Road to Enterprise Architecture for Big Data Applications

Mixing Apache Spark with singletons, wrapping, facade

Magneti Marelli, ICT Innovation
London, United Kingdom

#SAISEnt4

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Company Overview

Magneti Marelli is an international company committed to the design and production of hi-tech systems and components for the automotive sector.

AUTOMOTIVE LIGHTING
(Headlamp, Rearlamp, Lighting and Body Electronics)

POWERTRAIN
(Gasoline and Diesel engine control, Electric Motor, Inverter and Transmission)

ELECTRONICS
(Instrument Clusters, Infotainment & Telematics)

SUSPENSION SYSTEMS AND SHOCK ABSORBERS
(Suspension Systems, Shock Absorbers and Dynamic Systems)

EXHAUST SYSTEMS
(Manifolds, Catalytic converter, Diesel Particulate Filter and Mufflers)

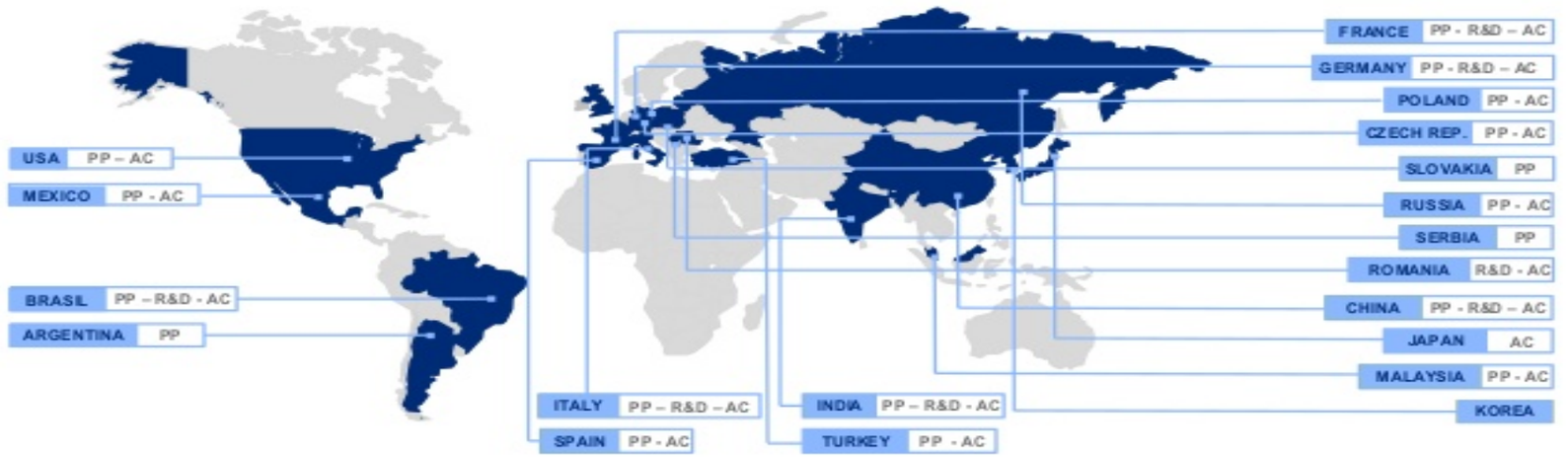
PLASTIC COMPONENTS AND MODULES
(Bumper, Dashboard, Central Console, Pedals, Hand Brake Levers and Fuel System)

AFTERMARKET PARTS & SERVICES
(Mechanical, Body Work, Electrics and Electronic and Consumables)

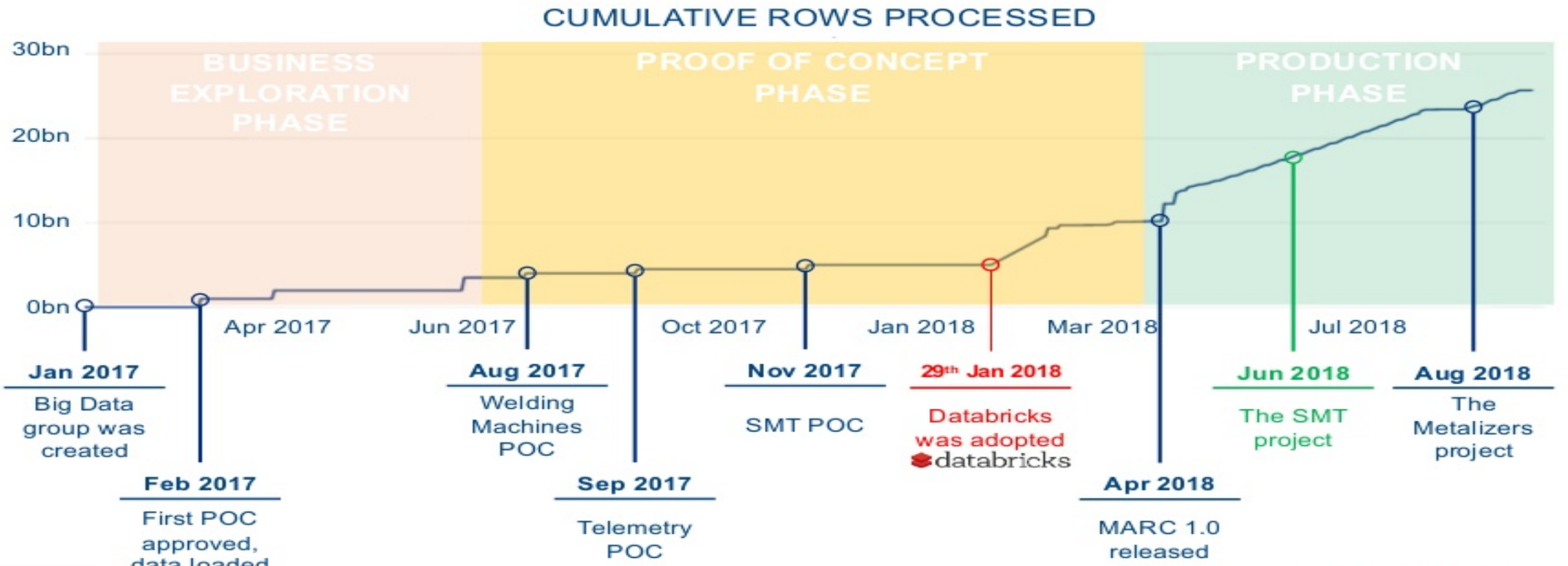
MOTORSPORT
(Injection Systems, Electronic Control Units, Hybrid Systems, Telemetry Systems, Electric Actuators)

Magneti Marelli Worldwide Footprint

PP: Production Plant **R&D:** R&D Center **AC:** Application Center



Big Data storyline



The Surface-Mount Technology (SMT) project

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Pre Production & Assembly Line

Surface-Mount Technology

PCB Preparation

Assembly Line

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Lasermarker

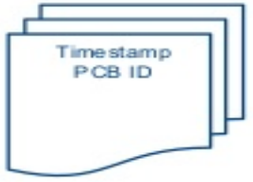
Serigraphy

Automated Optical Inspection Post Printing

Pick and Place

Oven

Automated Optical Inspection Post Reflow



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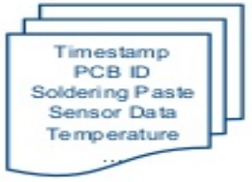

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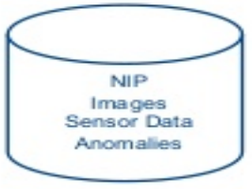

MDB

DB SQL

1 file per day

DB SQL

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Machine Learning Problems

1. Machine Status Monitoring
2. Bottleneck harmonic model
3. Anomaly Recommender Engine

Timestamp
PCB ID

1 file per Item

Timestamp
PCB ID
Soldering Paste Sensor Data
Temperature
...

