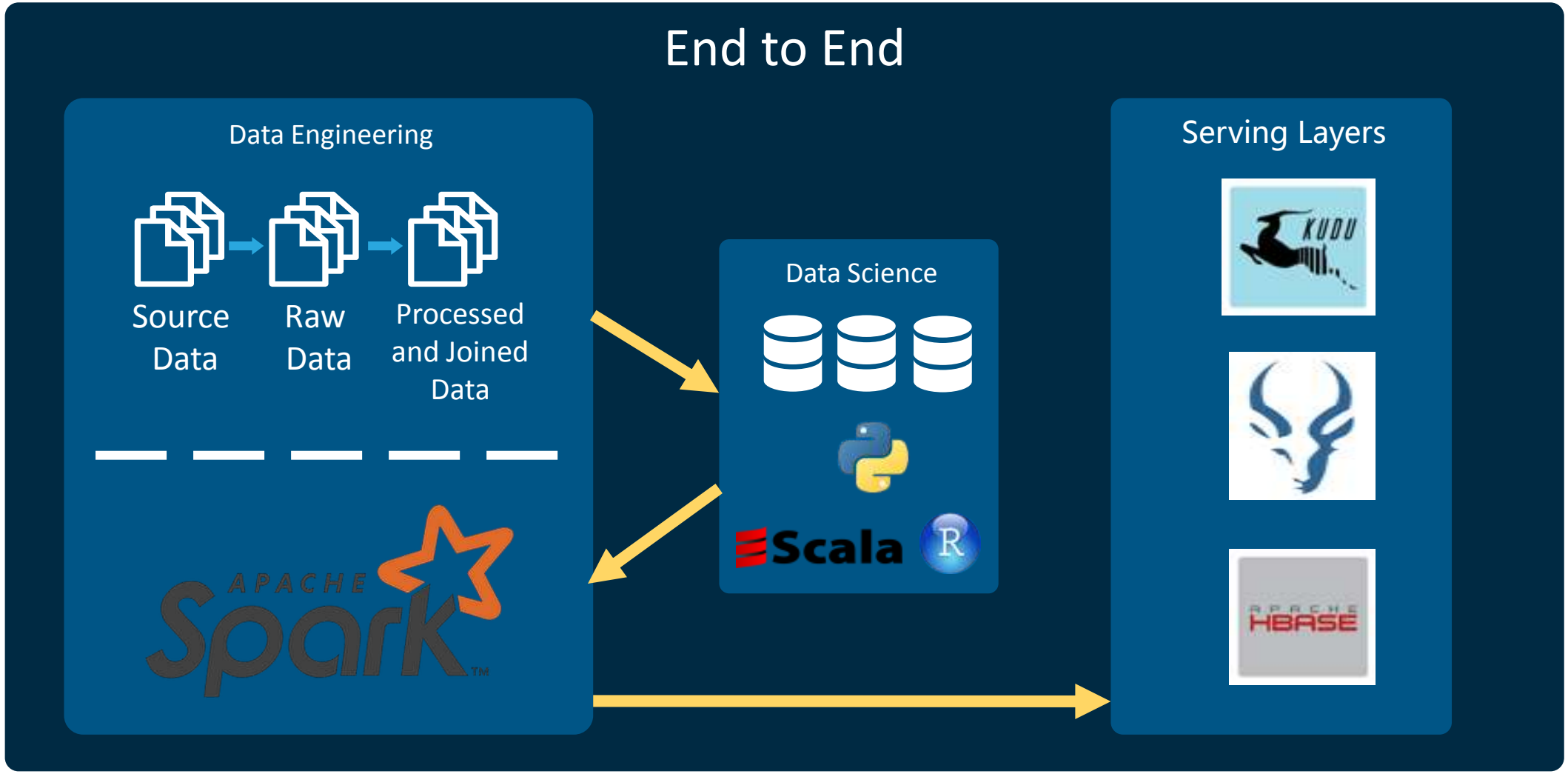
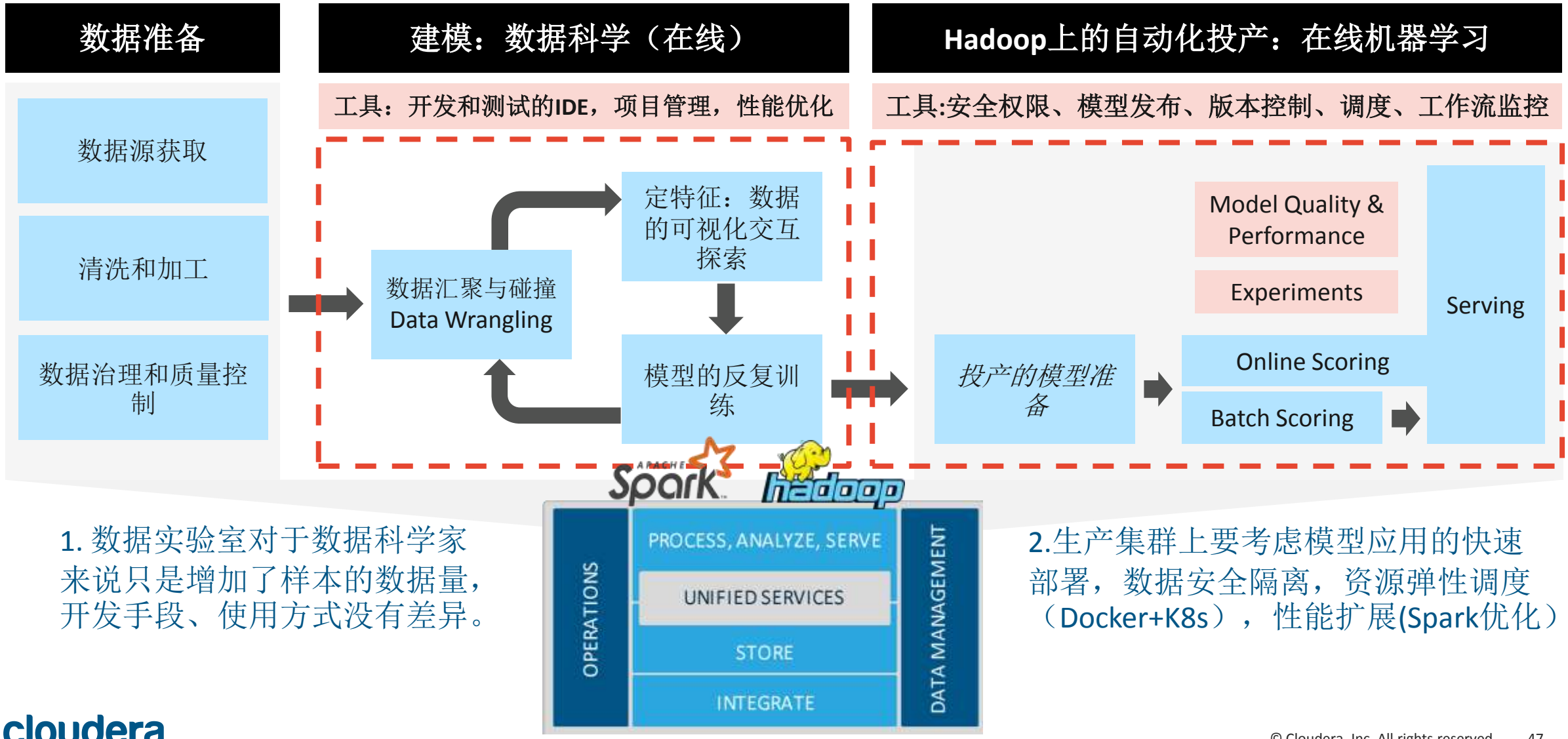
离线建模，在线加工，在线投产



