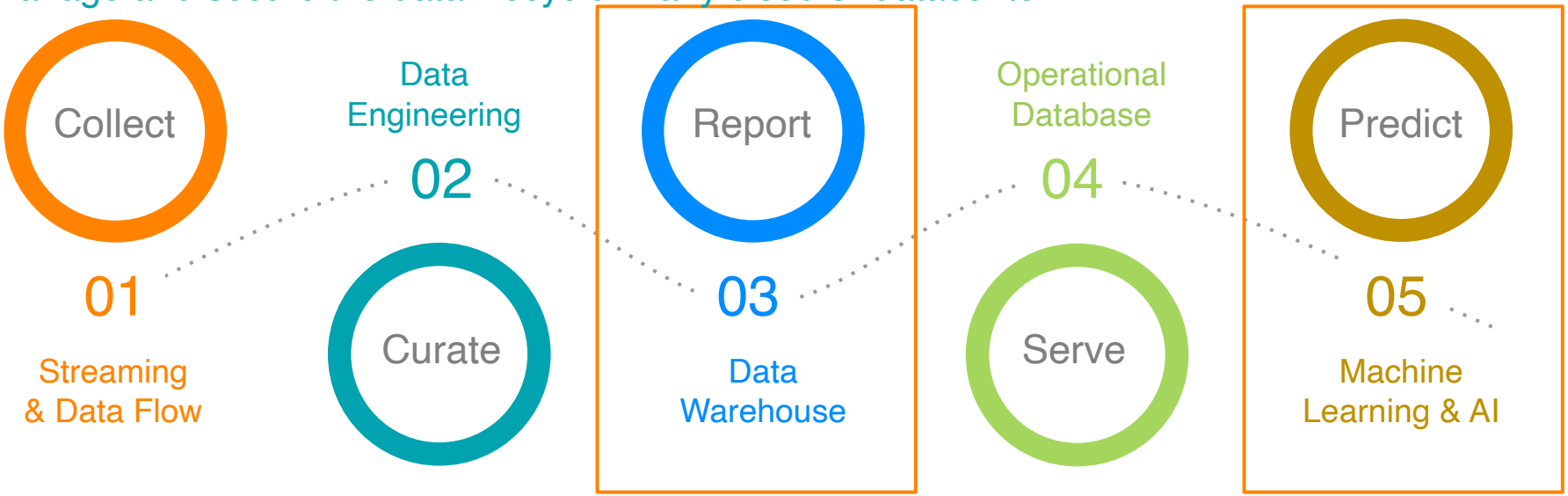
CLOUDERA

Cloudera Machine Learning (CML)

CLOUDERA - THE ENTERPRISE DATA CLOUD COMPANY

Manage and secure the data lifecycle in any cloud or datacenter

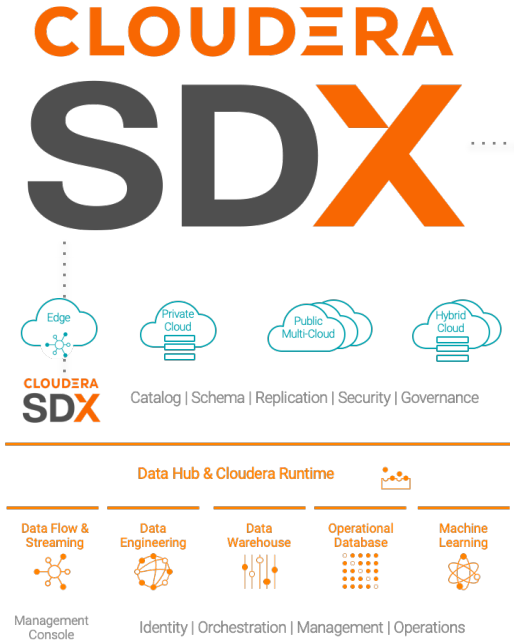


POWERED BY CLOUDERA SDX

Security | Governance | Lineage | Management | Automation

CONSISTENT SECURITY AND GOVERNANCE

Built for multi-functional analytics anywhere



- **Data Catalog:** a comprehensive catalog of all data sets, spanning on-premises, cloud object stores, structured, unstructured, and semi-structured
- **Schema:** automatic capture and storage of any and all schema and metadata definitions as they are used and created by platform workloads
- **Replication:** deliver data as well as data policies there where the enterprise needs to work, with complete consistency and security
- **Security:** role-based access control applied consistently across the platform. Includes full stack encryption and key management
- **Governance:** enterprise-grade auditing, lineage, and governance capabilities applied across the platform with rich extensibility for partner integrations

CML

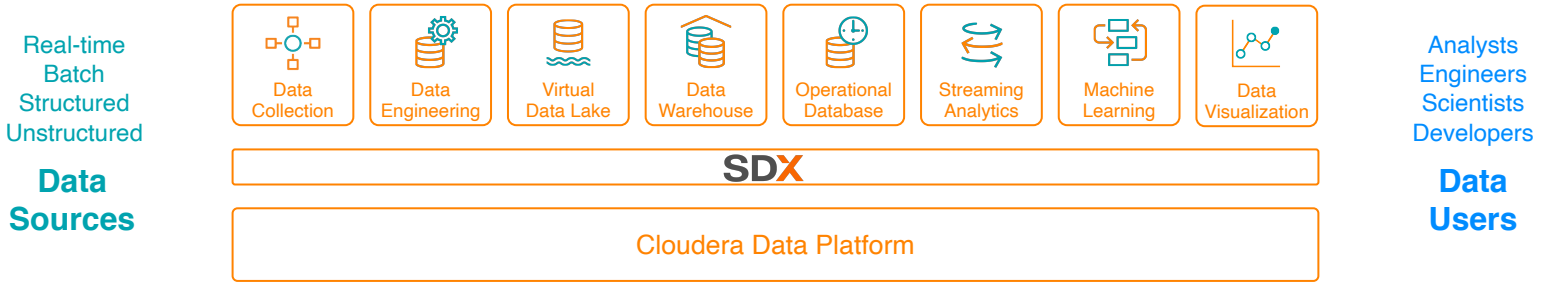
CLOUDERA

THE ENTERPRISE DATA CLOUD COMPANY

A HYBRID DATA CLOUD *AND* ANALYTICS FOR THE DATA LIFECYCLE

Storage & compute separation
Containers
SDX

Delivered as data architectures for key workload patterns



CML is a data service for creating and maintaining ML projects from code to production. Elasticity and collaboration are enabled through a **containerized architecture** and **shared workspaces**. Functionality is offered to conduct experiments, promote and govern models, and serve applications.