1 file per Item

NIP
Images
Sensor Data
Anomalies

MDB

NIP
Pick Up Info
Feeder Info

DB SQL

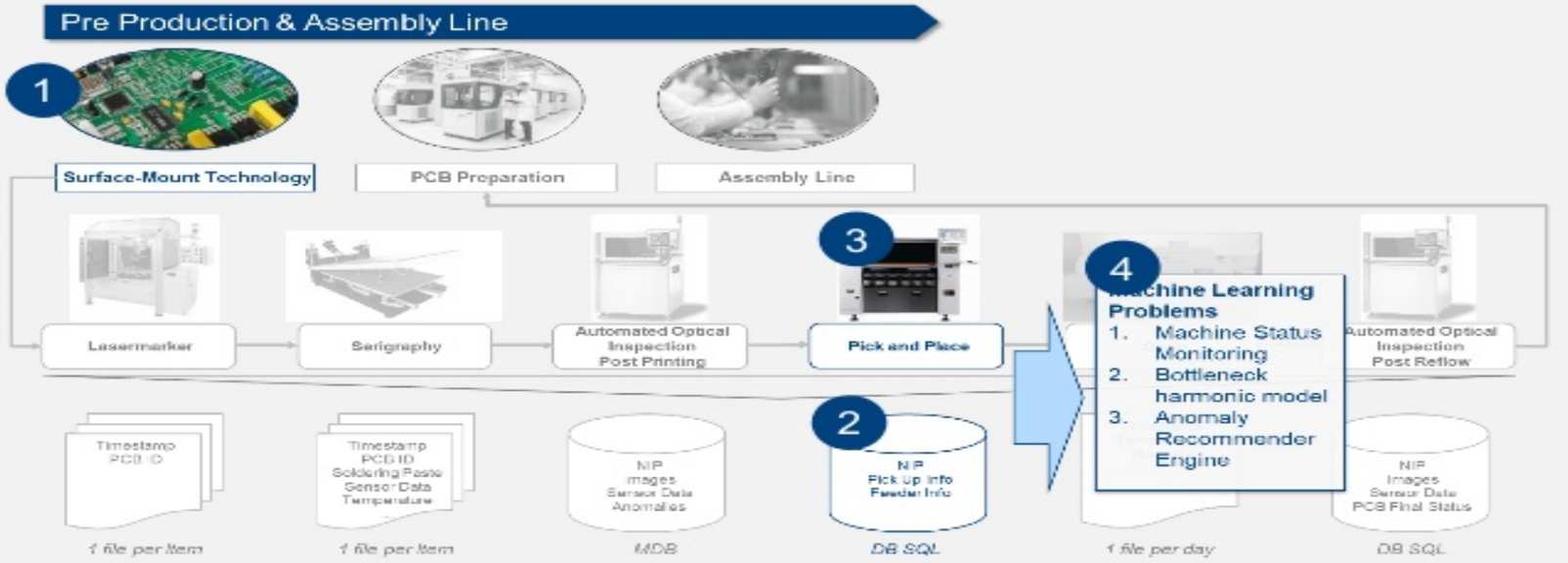
1 file per day

NIP
Images
Sensor Data
PCB Final Status

DB SQL

A Dream Project

1. Production process is well known
2. Data source is clearly defined
3. Need is raised by plant people
4. Algorithmic challenges are clear



Becoming a Nightmare

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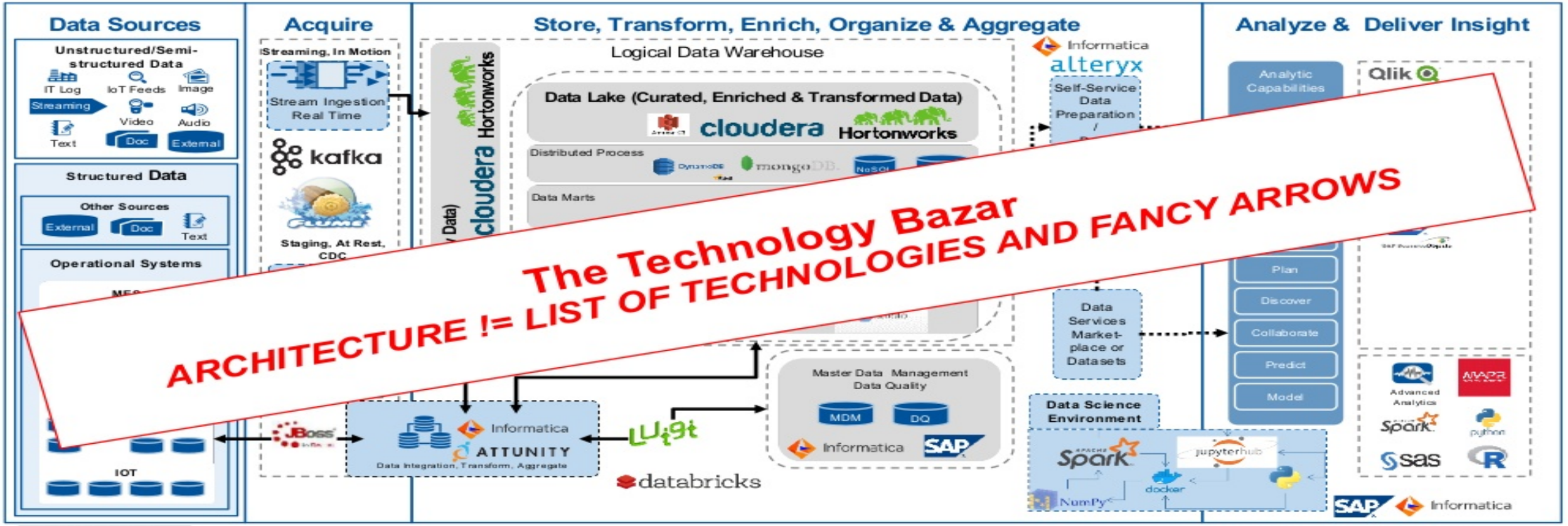
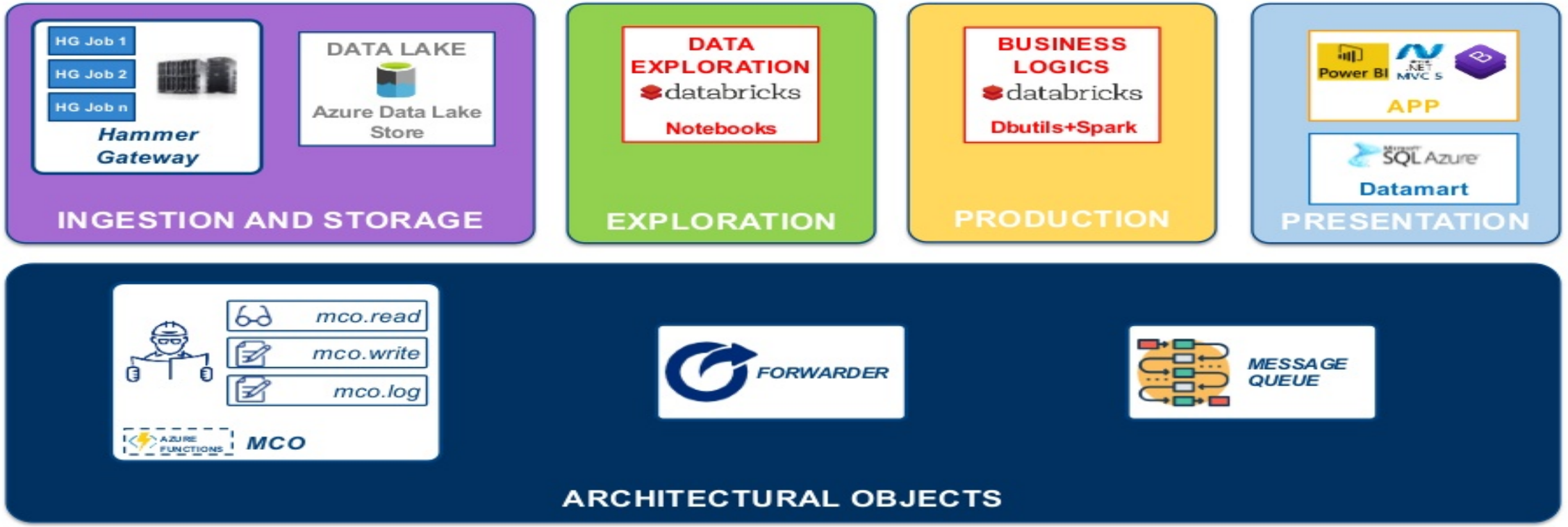
1. Production process is well known
2. Data source is clearly defined
3. Need is raised by plant people
4. Algorithmic challenges are clear

