# The road to the Enterprise AI/ML

Indaba X Morocco; 29 April 2019

Hicham Zmarrou, PhD

# Contents

# Machine Learning in Production

# GIT
# (GitHub; Bitbucket)

# Data Pipelines

# Model Management

# CI/CD pipelines
# Continuous Integration/Continuous Deployment

# DevOps

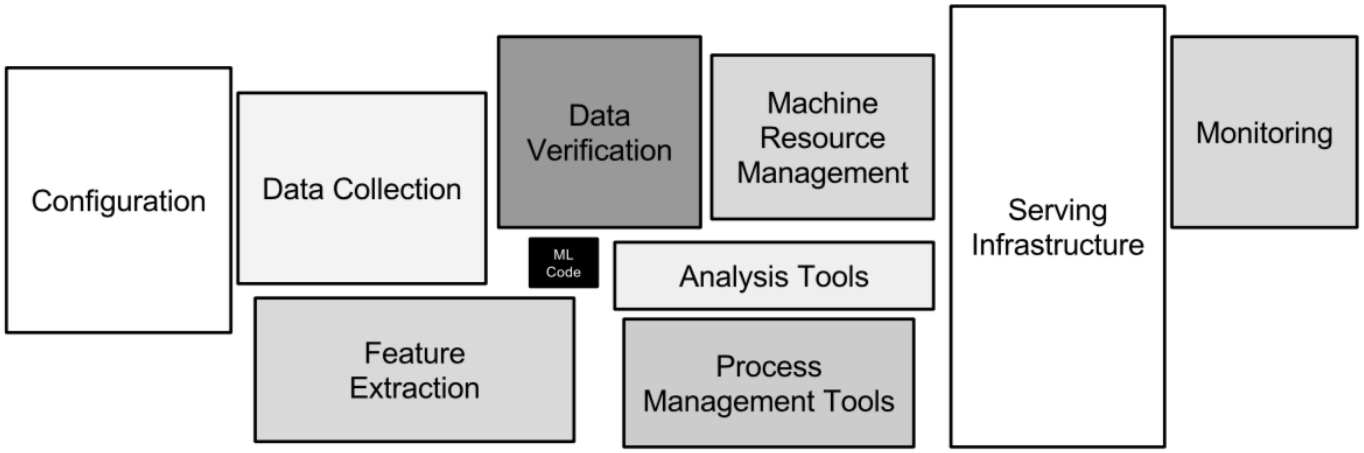



Figure 1: Only a small fraction of real-world ML systems is composed of the ML code, as shown by the small black box in the middle. The required surrounding infrastructure is vast and complex.

# The promise of AI

## Artificial Intelligence Is Transforming Oil Trade

By Irina Slav - Apr 14, 2019, 6:00 PM CDT


## Wie die Polizei mit Algorithmen experimentiert

spiegel.de - Von Sonja Peteranderl

Der Hype um Künstliche Intelligenz ist auch in der Polizeiarbeit groß: Viele Sicherheitsbehörden testen bereits Automatisierung und ...

## 人工智慧將取代部分人類工作，為什麼社會變得更「公平」？

2019/02/26 讚 91 分享

TO 創新瞎謅

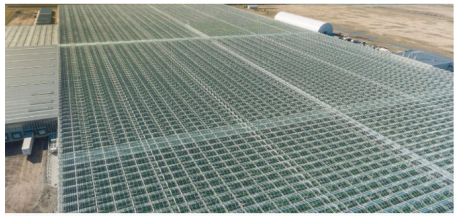
MACHINE LEARNING

## How Artificial Intelligence Is Changing Science

By DAN FALK

March 11, 2019

*The latest AI algorithms are probing the evolution of galaxies, calculating quantum wave functions, discovering new chemical compounds and more. Is there anything that scientists do that can't be automated?*