如何实现数据科学投产的全程自动化



1. 数据实验室对于数据科学家来说只是增加了样本的数据量，开发手段、使用方式没有差异。

2.生产集群上要考虑模型应用的快速部署，数据安全隔离，资源弹性调度（Docker+K8s），性能扩展(Spark优化）

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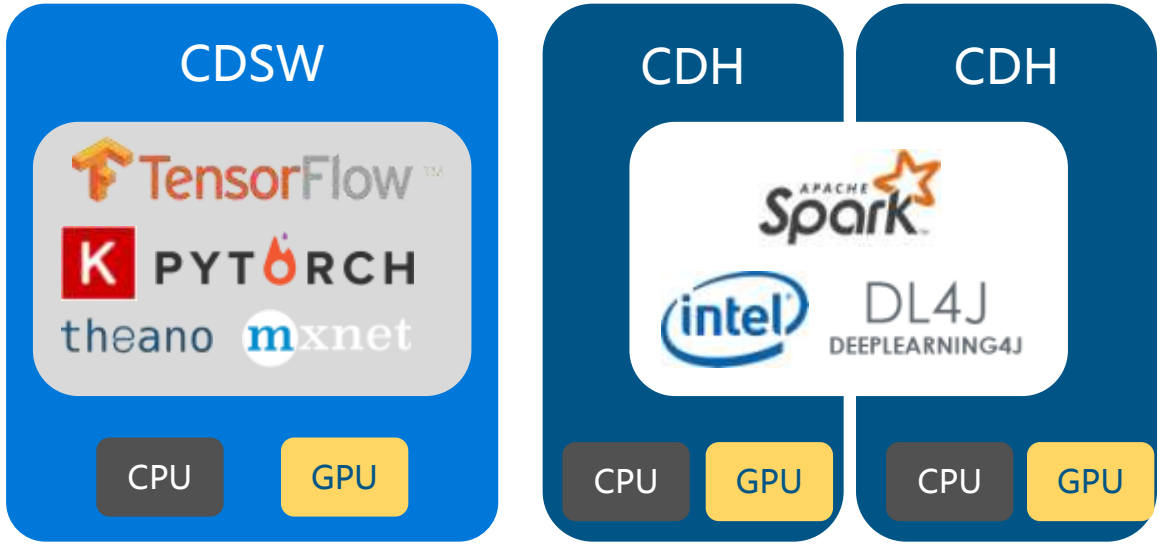
利用GPUS加速深度学习

多租户GPU支持本地或云端部署

“我们的数据科学家需要GPU，但我们需要多租户。如果他们自己去云端部署的话，那么成本将非常昂贵，我们也会失去对数据的治理。”

- 将CDSW扩展到深度学习
- 调度和共享GPU资源
- 在GPU上训练，在CPU上部署
- 在本地或云端上运行



单节点训练　　分布式训练，评分

GPU 在C6版本中支持

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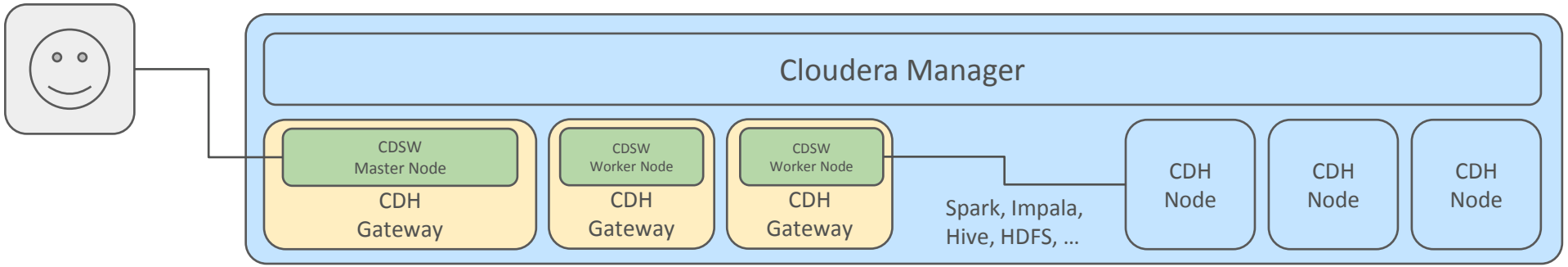
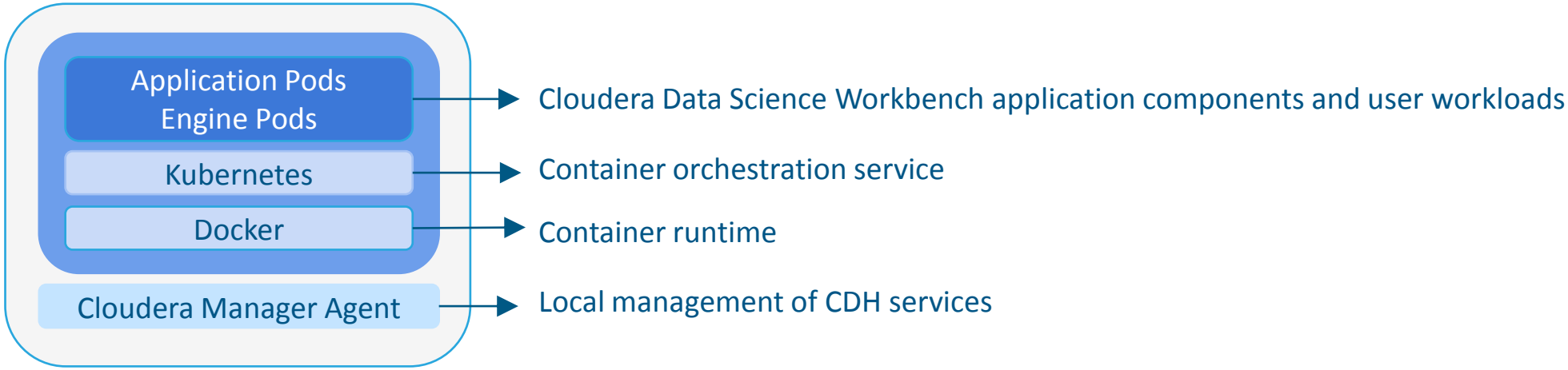
部署方式