- *So… Where is the data?*
- *How can I read/access the data?*
- *How can I be supported by my data scientist colleagues?*
- *How can I attach a Spark cluster to my Jupyter notebook?*
- *Who is going to port the notebook to production?*
- *What do you mean with* production*?*

Enterprise Architecture

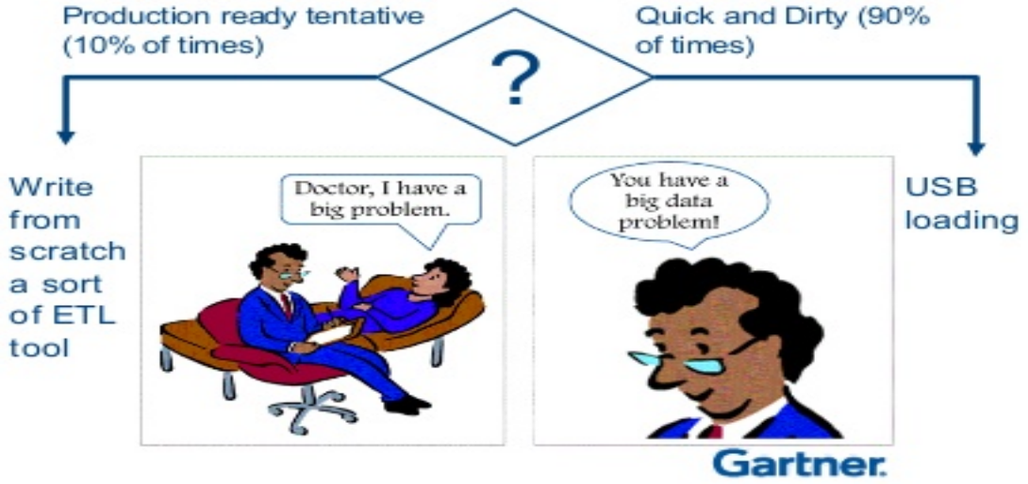


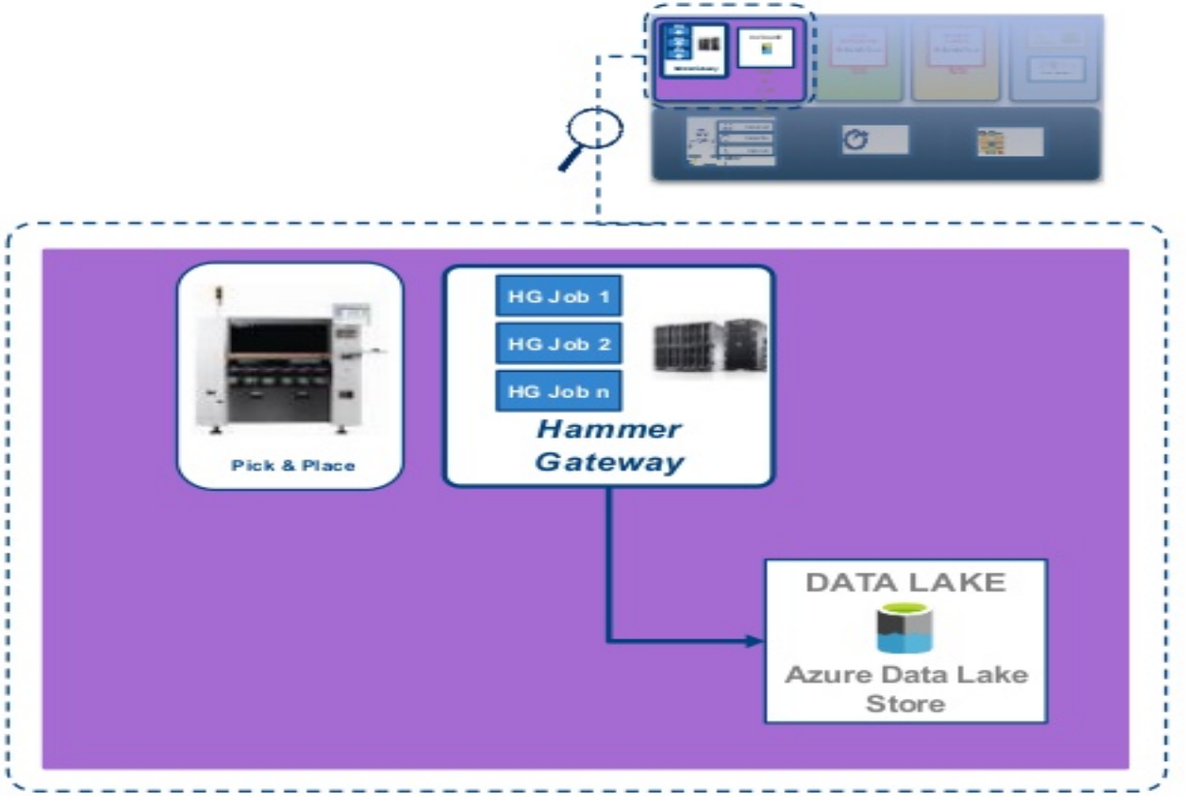
Keep it simple, stupid



Enterprise Architecture – Data, where are you?