Some Examples of AI and ML

Logistic Regression

- Predicting customer churn for subscription-based services from content providers

Neural Networks

- Image and obstruction detection in self-driving cars

Survival Analysis

- Predictive maintenance with IoT analytics in the manufacturing industry

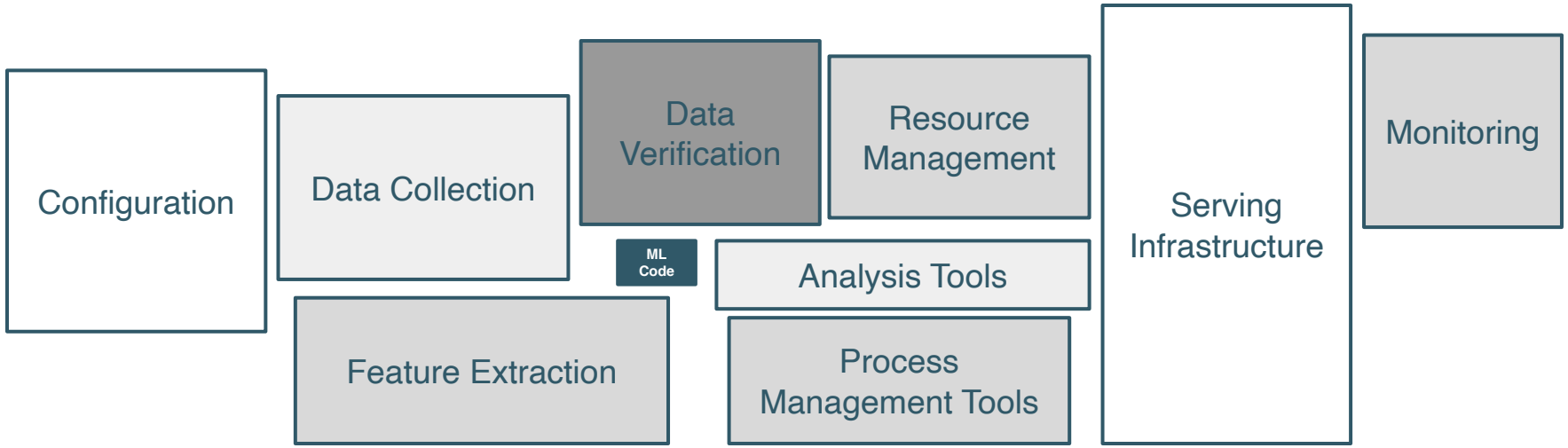
Clustering

- Customer segmentation in the retail industry for targeted, marketing campaigns

NLP

- Sentiment analysis to react quickly to call center and support issues

HIDDEN TECHNICAL DEBT IN MACHINE LEARNING SYSTEMS



Source: https://papers.nips.cc/paper/5656-hidden-technical-debt-in-machine-learning-systems.pdf

MOVING FROM EXPLORATION TO OPERATIONALIZATION

Production machine learning at scale

FROM THE LAB…

TO THE FACTORY

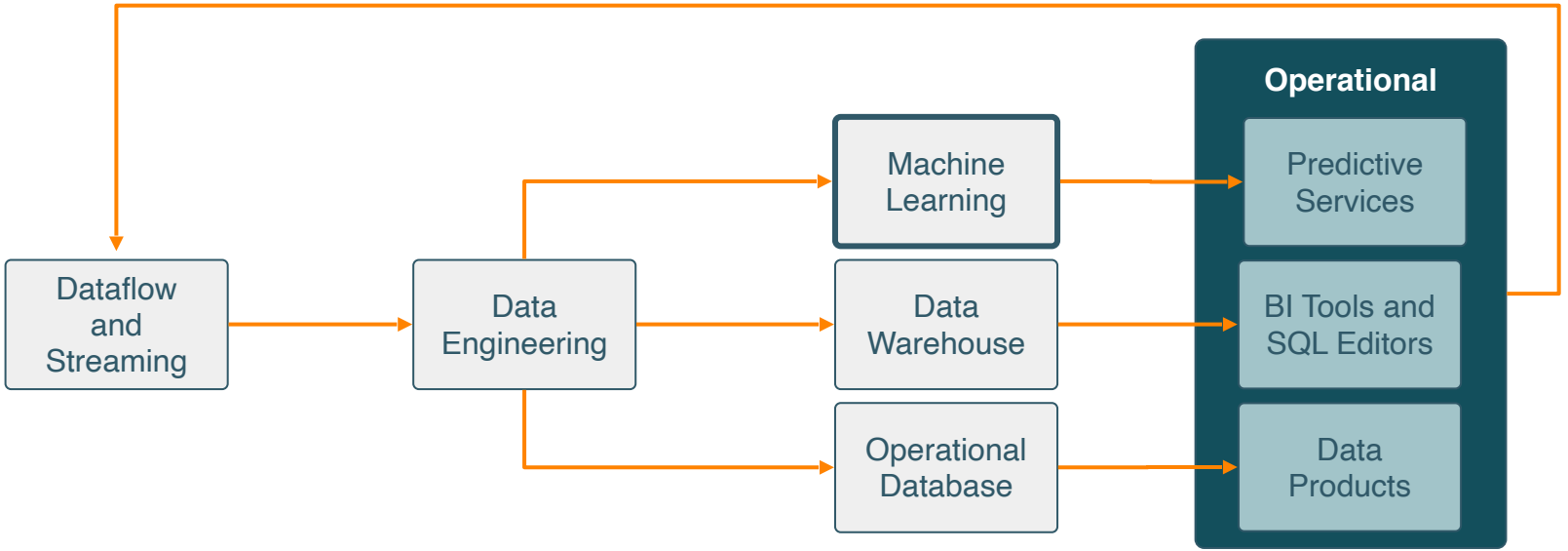
35%

Making it to production

Currently only 35% of organizations indicate that analytical models are fully deployed in production and are often challenged in the “last mile” of the complex and iterative ML workflow