1、Cloudera Data Science Workbench部署在CDH 5.7以上的集群中分布的边缘节点上，通过Spark/Impala连接集群数据节点



2、CDSW支持Docker和Kubernates的容器化部署

Cloudera Data Science Workbench

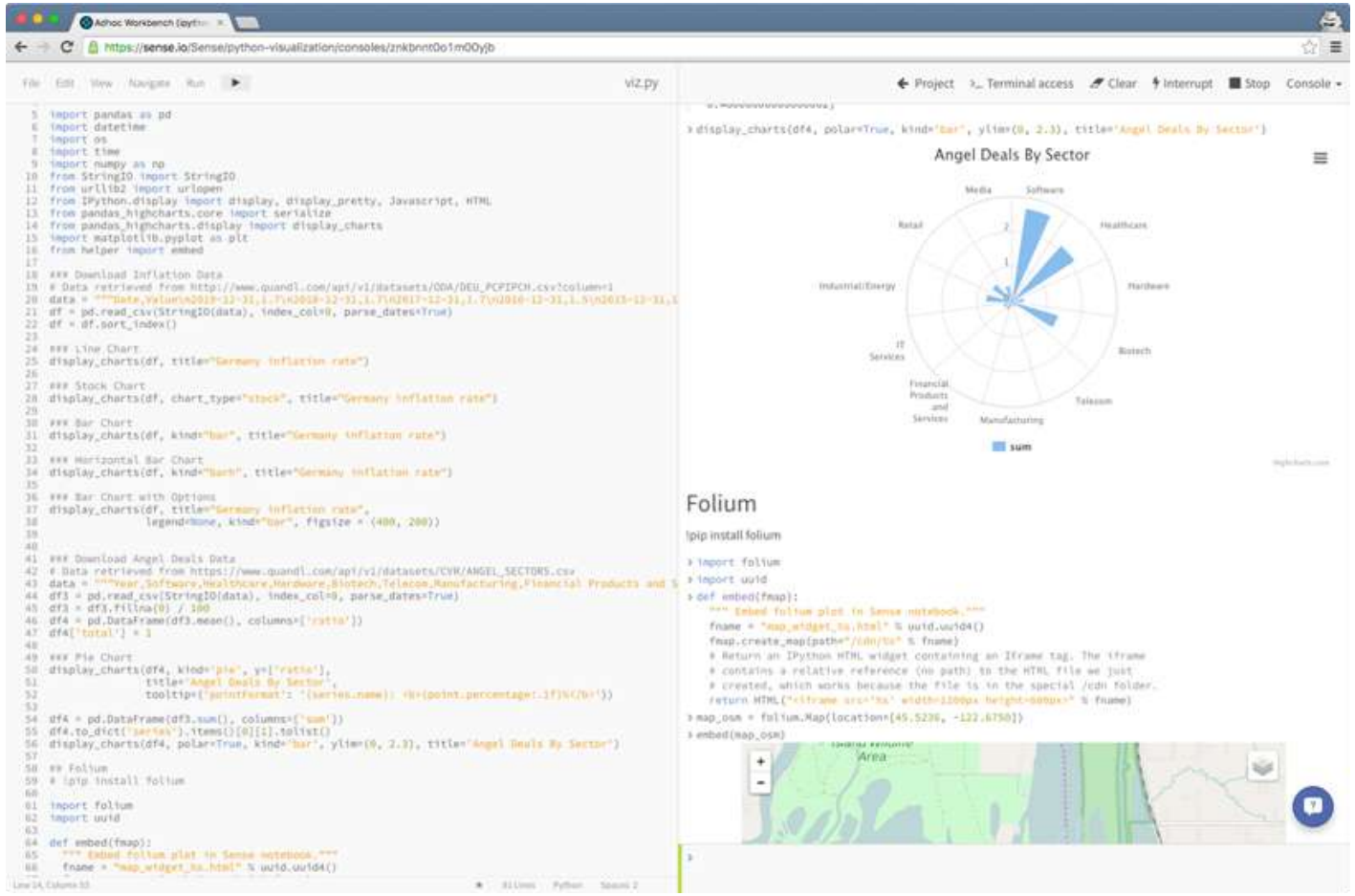
Self-service data science for the enterprise