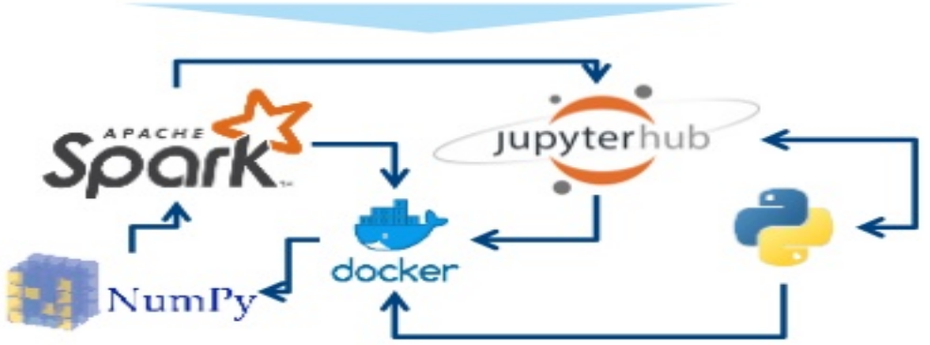
- Where are the csv?
- What do you mean with bcp out?
- How can I get a copy in the cloud?
- How can I update data on a regular basis?

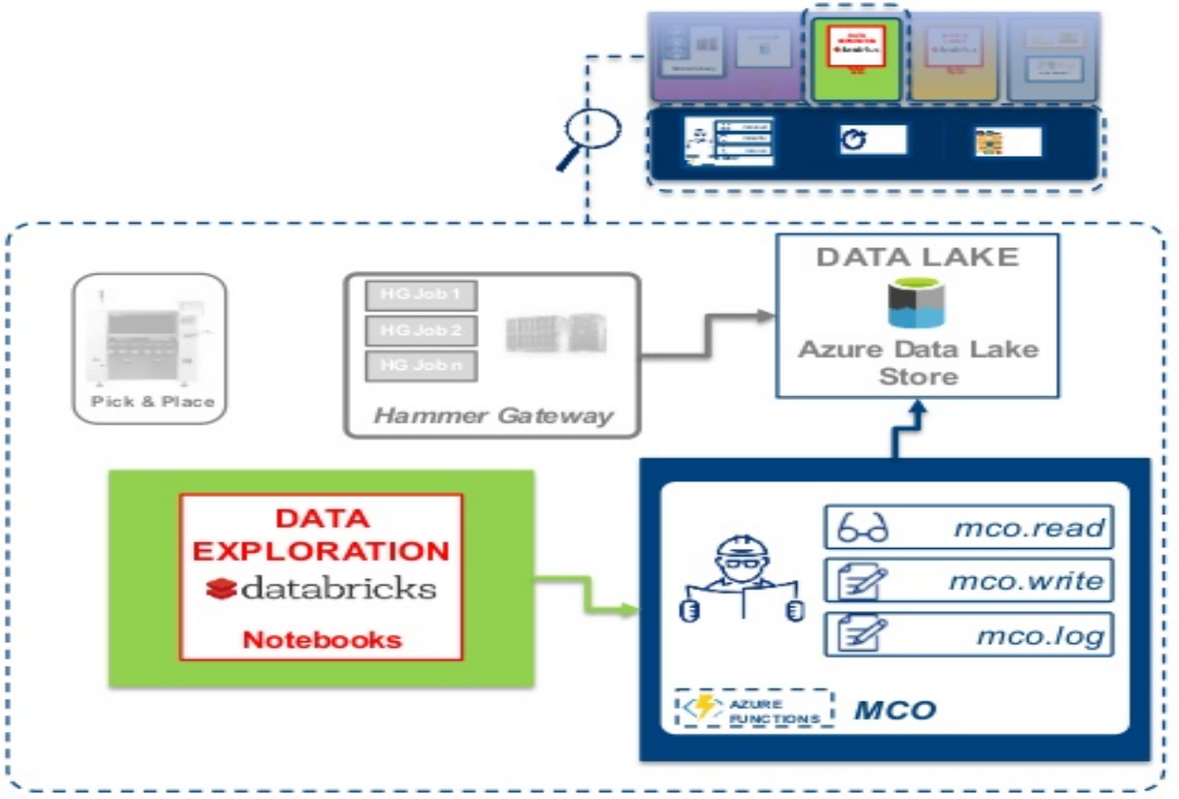




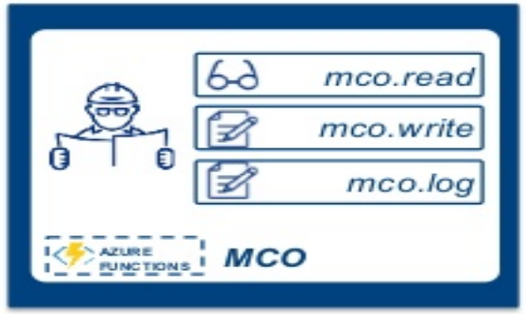
Enterprise Architecture – The Jupyter case

- How could I work together with other data scientists?
- How can I deal with computation spikes?
- How can I attach an Apache Spark cluster to my Jupyter?
- Damn, Java Heap Memory Exception: what do you mean?





One singleton *to rule them all*



mco
Pattern: Singleton
Use: bring tokens and technical access to notebook
Benefit:
- enhancing security
- enabling access control
- reducing vendor lock-in effect

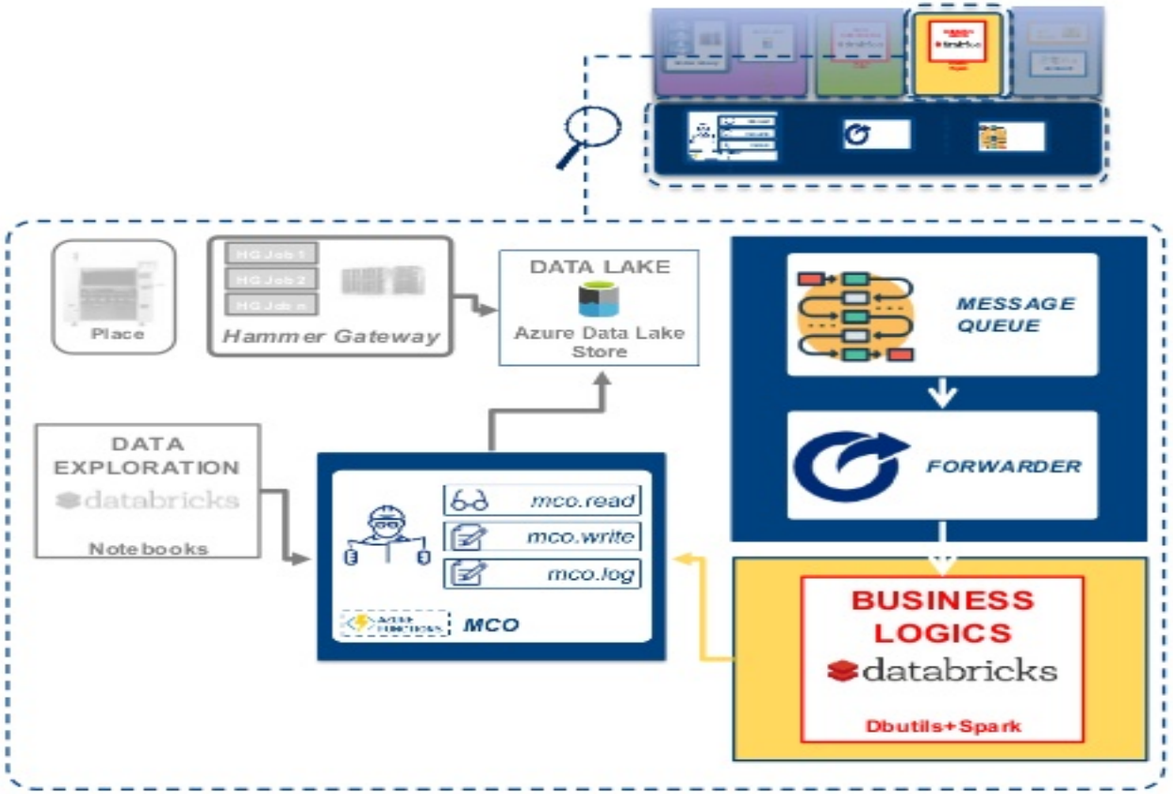
mco.read
Pattern: Wrapping
Use: take data from data lake knowing only data names
Benefit:
- no one will need to know where data are or how data are stored
- incremental read capability out-of-the-box
- reducing time to port code in production
- reduced reading time
- reduce the vendor lock-in effect (to propagate a new HDFS PAAS vendor on all services is a matter of hours)