2018. 08. 10. #TECH

## Intel: mesterséges intelligenciával optimalizált mezőgazdaság

## Cómo los Robots y la Inteligencia Artificial están transformando la industria alimentaria

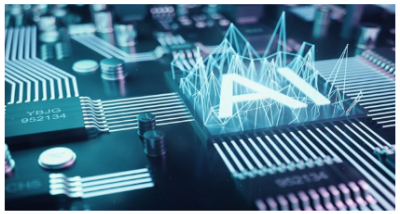
DellEMC Spain
13 julio 2018

الذكاء الاصطناعي

## كيف يمكن للذكاء الاصطناعي أن يساعد الجواسيس

عندما تلعب خوارزمية دور المحلل الاستخباراتي

## Cómo la inteligencia artificial está transformando el ecosistema financiero



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Kennisbank

## Hoe kunstmatige intelligentie het werk van recruiters drastisch gaat veranderen

Door Erwin Hokken - 1 augustus 2018 1.344 keer gelezen

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Un bouleversement. L'intelligence artificielle, ou IA, est en train de changer le monde. Microsoft experiences'17 l'a parfaitement illustré : 2 jours de conférences et

## Как искусственный интеллект меняет современное телевидение и киноиндустрию

## Future Now: How AI Is Already Changing the Global and Military Landscape

Cyber Security - 06.02.2018

# But what is the current state of AI

TECH | ARTIFICIAL INTELLIGENCE 11

## Forty percent of 'AI startups' in Europe don't actually use AI, claims report

*Companies want to take advantage of the AI hype*

By James Vincent | Mar 5, 2019, 8:14am EST

SHARE


Arlington, VA, December 5, 2018

## Gartner Survey Shows 27 Percent of Finance Departments Expect to Deploy Artificial Intelligence by 2020

Half of Respondents Also Expect to Deploy Predictive Analytics

A majority of finance departments expect to deploy one of several top emerging technologies by 2020, according to a worldwide survey of more than 400 organizations by Gartner, Inc.

"More than a quarter of organizations surveyed expect to deploy some form of artificial intelligence (AI) or machine learning in their finance department by 2020," said Christopher Iervolino, senior director analyst at Gartner. "Moreover, half the respondents expect to deploy predictive analytics in the same period."

STAMFORD, Conn., January 21, 2019

## Gartner Survey Shows 37 Percent of Organizations Have Implemented AI in Some Form

Despite Talent Shortages, the Percentage of Enterprises Employing AI Grew 270 Percent Over the Past Four Years

The number of enterprises implementing artificial intelligence (AI) grew 270 percent in the past four years and tripled in the past year, according to the Gartner, Inc. 2019 CIO Survey. Results showed that organizations across all industries use AI in a variety of applications, but struggle with acute talent shortages.

"Four years ago, AI implementation was rare, only 10 percent of survey respondents reported that their enterprises had deployed AI or would do so shortly. For 2019, that number has leapt to 37 percent — a 270 percent increase in four years," said Chris Howard, distinguished

Harvard Business Review

EXPERIMENTATION

## The First Wave of Corporate AI Is Doomed to Fail

by Kartik Hosanagar and Apoorv Saxena

APRIL 18, 2017

## Most AI Projects Fail. Here's How To Make Yours Successful

2018 JULY 25

by Greg Satell

*tags:* Artificial Intelligence, Digital Transformation

# Why do AI initiatives fail?

Not well understood

## Not well understood

- AI is still generally not well understood except by a relatively small number of people
- Few executives and managers truly understand what AI really is, the current state of AI and it capabilities and the value it represents.

Capabilities

## Lack of capabilities

- Lack of clear strategy
- Lack of talent with appropriate skill sets
- Lack of good quality data
- Lack of technological infrastructure