** IDC’s Advanced and Predictive Analytics survey and interviews, n = 400, 2017 – 2019*

… IS MORE THAN JUST ML



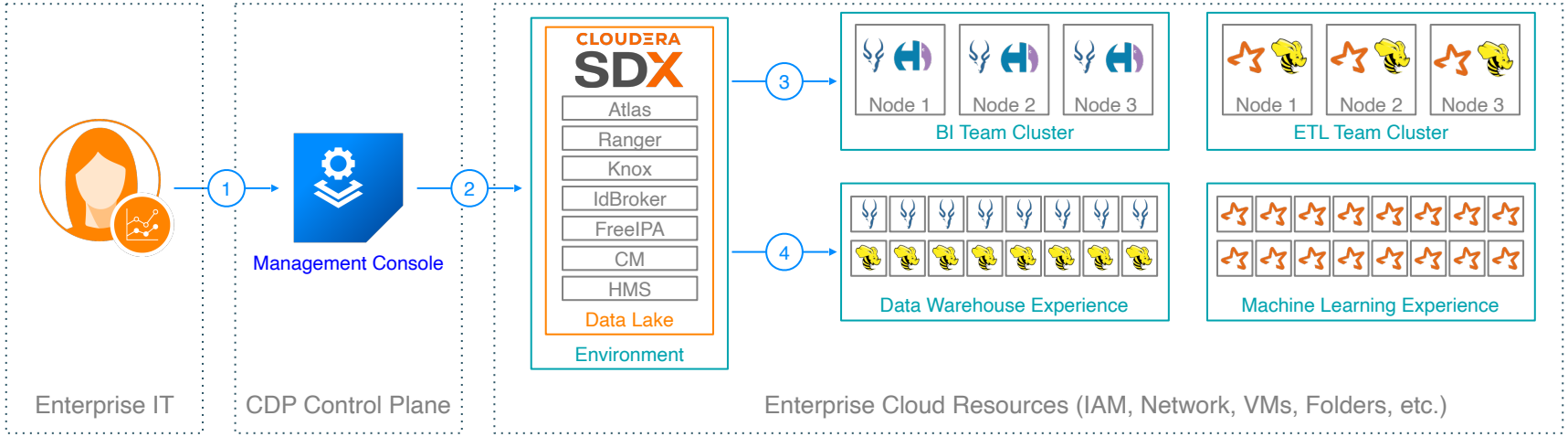
CLOUDERA SDX

Model Security | Model Governance | Model Catalog | Feature Store

Data Catalog

EXAMPLE INTEGRATION OF COMPONENTS

Typical user flow



Step 1
User connects to CDP with their enterprise identity

Step 2
They create an environment and data lake for their enterprise

Step 3
They create data hub clusters for traditional workloads

Step 4
They create access points for containerized analytic experiences

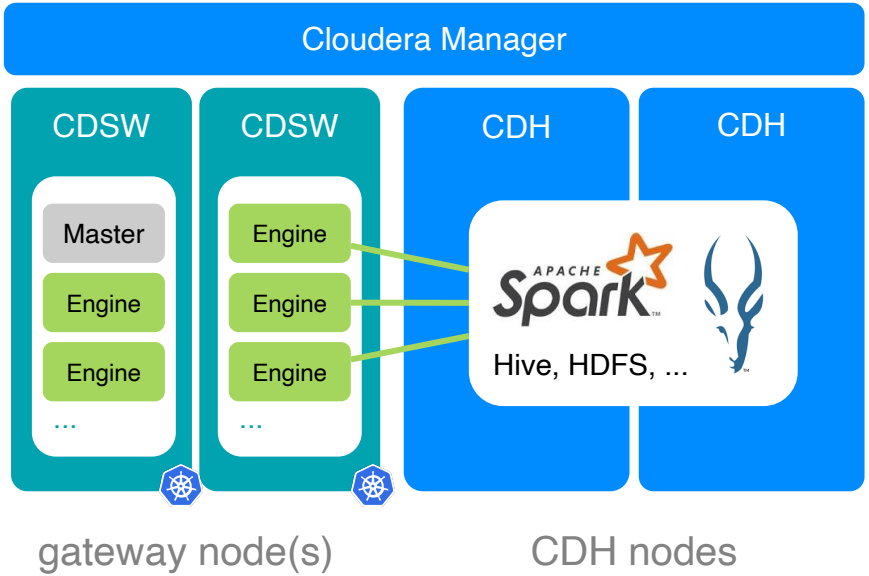
TECHNICAL FEATURES

CDSW IS DESIGNED FOR THE DATACENTER

Containerized environments with scalable compute powered by Kubernetes and CDH

- Easy addition for self-service data science
- Seamless connectivity to existing clusters
- Isolated, reproducible user environments

But… *Trade-offs...*



CML IS CLOUD READY

Cloud-native enterprise machine learning as-a-service

END-TO-END DS/ML

Accelerate Data Science from research to production

FLEXIBLE DATA ENGINEERING

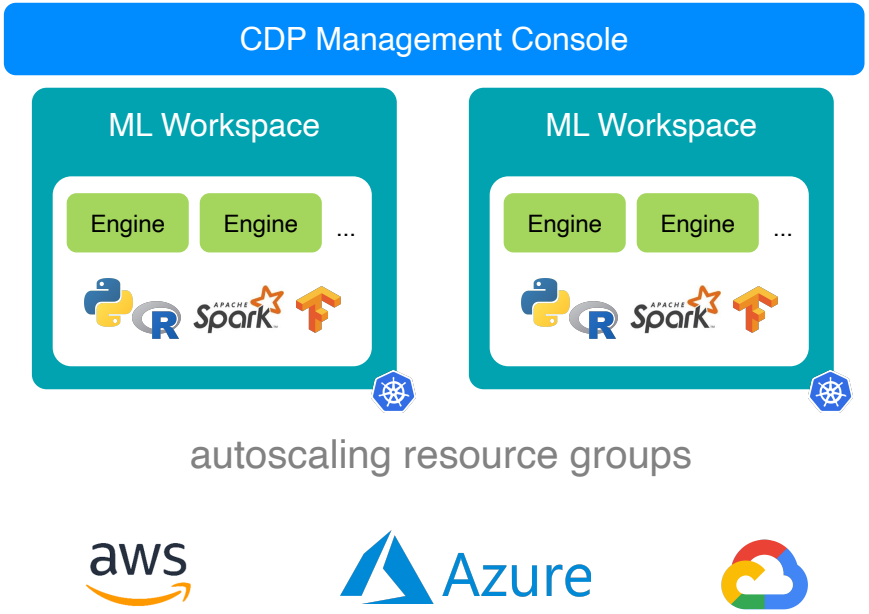
Easy to use, self-service, on-demand, elastic spark for data engineering