Develop

Workbench

Automate

Jobs



cloudera

Cloudera Data Science Workbench

Self-service data science for the enterprise

Develop

Workbench

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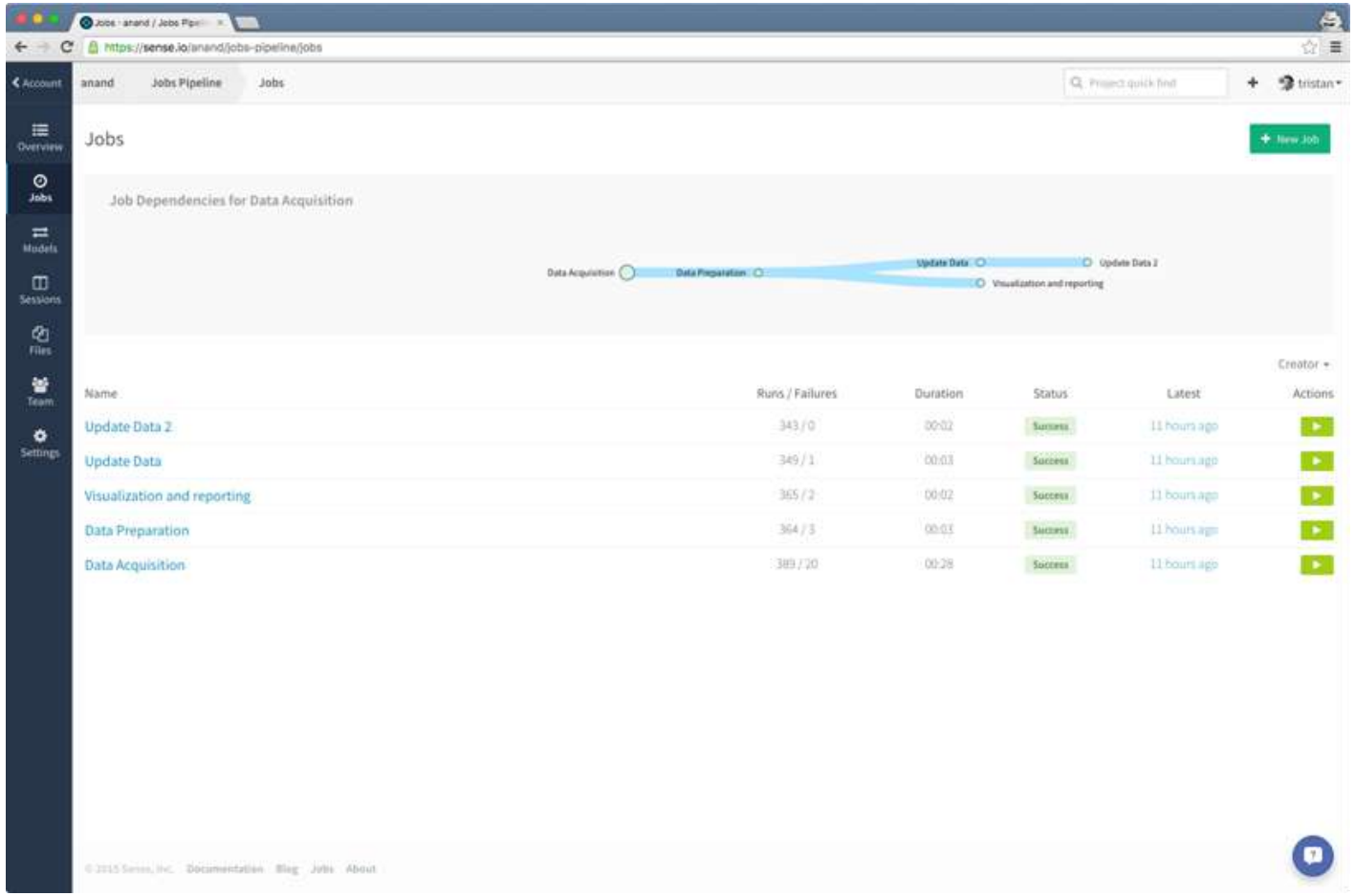
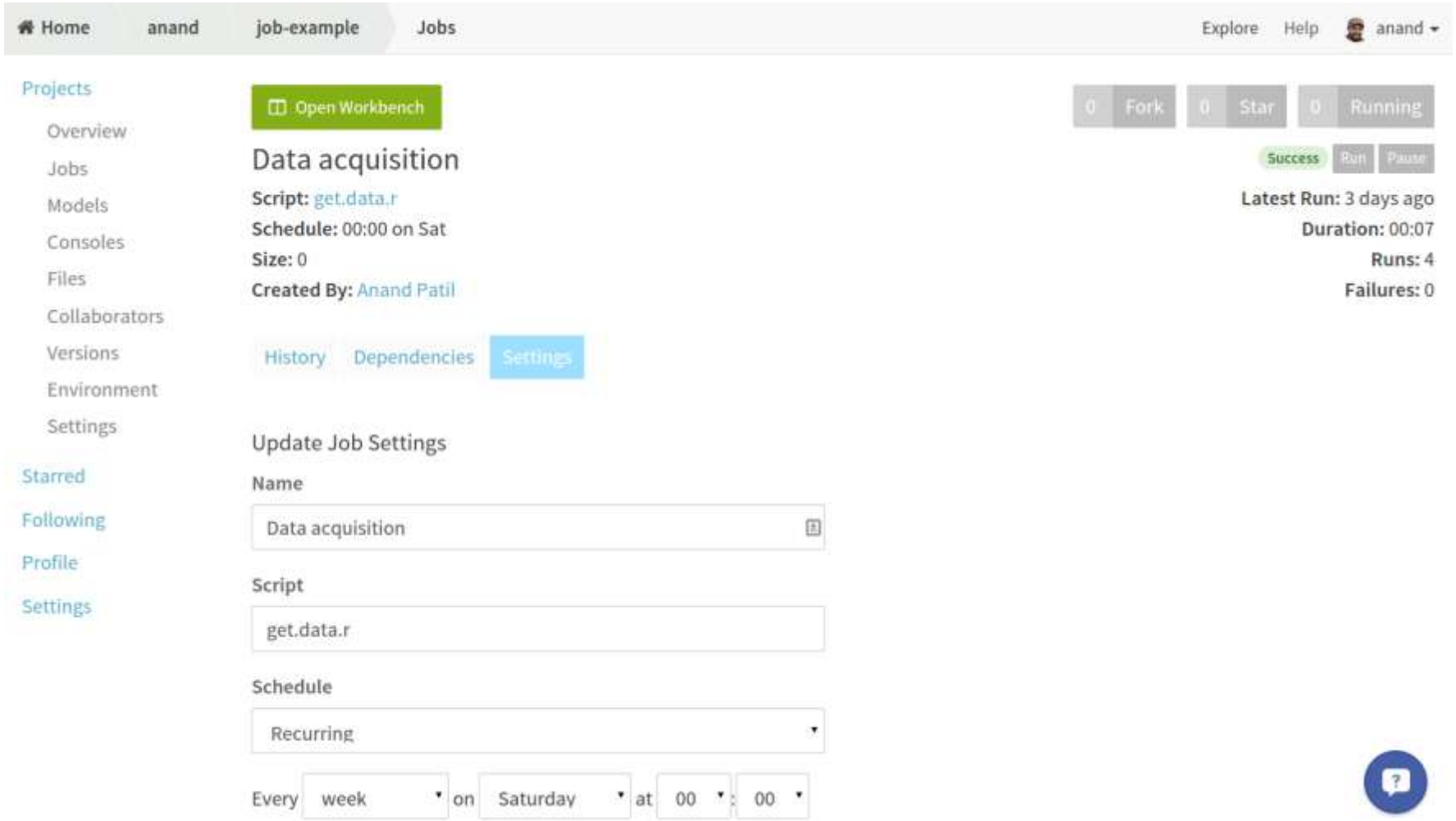
Jobs



cloudera

功能特性 - 创建数据源



支持多种类型数据源，简化了数据建模、分析前大量繁重、重复的数据加工、清洗工作

cloudera

功能特性 - 自动ETL作业

计划和监视R，Python，SQL，Spark等的ETL和分析管道。 构建分析基础架构，实现无限制的分析。

Job	Runs / Failures	Duration	Status	Actions
Data Import and Cleaning	5 / 1	00:05	Success	
Model Validation and Comparisons	6 / 1	00:05	Success	
Nightly Risk Reporting	1 / 1	07:46	Failed	

cloudera

功能特性 - 创建模型

Create a Model

Name

Calculate Components

Script

pca.r

Function

pca

Name of function within script to invoke

Engine Size

3.75GB RAM — 2 vCPUs (On-Demand)

Load-balance across 2 engine(s)

Auto-restart upon failure

Name	Value
db_host	testdb

Environmental variables will override the project environment.