Data-driven leadership

## Lack of data driven leadership

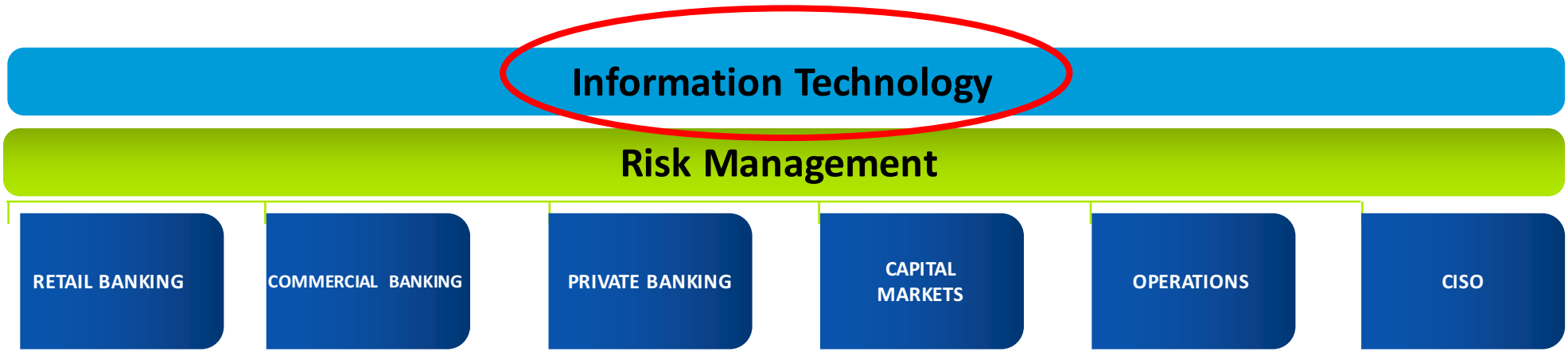
- Data-Driven Leaders build data culture.
- Data-Driven Leaders incorporate data into all positions
- Data-Driven Leaders communicate between data scientists and management

Agile

## Pursuing in non agile way

- Many organisations stick to standard systems development lifecycle (SDLC)
- Not appropriately respecting the exploratory and experimental nature of AI

# Organization



# Some Initiatives in ABA-AMRO to make AI succeed

80% of analyst's time is spent simply discovering and preparing data.

HARVARD BUSINESS REVIEW

Data is a precious thing and will last longer than the systems themselves.

TIM BERNERS-LEE,
FATHER OF THE WORLDWIDE WEB

**Improving Data Quality**

- Coherent approach to improve the data quality at the source is required
- Improved Reference and Master Data management
- Certain foundational capabilities like Enterprise Party Reference are key to enable better data quality

**Ensuring Data Governance**

- Continue the implementation of List of Golden Sources across the organisation
- Establish clear data owners for the identified sources
- Data dictionary is key to understand meaning of data supported by information modelling
- Support businesses to build the data strategy based on the business strategy

**Enabling Advanced Analytics/AI**

- Raising Awareness
- Building Capabilities
- Execute Uses Cases /Lighthouse projects

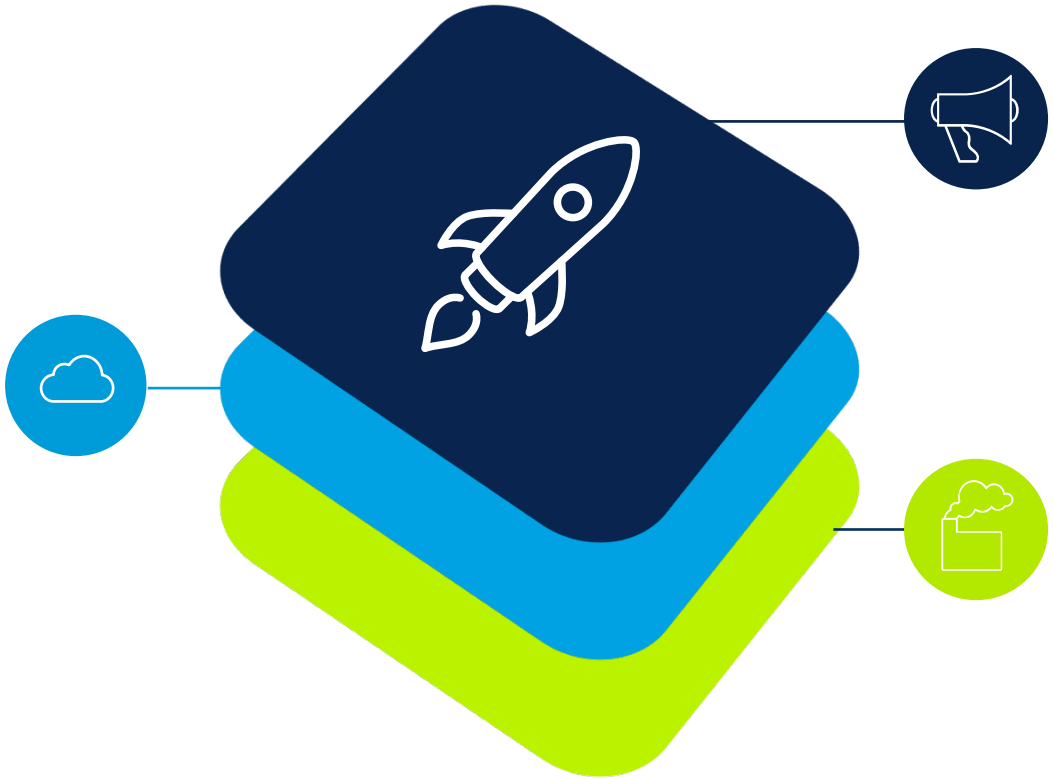
# A use case driven approach combined with capability building and a data centric culture is key