SECURE & GOVERNED

Self-service data & elastic compute with guardrails

KUBERNETES & CONTAINERS

Adoption as standard operating environment for flexibility and agility



Agility

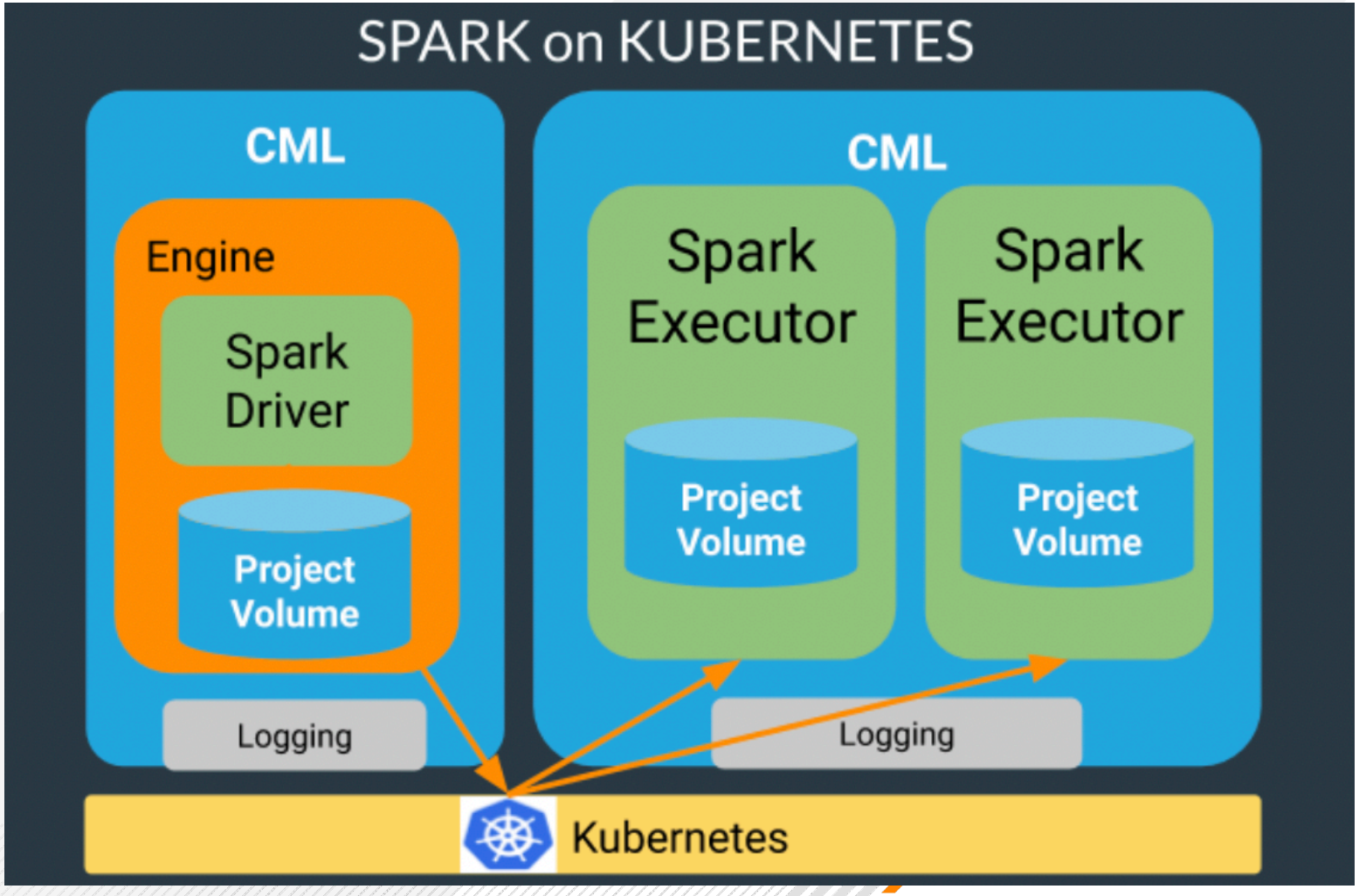
Collaboration

Dependency Management

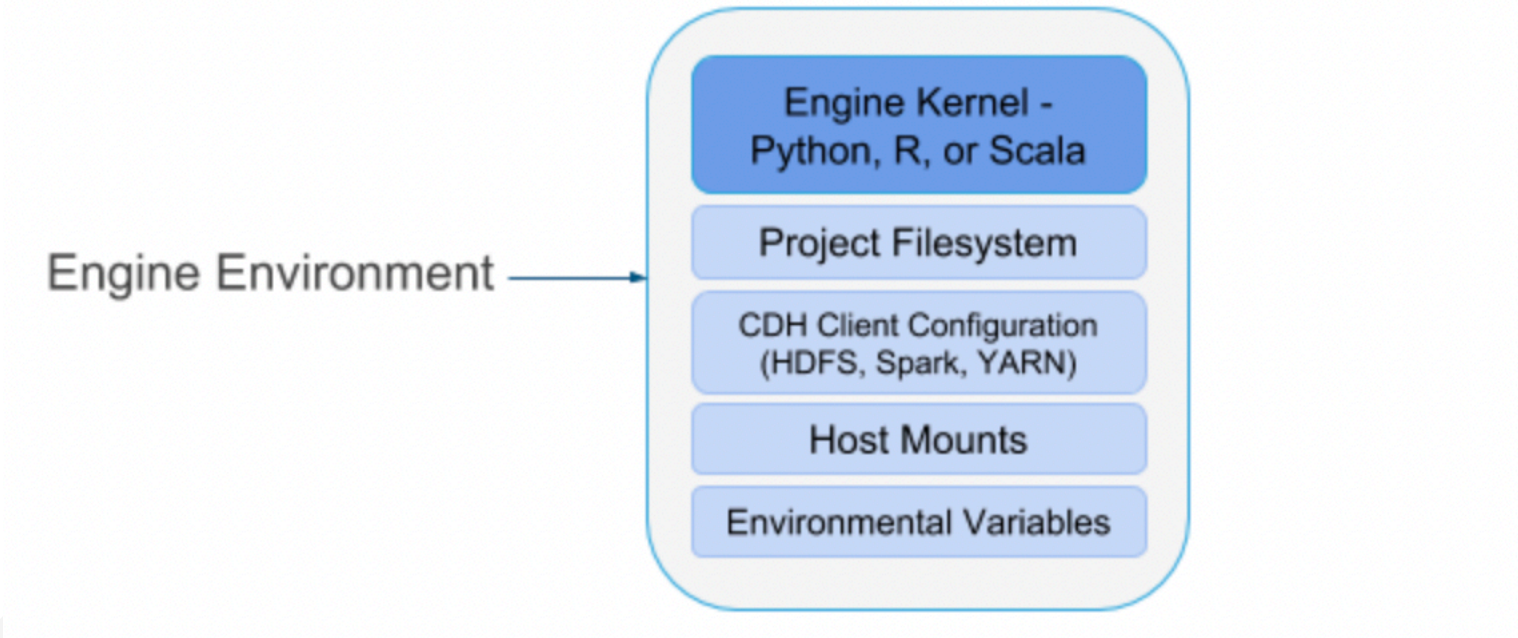
Auto-scaling

Workload Isolation