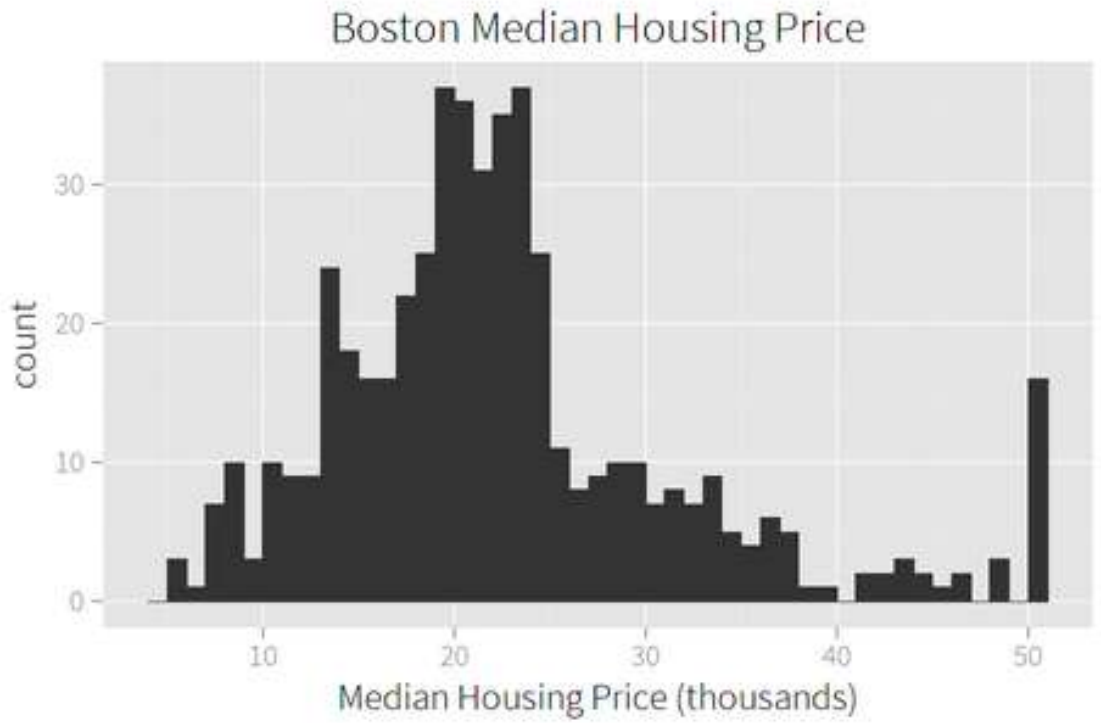
Launch Model

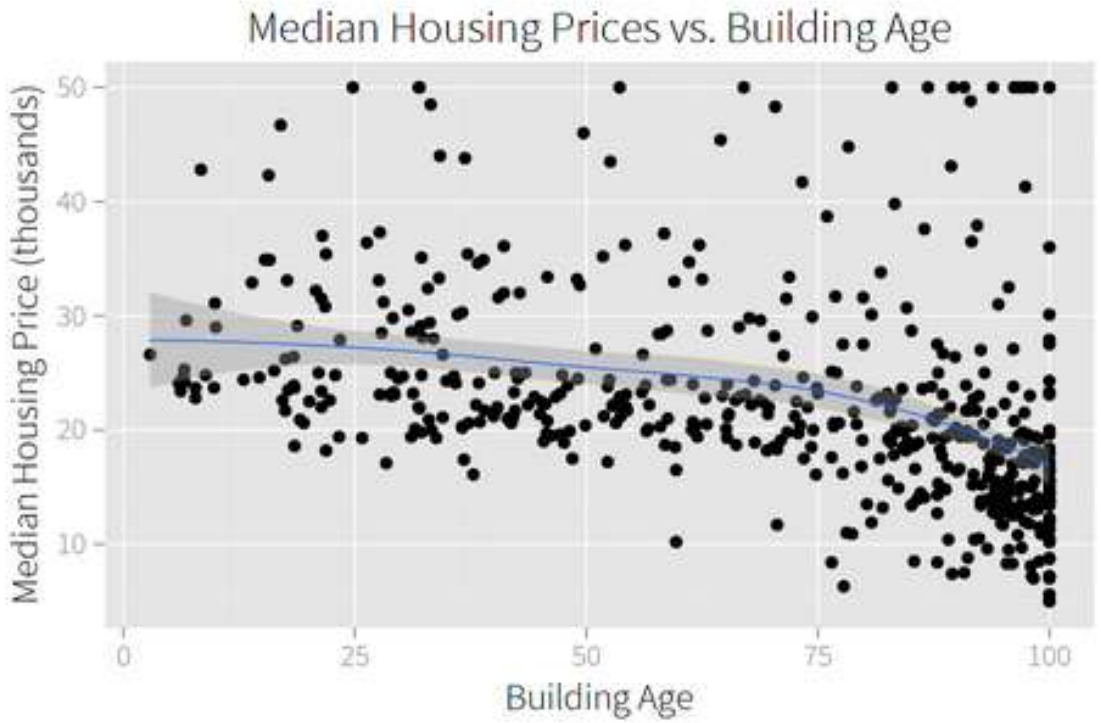
使用最强大的工具，包括R，Python，SQL，Spark等，来构建数据科学和高级分析解决方案，加速数据科学从探索到部署。

功能特性 - 初步展现结果

自动部署自助服务报告和应用程序，将数据科学家和业务团队带到一起，构建分析管道和模型，为企业带来更深入的洞察。

```
> grid.arrange(plot1, plot2, ncol=2)
```





新产品： CLOUDERA DATA SCIENCE WORKBENCH 1.4

加速并简化机器学习从研究阶段到生产部署

分析数据

- 安全地探索数据并与团队分享洞察力

训练模型

新功能!

- 运行、跟踪和比较可重复性的实验

部署API

新功能!