## Culture and awareness

- Establish a data centric culture
- Enhance data-savviness of employees and leadership
- Think like “reCAPTCHA”, create or buy new products to collect data
- Use external data

## Capabilities

- Scale-up analytical software and hardware, including cloud
- Attract talent and build communities
- Progress on delivery by creating grids for Data & Analytics

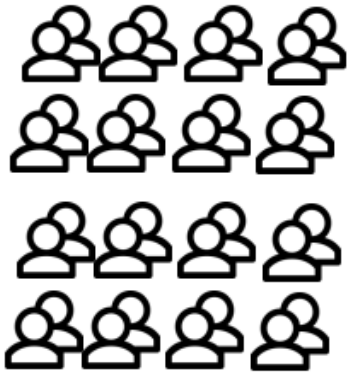


## Use cases/ Lighthouse projects

- Operationalise use cases beyond the stage of experiments
- Achieve synergy within the organisation based similar characteristics of use cases
- Capabilities built based on use cases which deliver value

# Culture and awareness

## Democratizes data-driven decision making with Data Academy



Empower every employee at ABN AMRO

To make data-informed decisions ...

By providing data education ...

That scale by role and team ...

# Culture and awareness

Data Academy Curriculum  Overview

## High-Level: Offensive strategy for Management Teams and Executive Committee

- Key financial services opportunities enabled by AI (examples in Deposits and Lending; Insurance; Payments; Investment Management ; Capital Markets; Market Infrastructure; etc)

## 100 –Level: Data Awareness

- Data management principles (MDM); data quality improvement; data informed decision making; intro to stats and data resources

## 200 –Level: ML/AI for developers

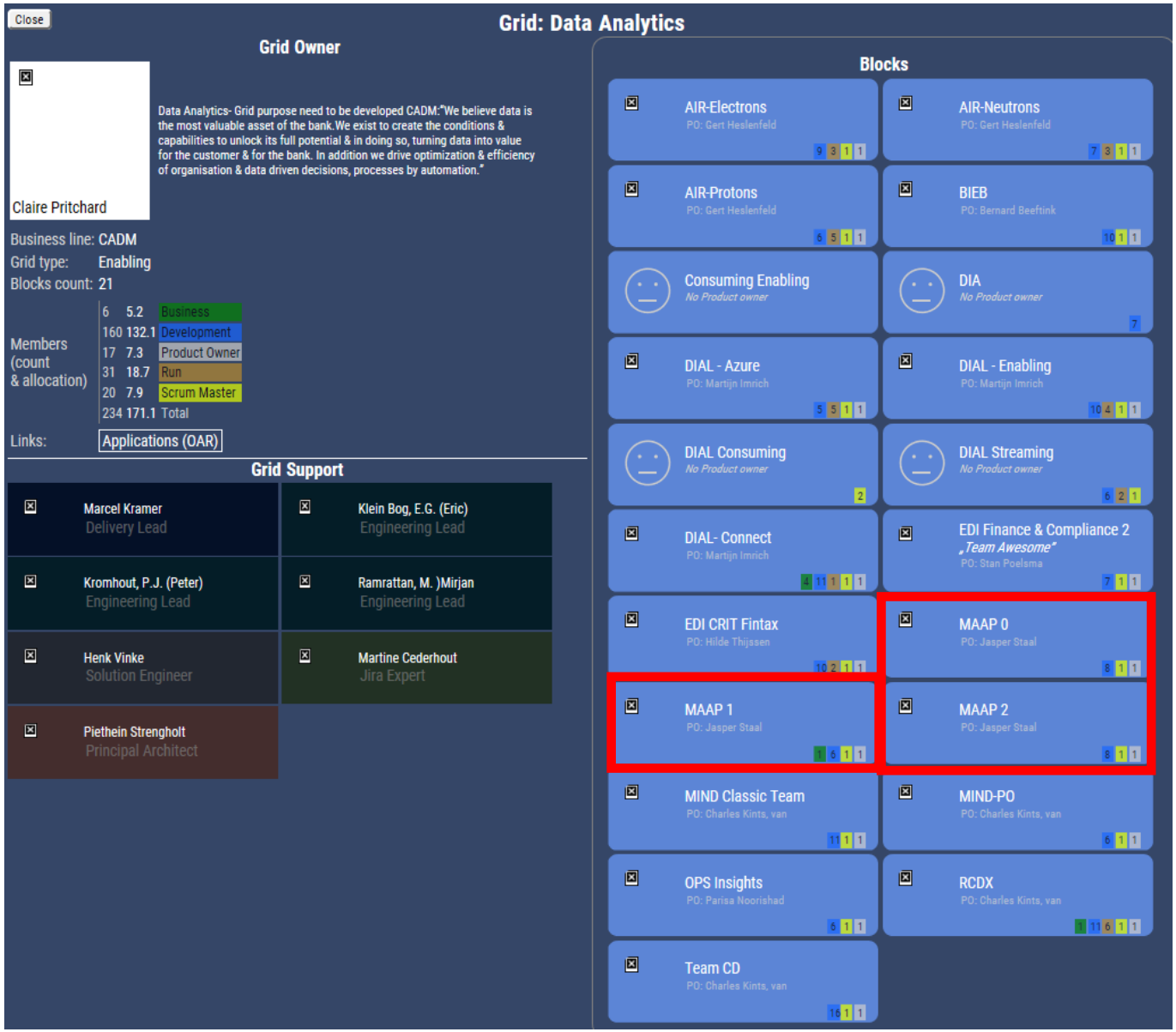
- Difference between traditional programing and ML; How ML works (Cost function optimization , Gradient descent, transfer learning), Training vs Inference; Testing with data; DTAP vs DAP