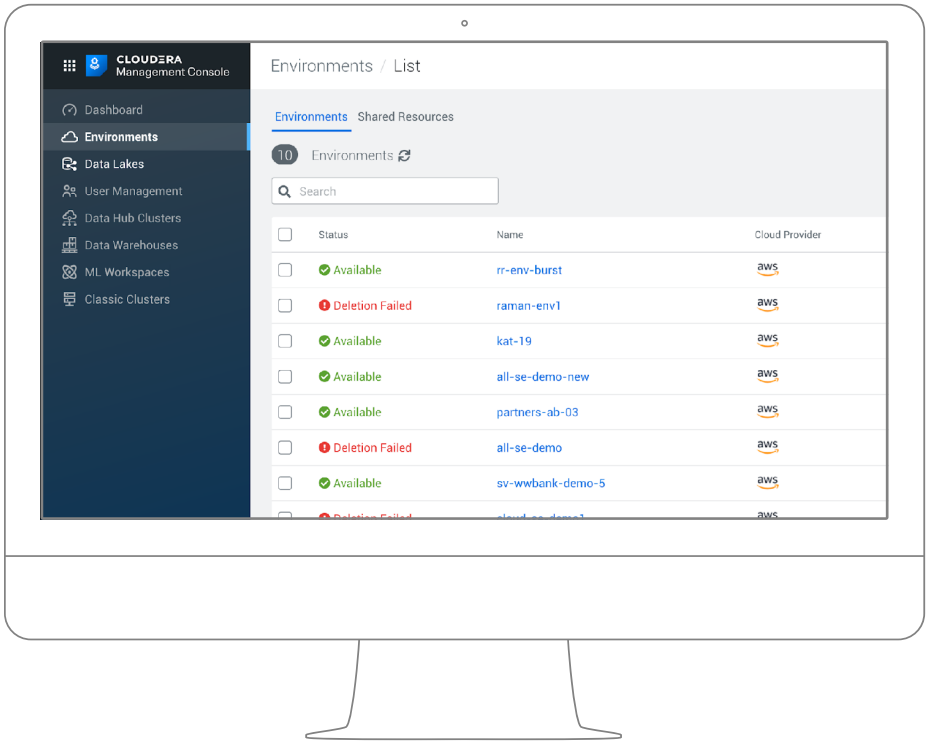
Versioning



CML Session and Jobs use a virtual ‘engine’



KEY COMPONENTS



ENVIRONMENTS

Environment

- 1 Template
- 1 Region
- 1 VNET
- Multiple Roles/Folders

1:1

Data Lake

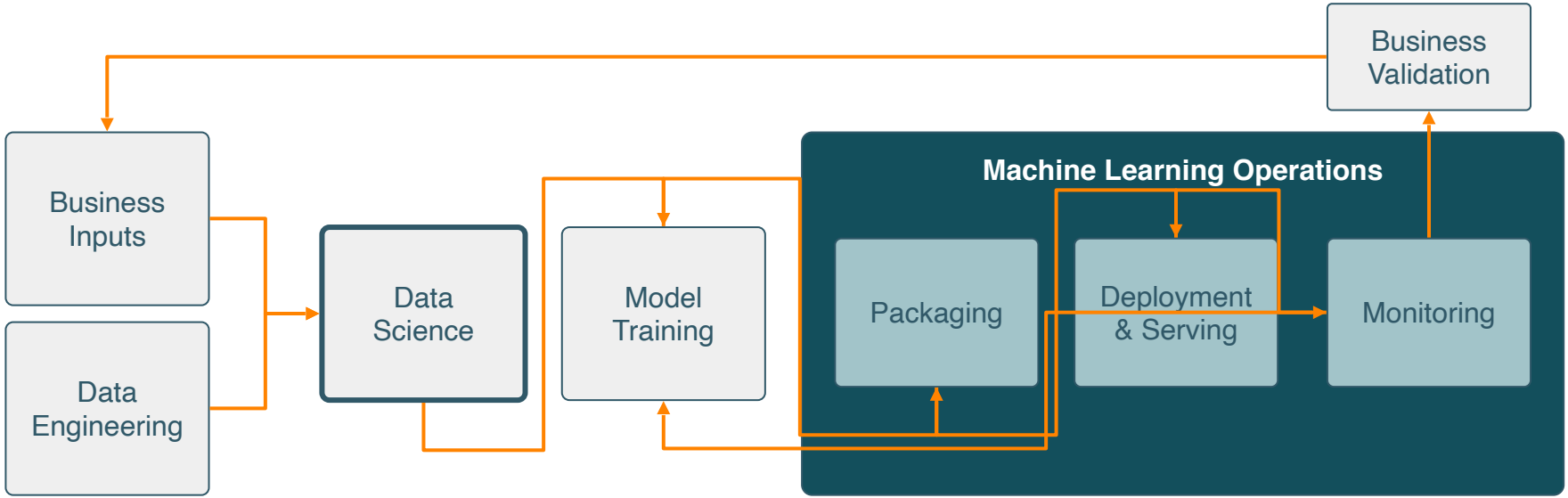
- SDX: Atlas, Ranger, Knox, IdBroker, CM
- Associated with groups/users