mco.write
Pattern: Wrapping
Use: save data everywhere
Benefit:
- no one will need to know where data must be put or how
- avoid dangerous behavious such as writing on a SQL with a transformation action (connection pool, my beloved friend...)

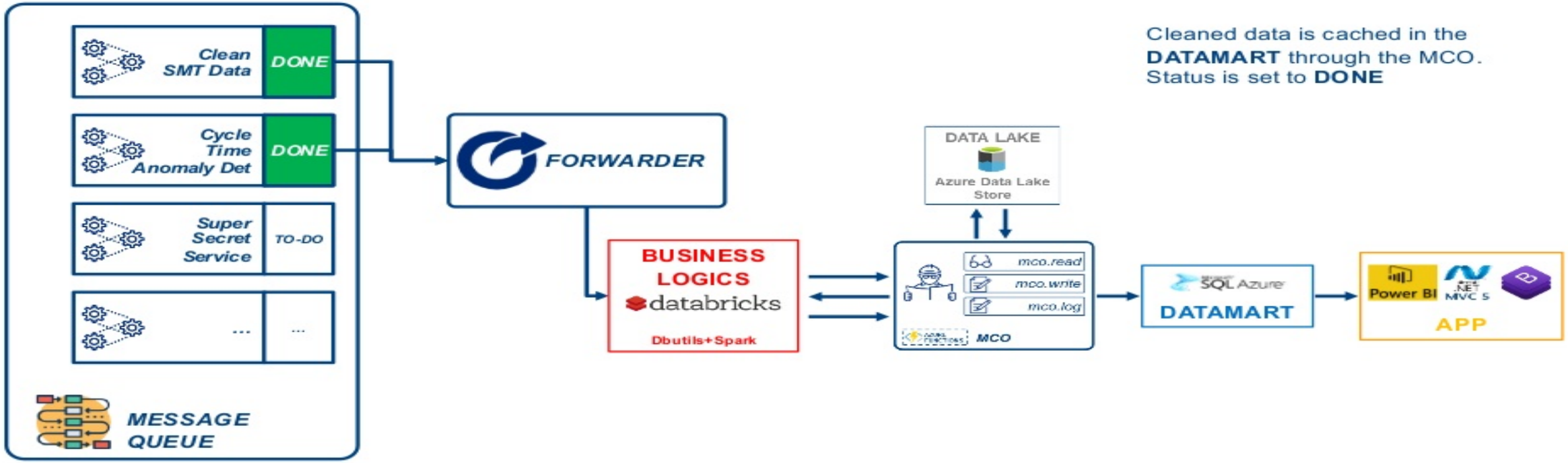
mco.log
Pattern: Wrapping
Use: bring developer grade logging capability
Benefit:
- reducing debug time
- enabling process audits

Enterprise Architecture – The model is ready!

- Is the code production ready?
- Who is going to port the notebook to production?
- Developer algorithm is wrong: it produces different numbers…
- Ok, I got it! I'll need a crontab… but where?



A For-what? *What the hell?*



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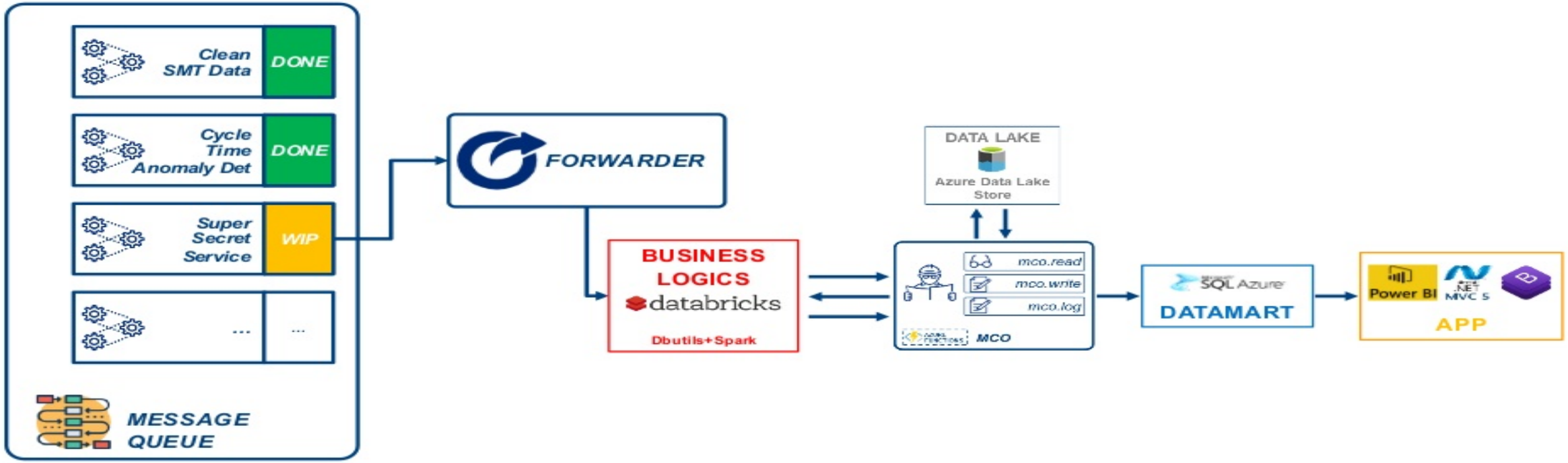