## 300 –Level: ML/AI at scale

- Cloud services (Data Lake; DWH; noSQL DB); Hadoop; databricks (spark); Containers; Microservices; Version control; CI/CD pipelines; Model management; Python, ect.

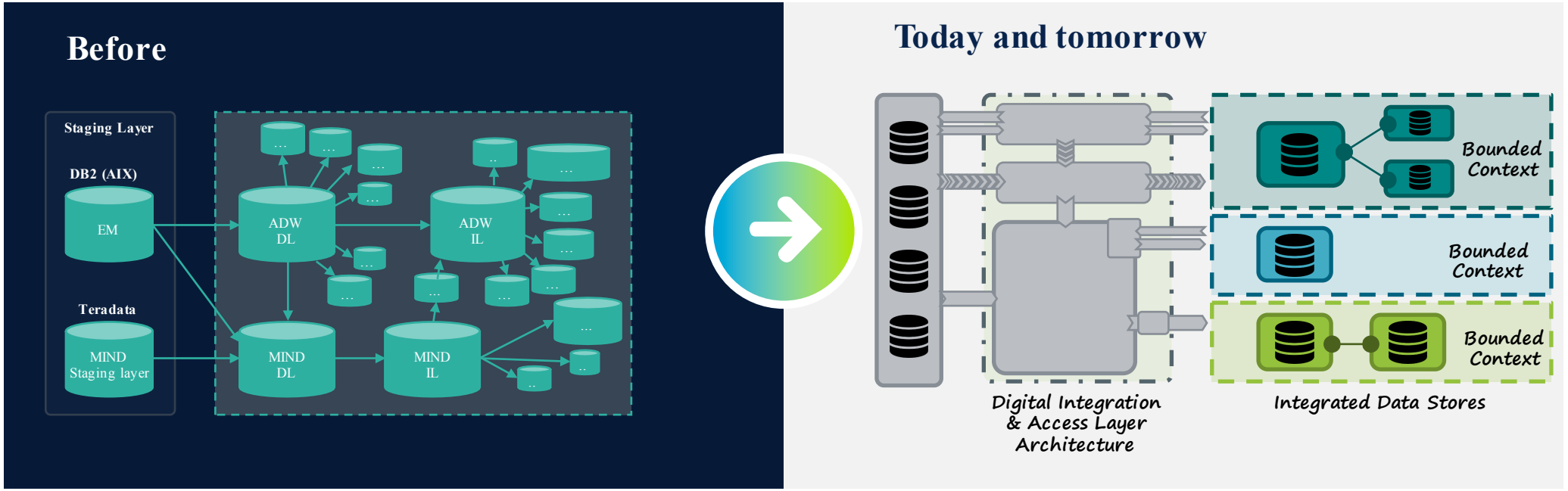
# Capabilities

## Creation of a dedicated