1: N

Data Hub Clusters / Experiences

- DH templates
- ML Env
- DW Database Catalogs/Virtual Compute

MACHINE LEARNING IN PRODUCTION



Business, IT - Data Engineering

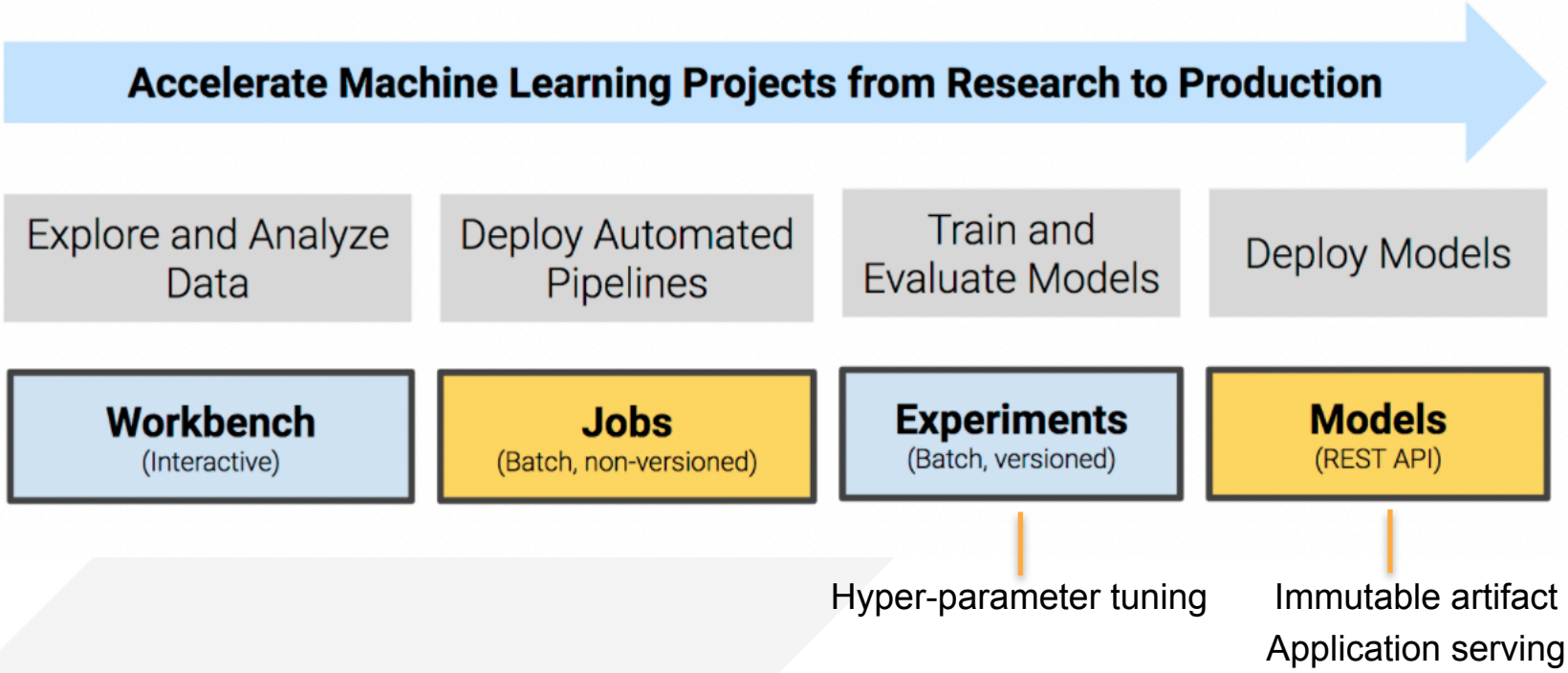
Data Scientists

IT - DevOps

ML Ops / ML Engineer

Business

CML ENABLEMENT



Demo

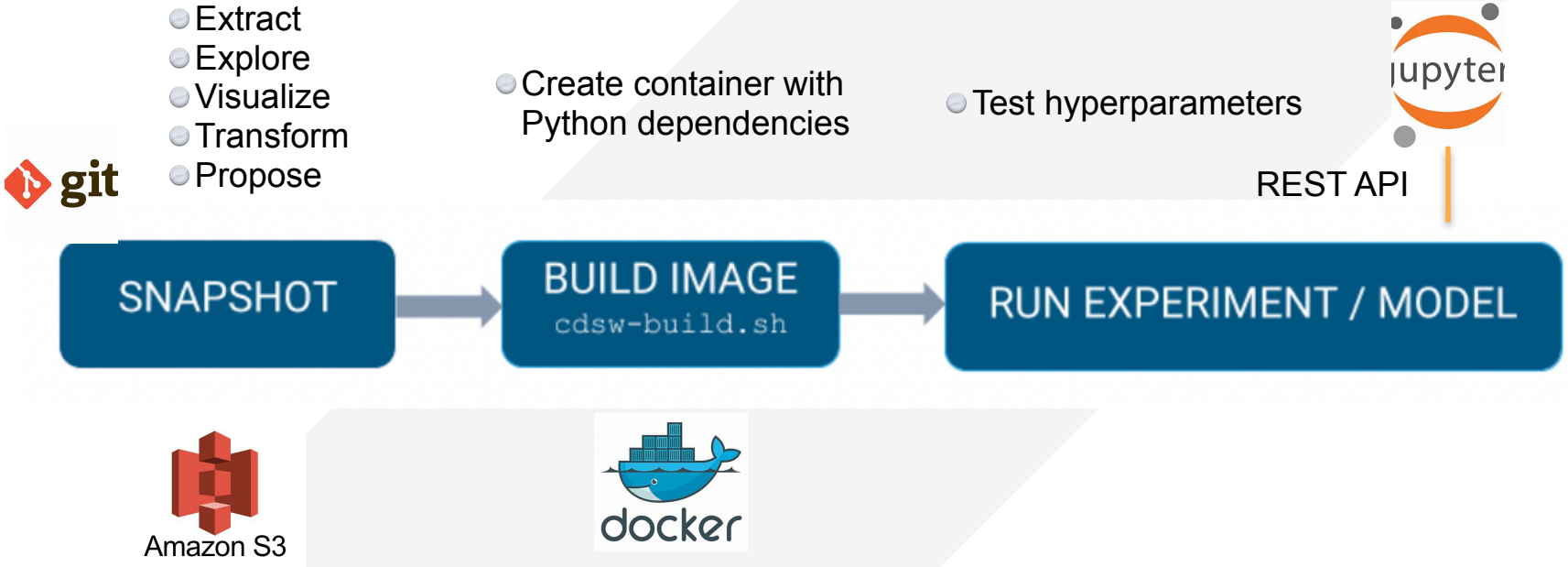
Demo: Predict the number of flight cancellations based upon historical data dating back to 2003. Perform time-series analysis to experiment with ARIMA models. Conduct feature extraction and transformations with data persisted in S3.