- 部署并监控作为API的模型来服务于预测

管理共享资源

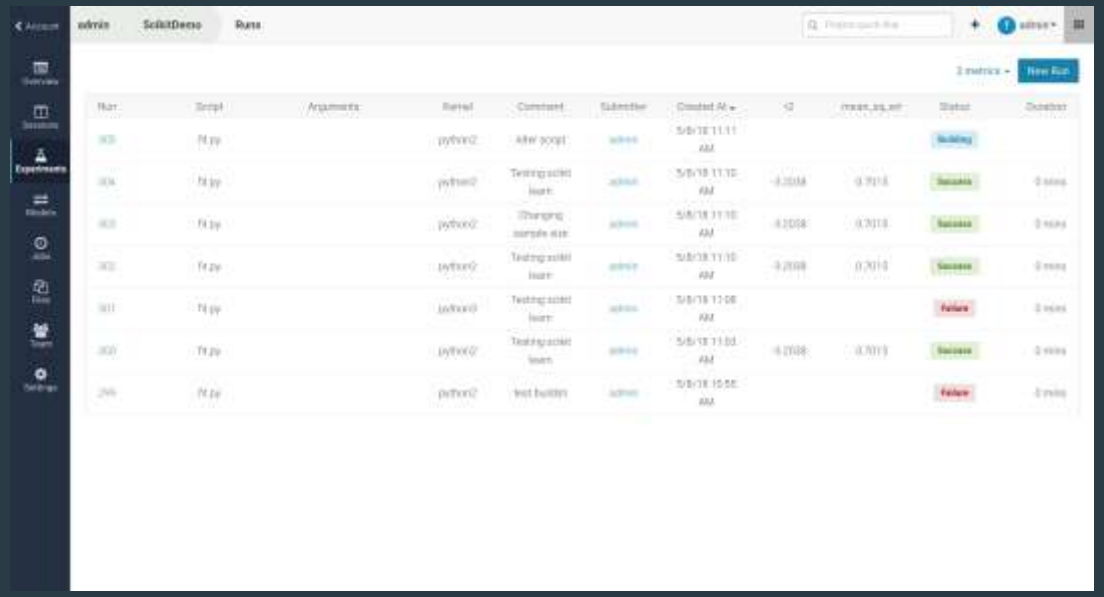
- 为您的数据科学团队提供一个安全的、协作式的自助服务平台

引入实验

运行版本化的模型训练以进行评估和再现性

数据科学家现在可以……

- 创建训练模型所需的模型代码、依赖关系和配置的快照；
- 在独立的容器中构建模型并执行训练；
- 跟踪指定的模型指标、性能和模型构件；
- 检查、比较或部署先验模型。



引入模型

作为一键式微服务 (REST API) 的机器学习模型

1、选择文件，例如 score.py

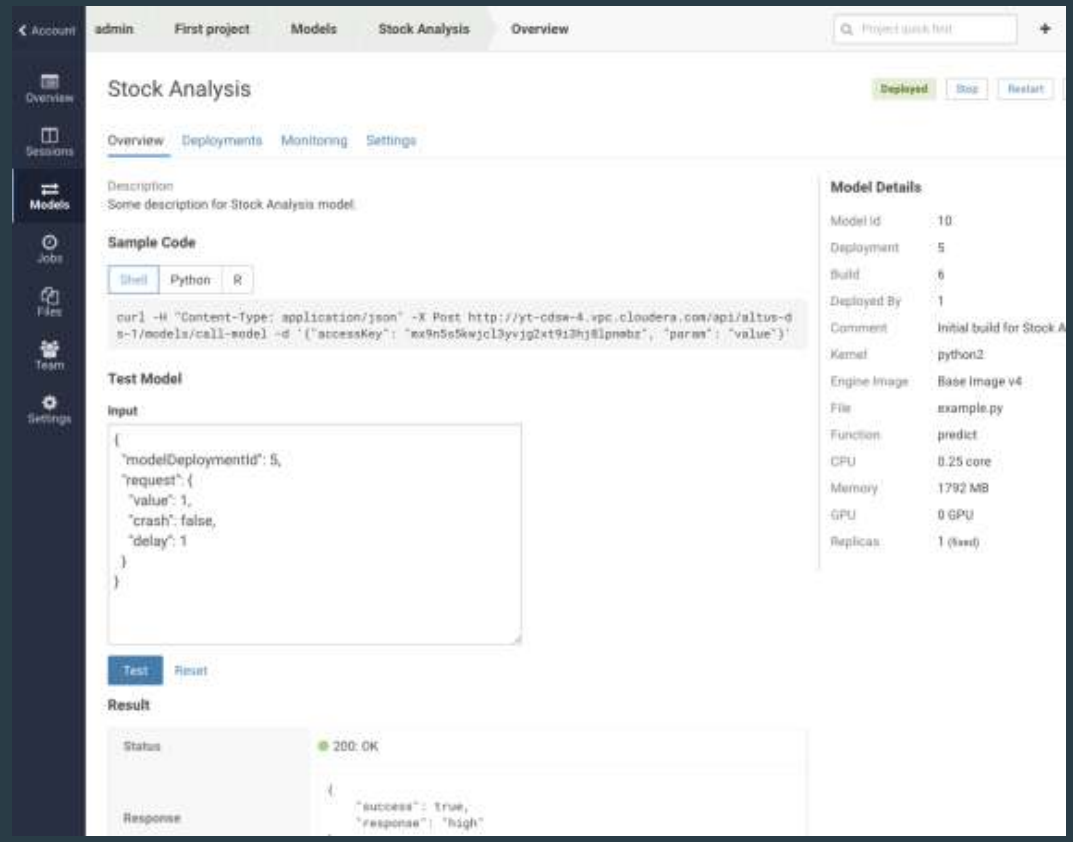
2、选择功能，例如 forecast

```
f = open('model.pk', 'rb')
model = pickle.load(f)
def forecast(data):
    return model.predict(data)
```