grid for enabling data & analytics



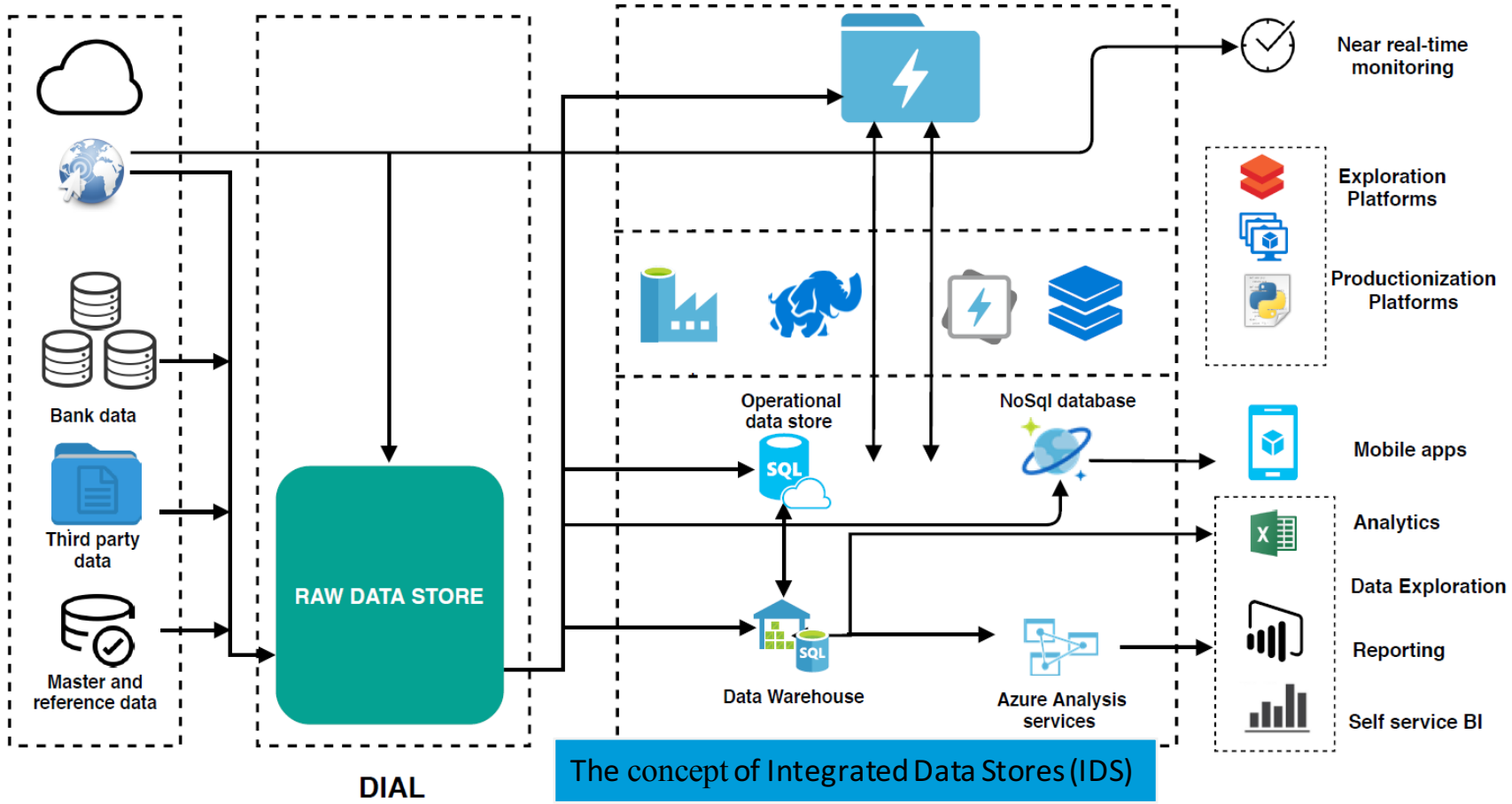
# Capabilities

## Digital Integration Access layer: the data lake



# Capabilities

## Modern data warehousing: The concept of Integrated Data Stores (IDS)




The concept of Integrated Data Stores (IDS)