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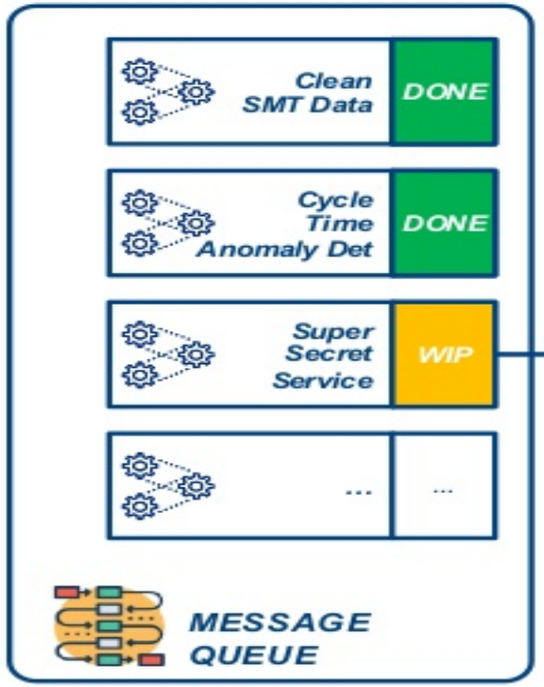
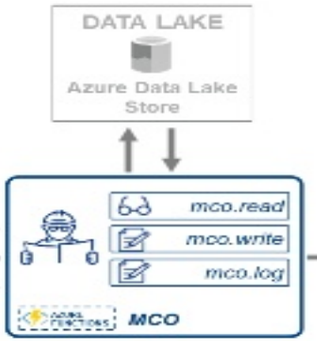


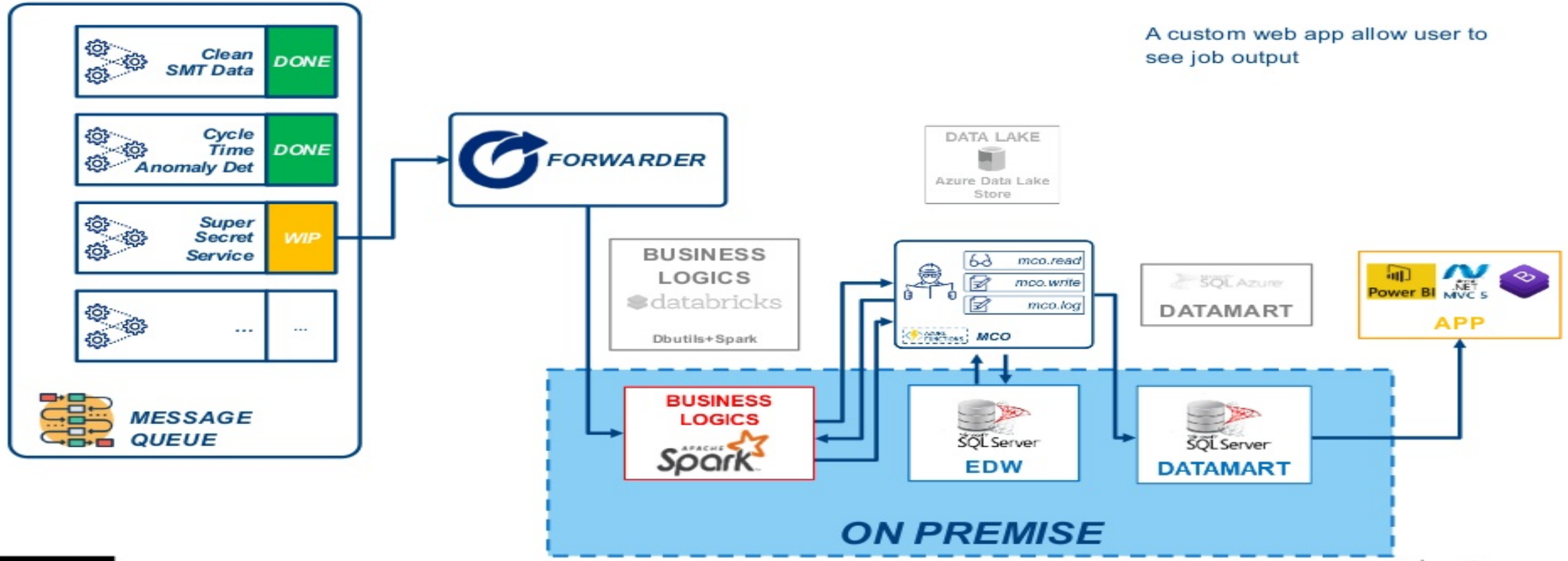


Data needed to run **Super Secret Service** cannot be moved outside Magneti Marelli servers

- What if some datasets could not be moved into the cloud?
- How to deal with *super secret* business logic?

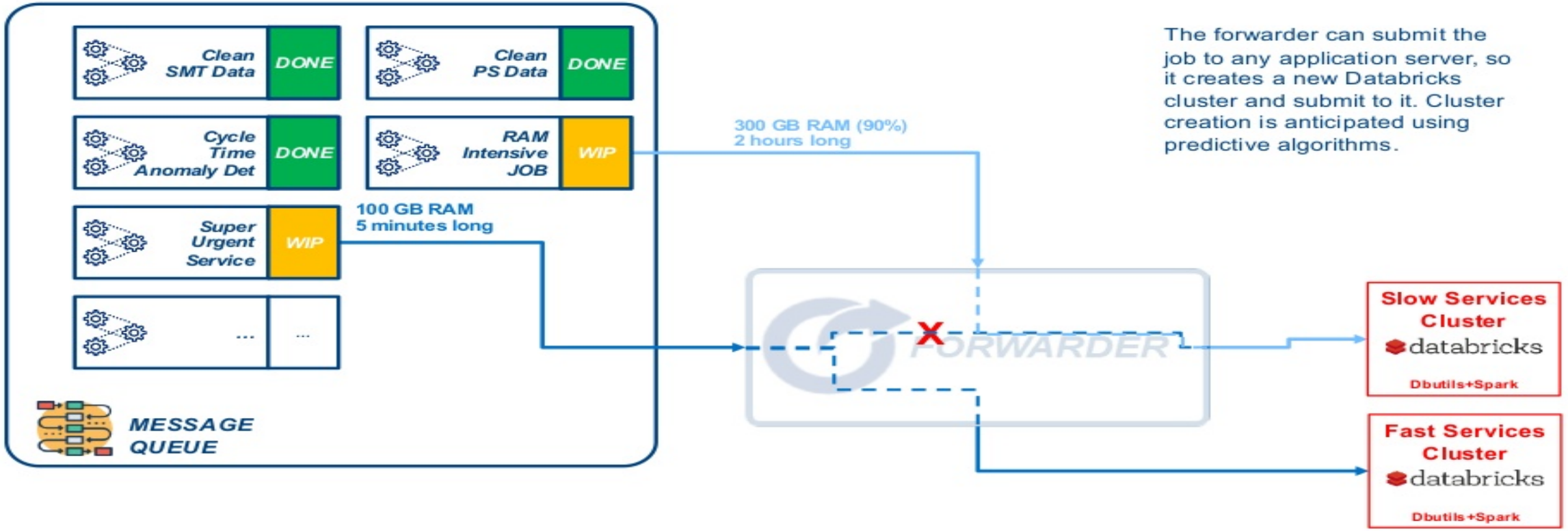
FORWARDER as the main component for cloud hybridization!