3、选择资源。

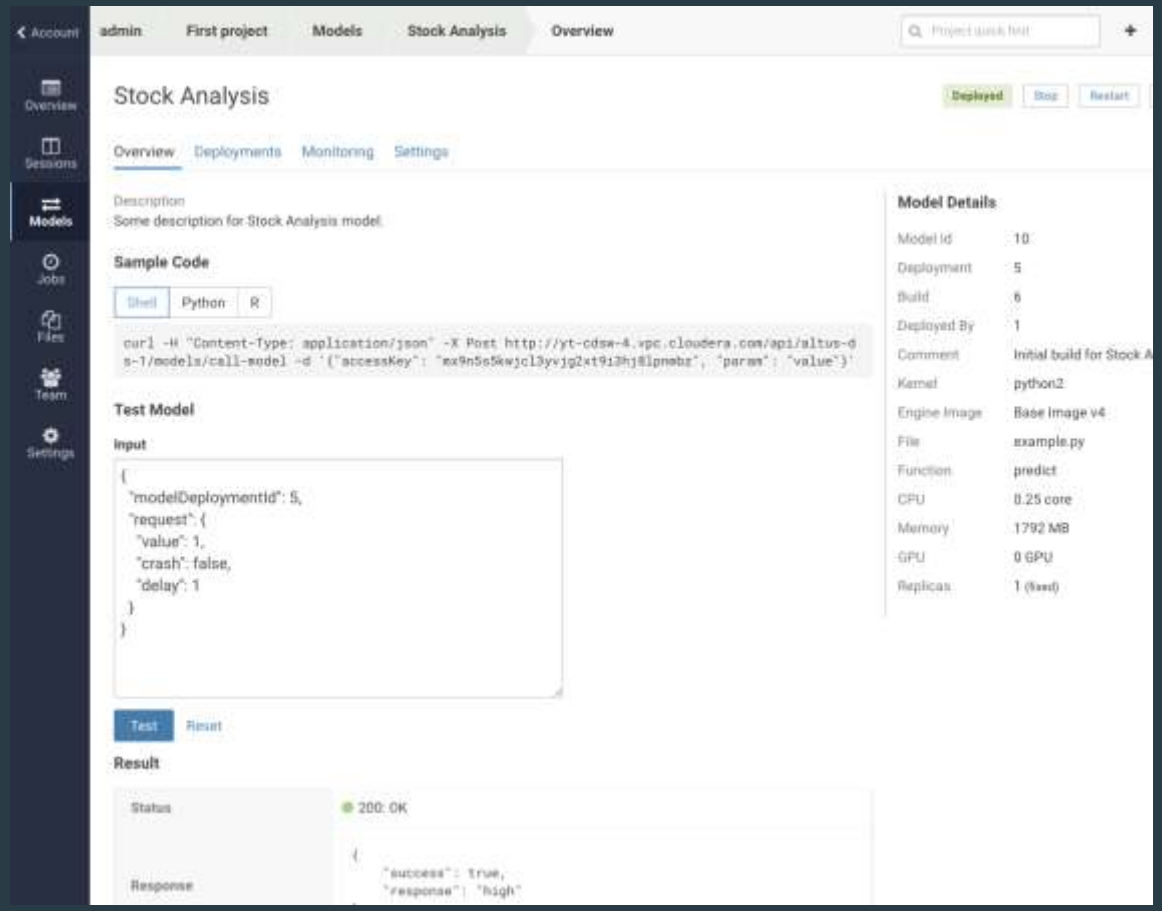
4、部署！

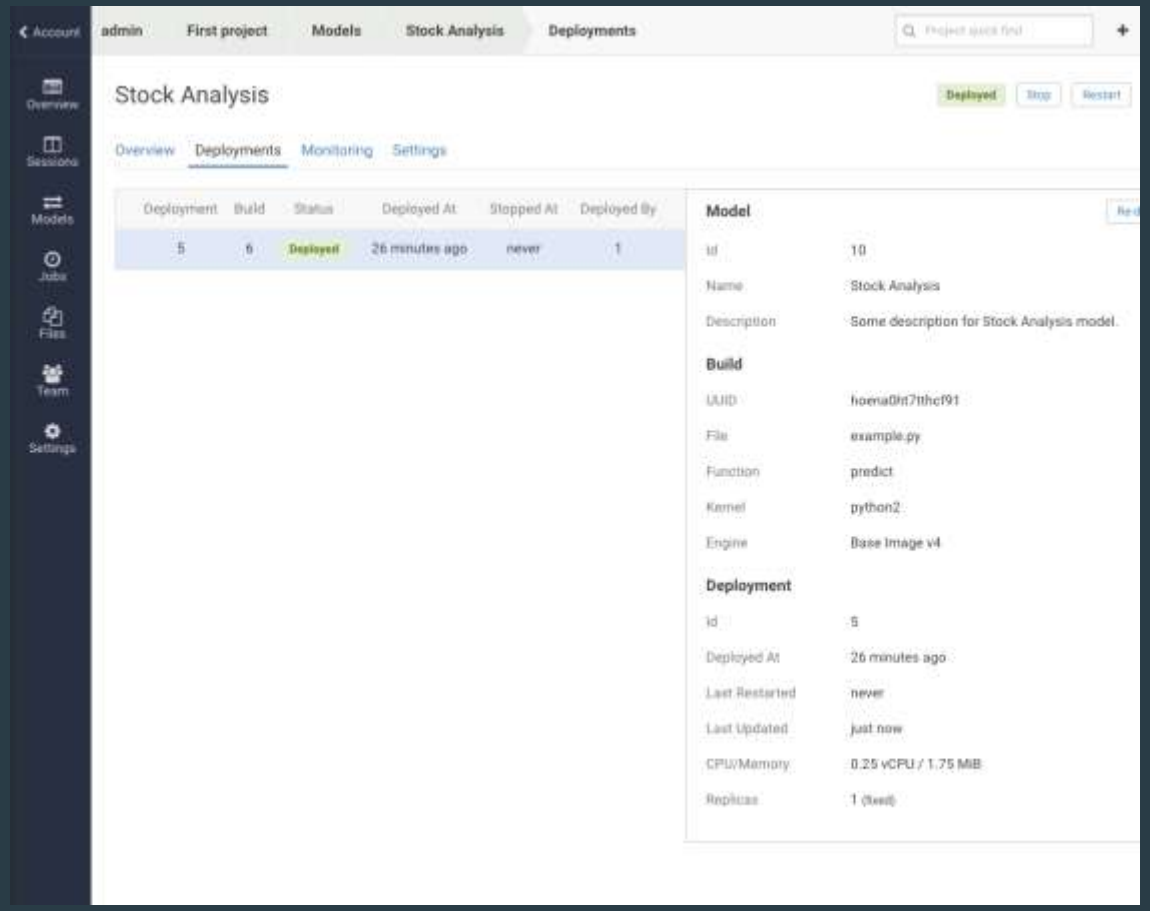
运行模型容器也可以访问CDH进行数据查找。



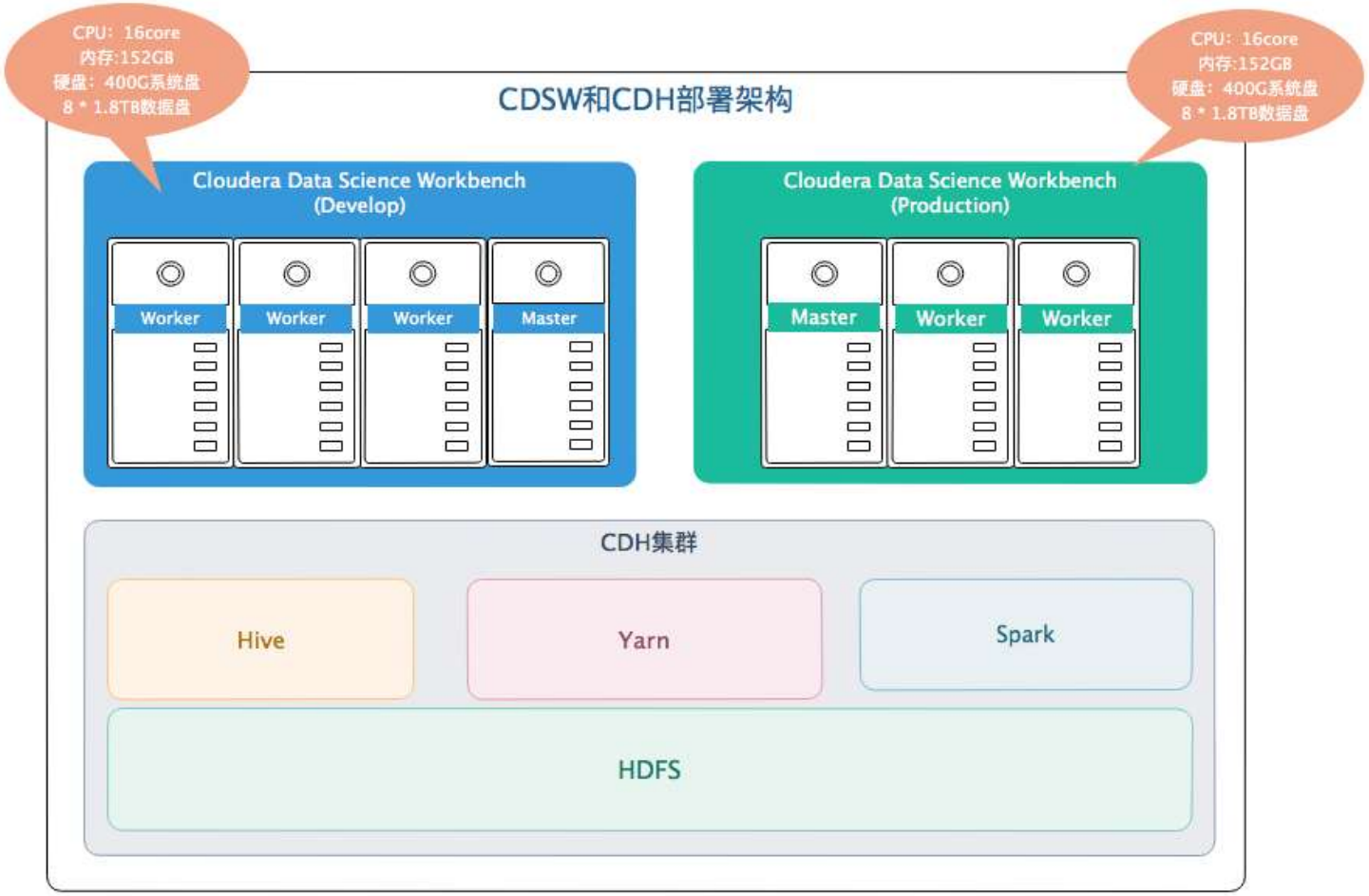
模型管理

按团队或项目查看、测试、监控和更新模型

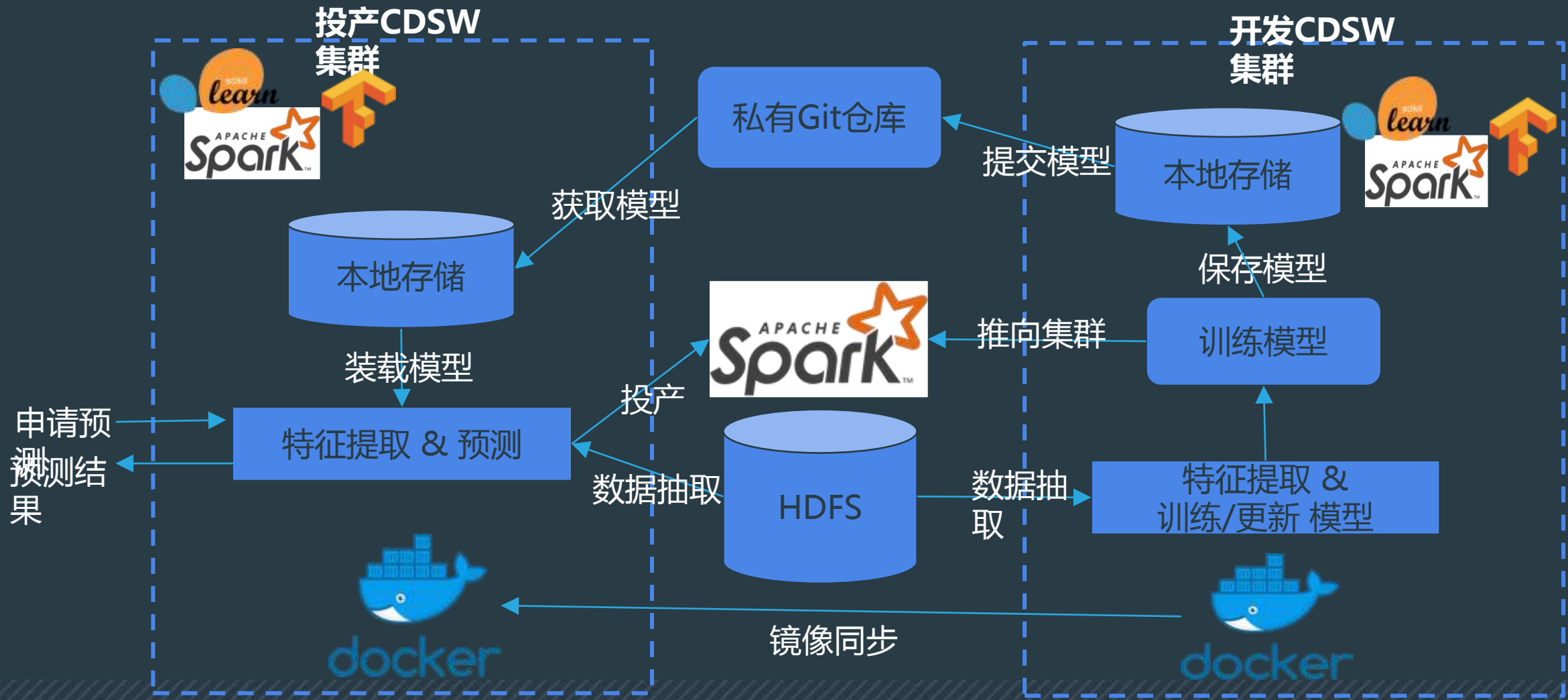




集群现状


CPU：16core
内存:152GB
硬盘：400G系统盘
8 * 1.8TB数据盘
CDSW和CDH部署架构
CPU：16core
内存:152GB
硬盘：400G系统盘
8 * 1.8TB数据盘
Cloudera Data Science Workbench
(Develop)
Worker
Worker
Worker
Master
Cloudera Data Science Workbench
(Production)
Master
Worker
Worker
CDH集群
Hive
Yarn
Spark
HDFS

模型开发与投产


投产CDSW
集群
开发CDSW
集群
私有Git仓库
提交模型
本地存储
获取模型
本地存储
保存模型
APACHE
Spark
推向集群
训练模型
装载模型
投产
申请预测
预测结果
特征提取 & 预测
数据抽取
HDFS
数据抽取
特征提取 &
训练/更新 模型
docker
镜像同步
docker