# Capabilities

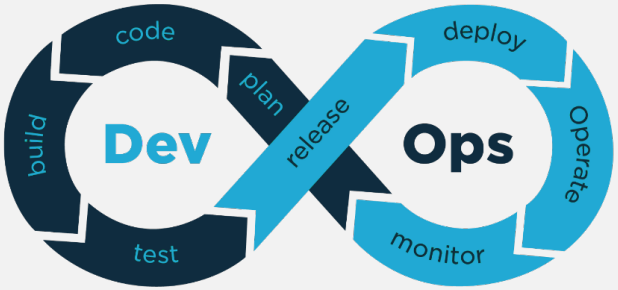
## IT decentralization

**Today**

Centralized IT organization
ML models build in the business department; run and monitor within the IT department

☹️

**Today and tomorrow**



# Capabilities

## Human resources

Recruit

- Big data integration; security and cloud architects ;
- Big data engineers;
- Lead data scientists;
- Change managers etc

# Use cases

## Lighthouse projects

- Lighthouse projects are projects with a high degree of innovation that run largescale data-driven demonstrations whose main objectives are to create impact and to promote visibility and awareness, leading to a faster uptake of ML/AI applications and solutions.
- They are the major mechanism to demonstrate ML/AI ecosystems and sustainable data marketplaces, and thus promote increased competitiveness of established services as well as the creation of new services for the bank's customers.
- Furthermore, they propose replicable solutions by using the scalable cloud technologies that show evidence of data value and could be integrated in an innovative way.
- Examples: Anti Money Laundering, Fighting human trafficking with financial traces, New Client Take On risk assessment, Instant payment

# Use cases

## Instant payment model

Already possible to transfer money real-time between two accounts of the same bank.

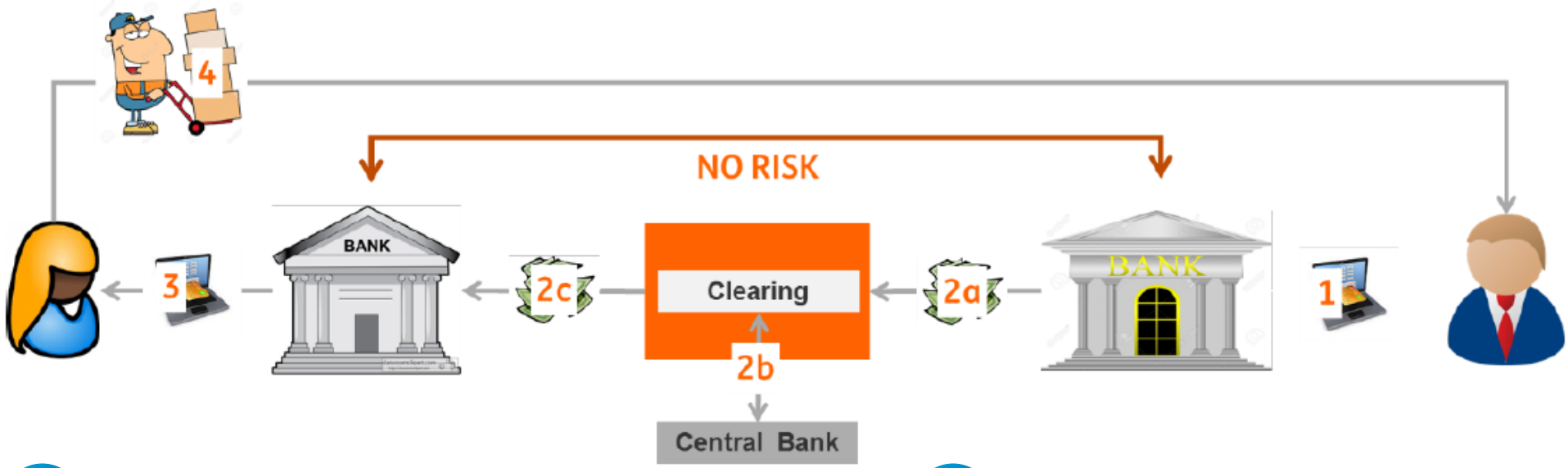
This real-time experience will now also become normal for transfers between accounts of different banks


The credit transfer, Instant Payment, is processed within 5 seconds and the funds are directly available for re-use by the recipient, also when bank accounts are held at different banks.