A For-what? *What the hell?*



A custom web app allow user to see job output

A For-what? *What the hell? – Predictive balancing*



The forwarder can submit the job to any application server, so it creates a new Databricks cluster and submit to it. Cluster creation is anticipated using predictive algorithms.

Enterprise Architecture – Don't mind about nerd stuff

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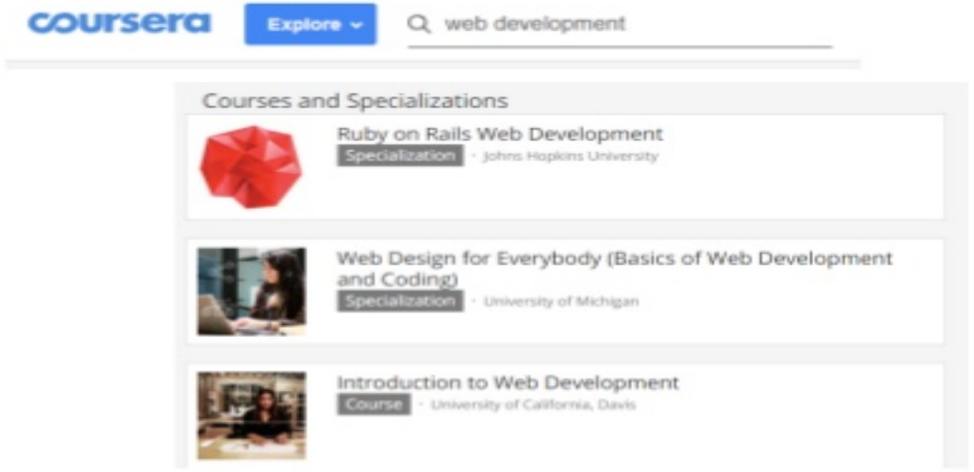
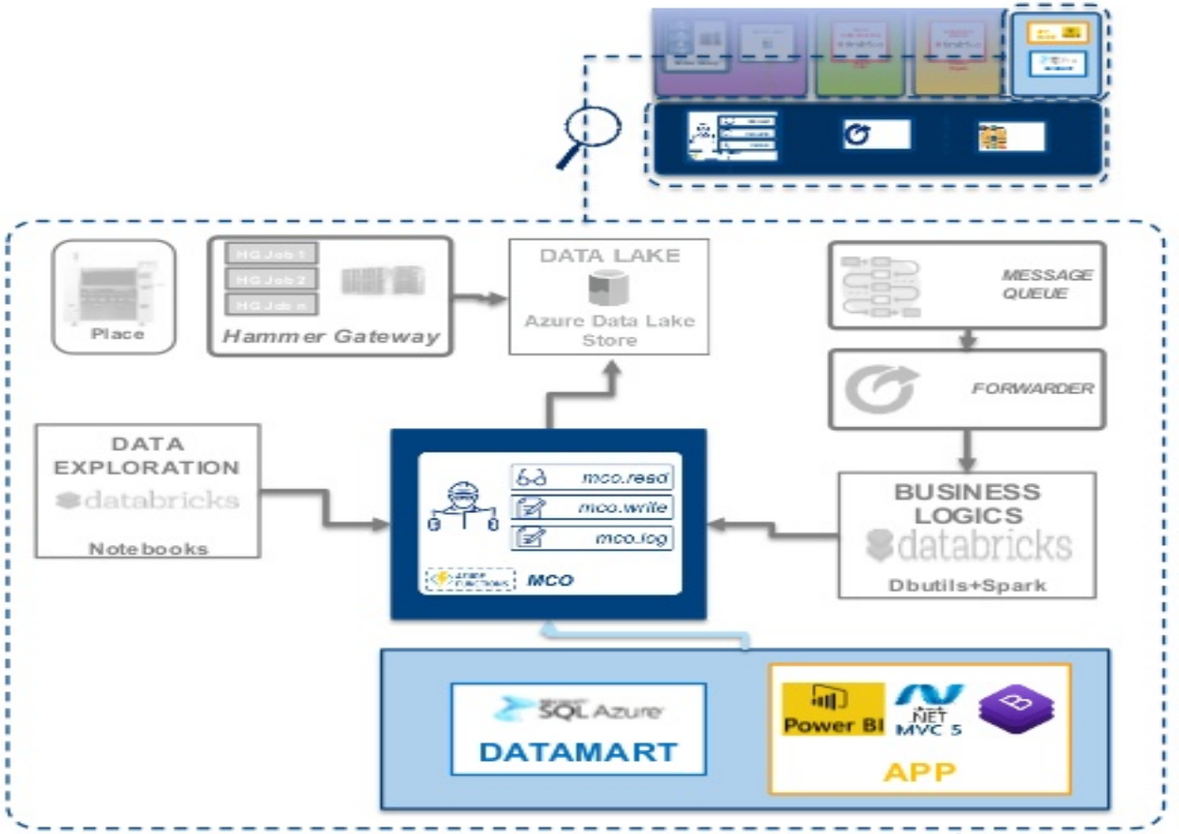
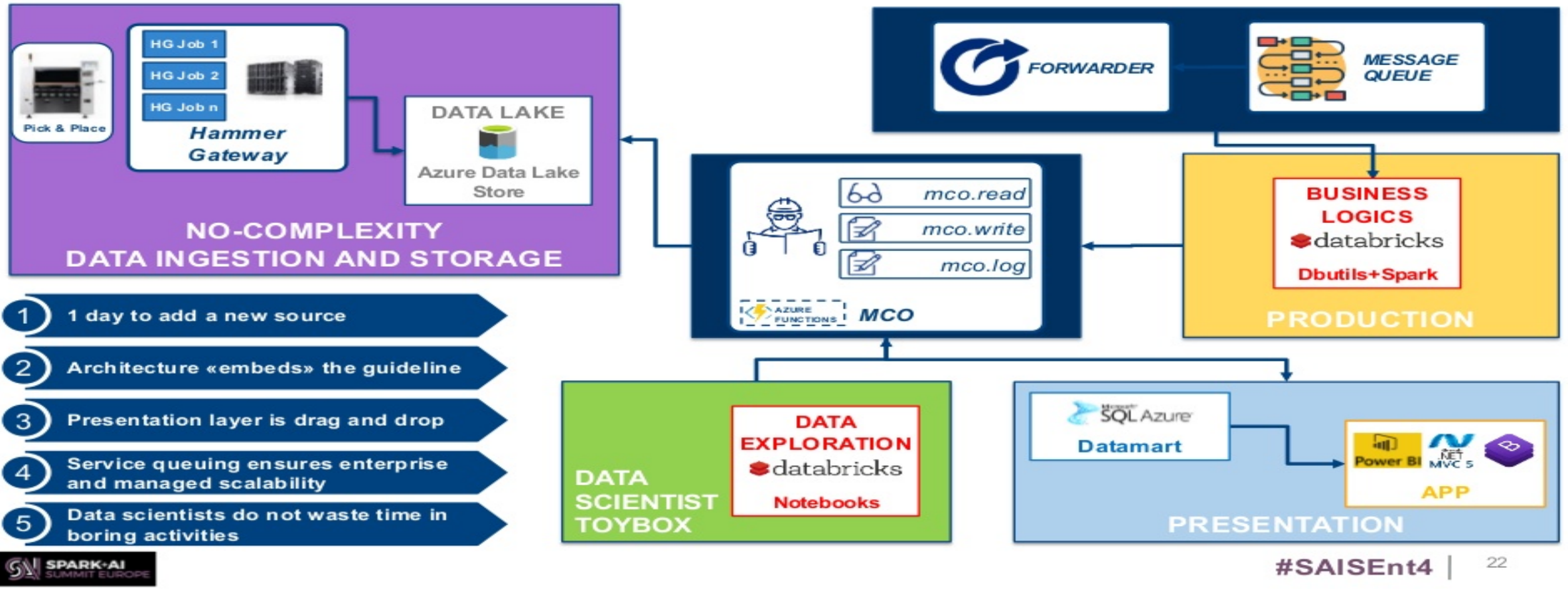
Data Scientists' presentation concerns:

- How do I write a web page?
- Do I need to bootstrap?
- MV-what? I thought Spring was just a season!
- Single sign-on? What do you mean?