Demo: ML Lifecycle

- Extract
- Explore
- Visualize
- Transform
- Propose

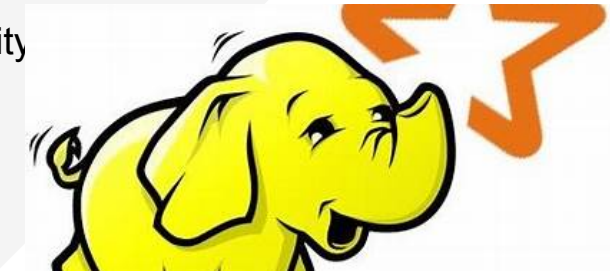
- Create container with Python dependencies

- Test hyperparameters



What is a Time Series

- **Time series = a sequence of data points occurring in order as measured over time**
- **Time series prediction = using previous values to predict future values**
- Stationarity = constant mean, constant variance, and no seasonality
- Seasonality = patterns and trends that repeat over time



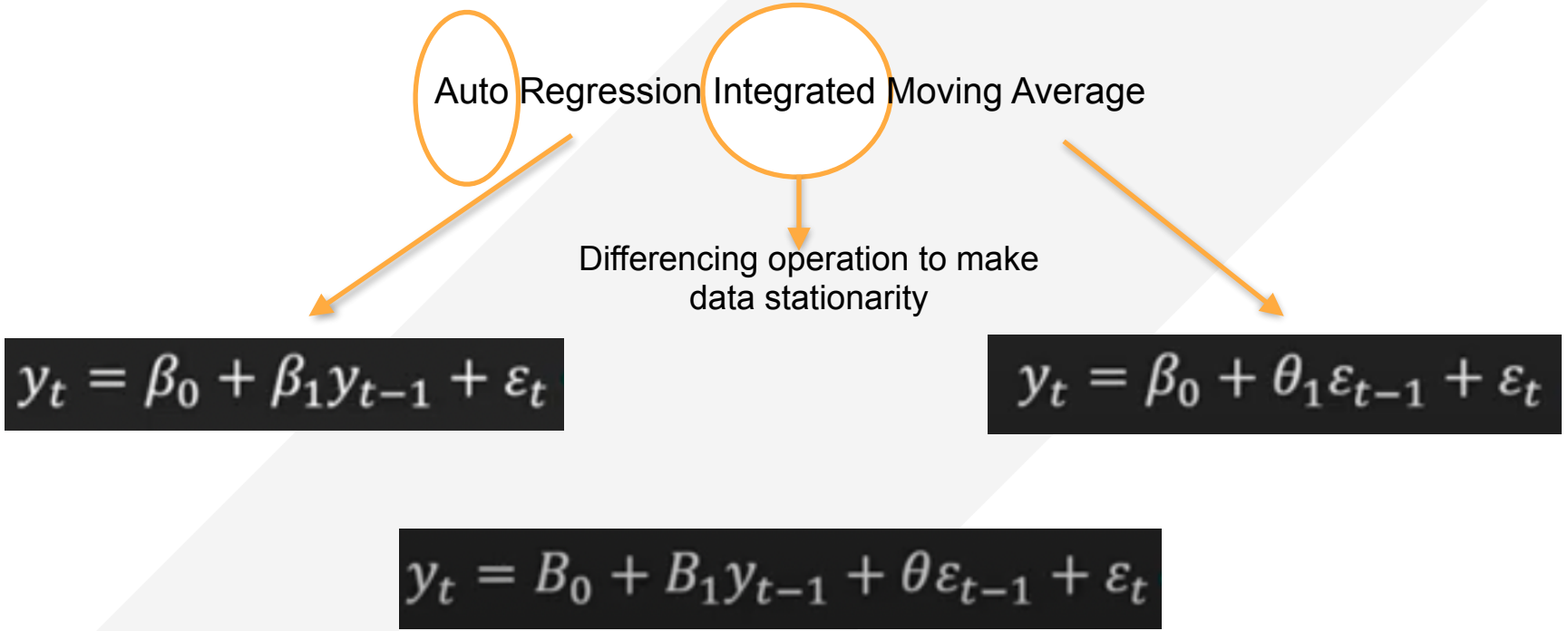
Data Engineering exercise

How to check for stationarity:

- Plotting
- Local versus global means checks
- Kwiatkowski-Phillips-Schmidt-Shin (KPPS) Test
- Augmented Dickey-Fuller Test (ADG)

Exponential smoothing Y = Log(Exp(Y))
Seasonal differencing Y(t) - Y(t-N)

What is an ARIMA Model



Converge to the best ARIMA Model

Find the optimal value for the mean and variance given a number of observed measurements

Balance between maximizing the log likelihood versus overfitting

L = log likelihood
K = number of parameters
N = number of samples used for fitting