Enterprise Architecture ("...and in the darkness bind them")



1. 1 day to add a new source
2. Architecture «embeds» the guideline
3. Presentation layer is drag and drop
4. Service queuing ensures enterprise and managed scalability
5. Data scientists do not waste time in boring activities

“I have done the deed. Did you hear a noise?”

1. Production process is well known
2. Data source is clearly defined
3. Need is raised by plant people
4. Algorithmic challenges are clear

“The Guide says there is an art to flying", said Ford, "or rather a knack. The knack lies in learning how to throw yourself at the ground and miss.”

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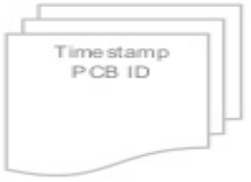

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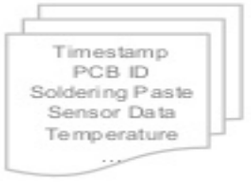

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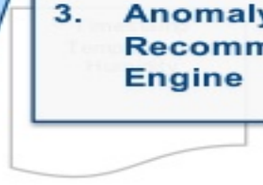
DB SQL



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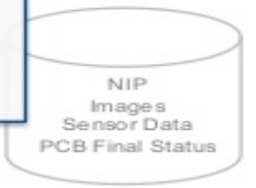
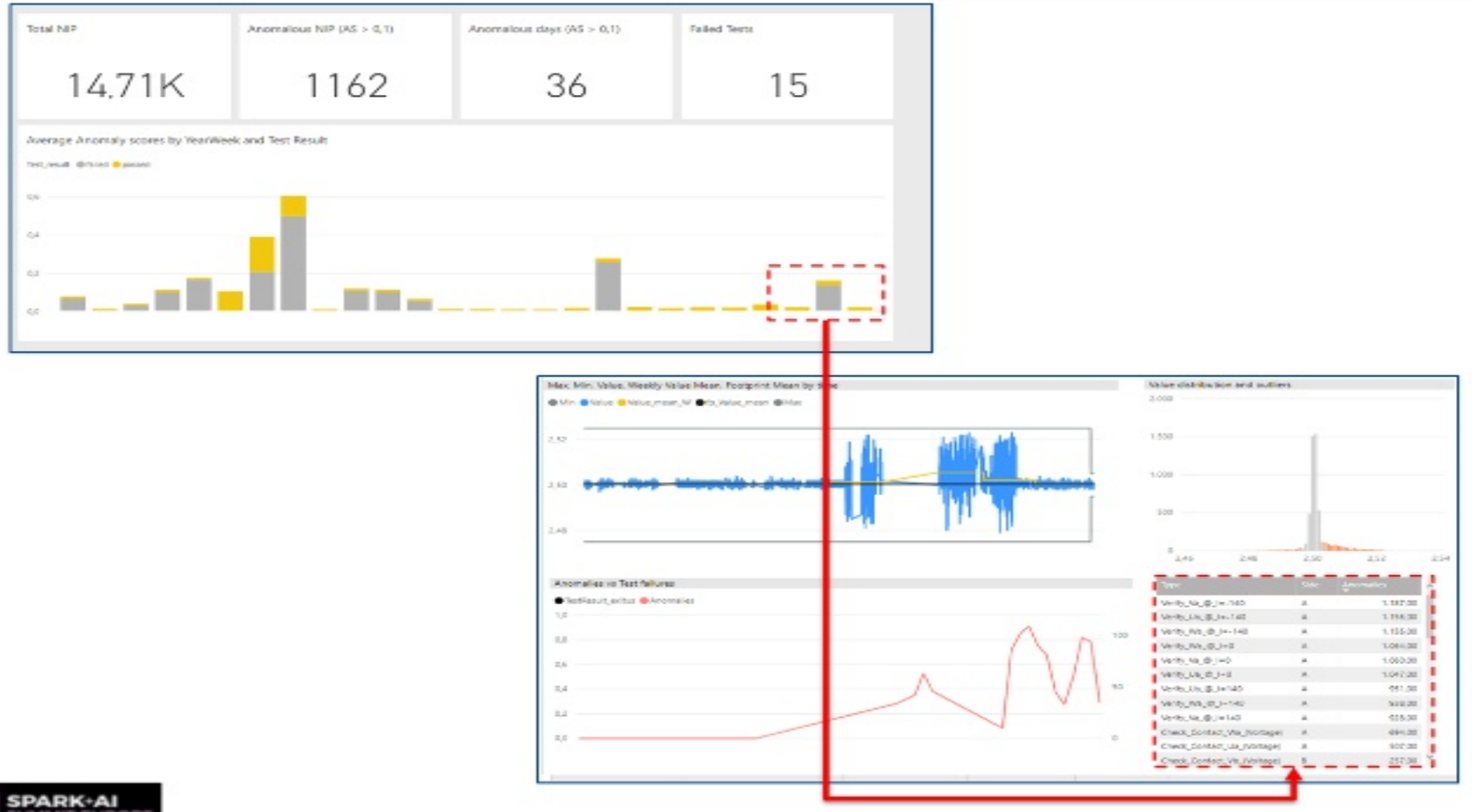


DB SQL

Anomaly Recommender Engine



Description

A **summary dashboard** shows the health of each part of the line. A drill down with details is available.

Use Case

Support maintenance team to **prioritize standard** and extraordinary maintenance activities.

Benefit

Reducing machine stoppage losses per year per line.
Down time reduction.

Much ado about nothing... ?

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Assembly Line

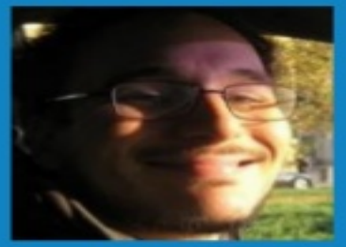
- Break-even point reached after 8 months
- Cost per line reduced by 90% after the first one
- Return On Investment: 12X in 3 years

- **Databricks** and Microsoft **PowerBI** allow a very cost effective first project
- **Hammer Gateway** allows cost effective **ingestion**
- **MCO** enabled Data Scientists to convert notebooks in services with a very very low effort
- **Microsoft Azure** and **Databricks** ensure *endless* scalability

People behind

THE TEAM

Florindo PALLADINO



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