Model quality => Lower values of *AIC* and *BIC*

$$AIC = 2K - 2L \qquad BIC = K*ln(N) - 2L$$

Assess Model Performance

Compare model predictions to actual data

$$\mathrm{RMSD} = \sqrt{\frac{\sum_{t=1}^{T} (\hat{y}_t - y_t)^2}{T}}.$$

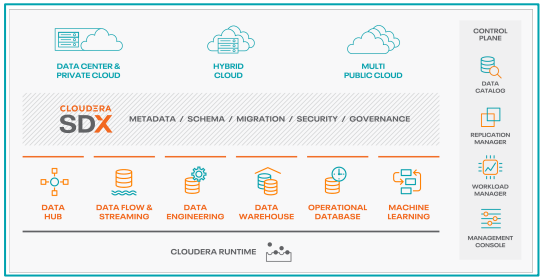
Example Airlines Data

Airport.Code	Airport.Name	Time.Label	Time.Month	Time.Month Name	Time.Year	Statistics.# of Delays.Carrier	Statistics.# of I
ATL	Atlanta, GA: Hartsfield-Jackson Atlanta International	2003/06	6	June	2003	1009	
BOS	Boston, MA: Logan International	2003/06	6	June	2003	374	
BWI	Baltimore, MD: Baltimore/Washington International Thurgood Marshall	2003/06	6	June	2003	296	
CLT	Charlotte, NC: Charlotte Douglas International	2003/06	6	June	2003	300	
DCA	Washington, DC: Ronald Reagan Washington National	2003/06	6	June	2003	283	
DEN	Denver, CO: Denver International	2003/06	6	June	2003	516	
DFW	Dallas/Fort Worth, TX: Dallas/Fort Worth International	2003/06	6	June	2003	986	
DTW	Detroit, MI: Detroit Metro Wayne County	2003/06	6	June	2003	376	
EWR	Newark, NJ: Newark Liberty International	2003/06	6	June	2003	322	
FLL	Fort Lauderdale, FL: Fort Lauderdale-Hollywood International	2003/06	6	June	2003	247	
IAD	Washington, DC: Washington Dulles International	2003/06	6	June	2003	320	
IAH	Houston, TX: George Bush Intercontinental/Houston	2003/06	6	June	2003	329	
JFK	New York, NY: John F. Kennedy International	2003/06	6	June	2003	376	
LAS	Las Vegas, NV: McCarran International	2003/06	6	June	2003	511	

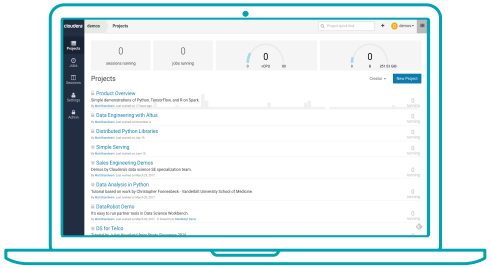
Closing Notes

MACHINE LEARNING AT CLOUDERA

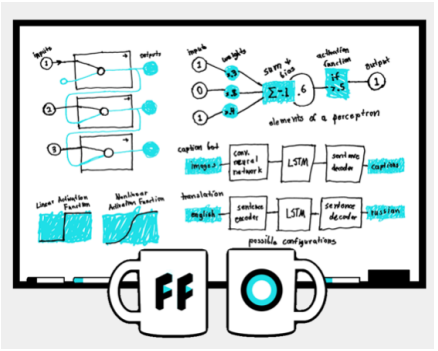
Build your enterprise AI Factory



Open **platform** to build, train, deploy and operationalize ML models at scale



Comprehensive data science **tools** to accelerate team productivity



Expert guidance & services to fast track value & scale

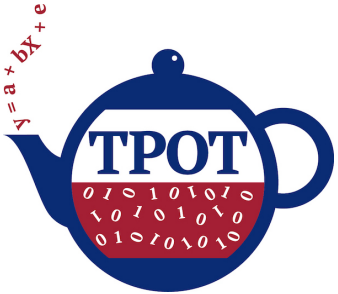
Project development can be done in the editor of your choice

PyCharm

Data scientist productivity

CML is open and extensible *by design*

auto-sklearn



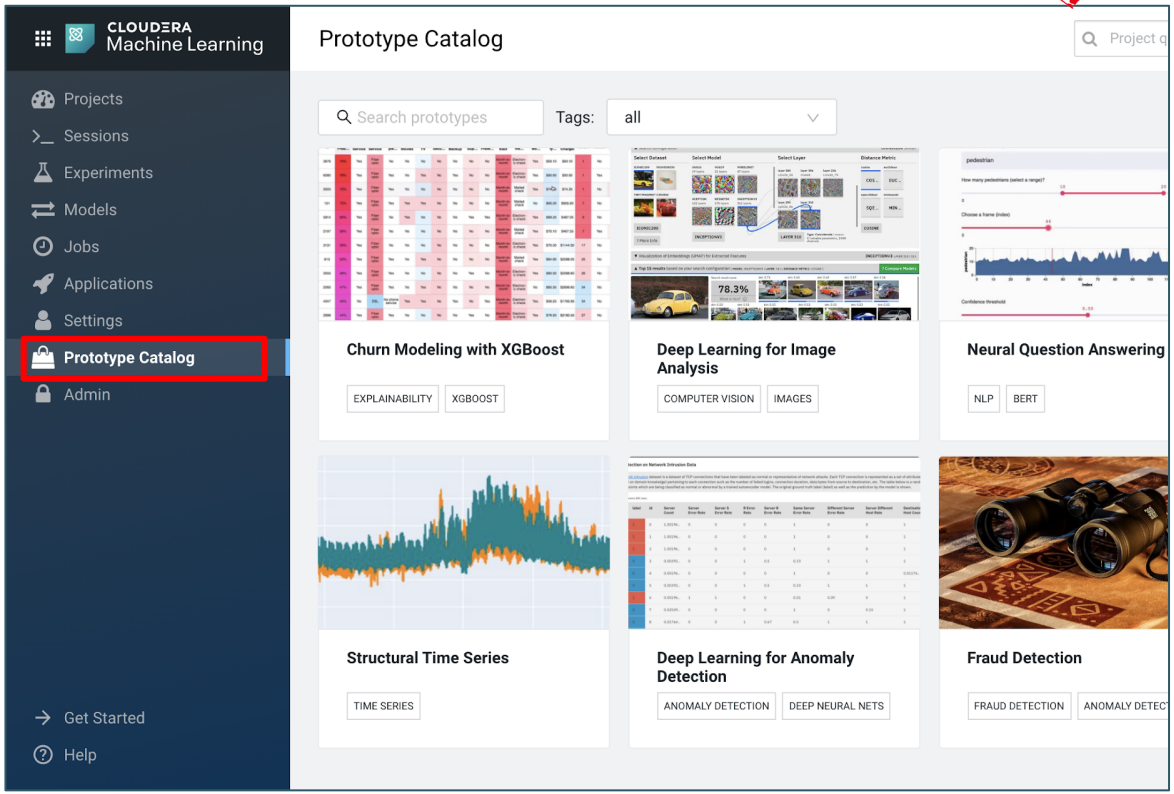
TransmogrifAI

automl-gs

App development can be done in the framework of your choice

APPLIED MACHINE LEARNING PROTOTYPES

- Complete auto-deployed ML projects
- Pre-built algorithms & ML models OOTB
- Auto-deployed predictive apps
- Build and deploy your own AMPs
- Fully built in to CML



THANK YOU