Instant Payments can be made at any time of the day, every day of the year. Also during weekends, on public holidays or even at night

Instant Payments is based on a European standard making transactions between Dutch and European banks possible.

# Traditional Payment.




**01** Person 1 buys goods from someone else and initiates a credit transfer

**2a** The payment order is received by the bank of the buyer and will be routed to the bank of the beneficiary (payee). A SEPA compliant clearing mechanism is used.

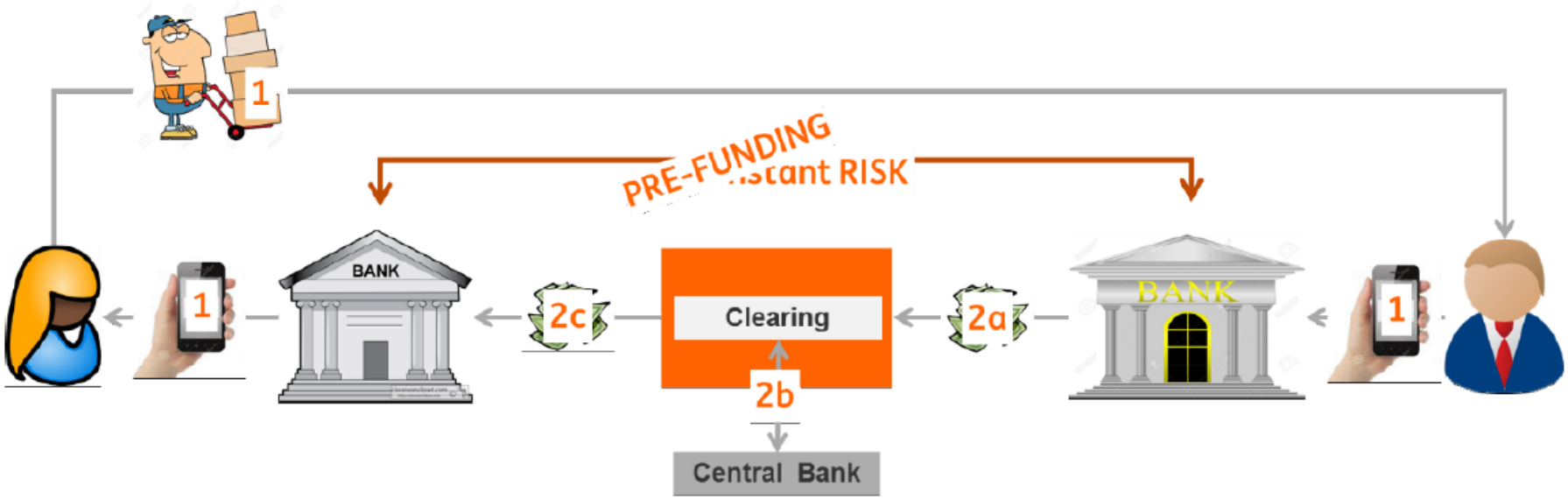
**2b** The exchange funds between the banks at central bank level is completed before the payment order 2c

**2c** The bank of the beneficiary receive a payment order to credit the beneficiary

**3** Payee receives the payment

**4** The beneficiary delivers the goods

# Instant Payment




**01** Person 1 buys goods from someone else and initiates a credit transfer

**01** The Payee receives the payment

**01** The beneficiary delivers the goods

**2a** The payment order is received by the bank of the buyer and will be routed to the clearing

**2b** The exchange funds between the banks at central bank level is completed

**2c** The bank of the beneficiary receive the money

# Instant Payment: How much PRE-FUNDING

We need to maintain sufficient balance to facilitate the instant payments in the account of clearing agency by paying some commission, which in turn adds cost overhead to ABN and also limits the bank to invest this money in other channels

Accurate prediction on the account flow which can help bank to minimize the balance that we need to maintain with clearing agency

# Model walkthrough

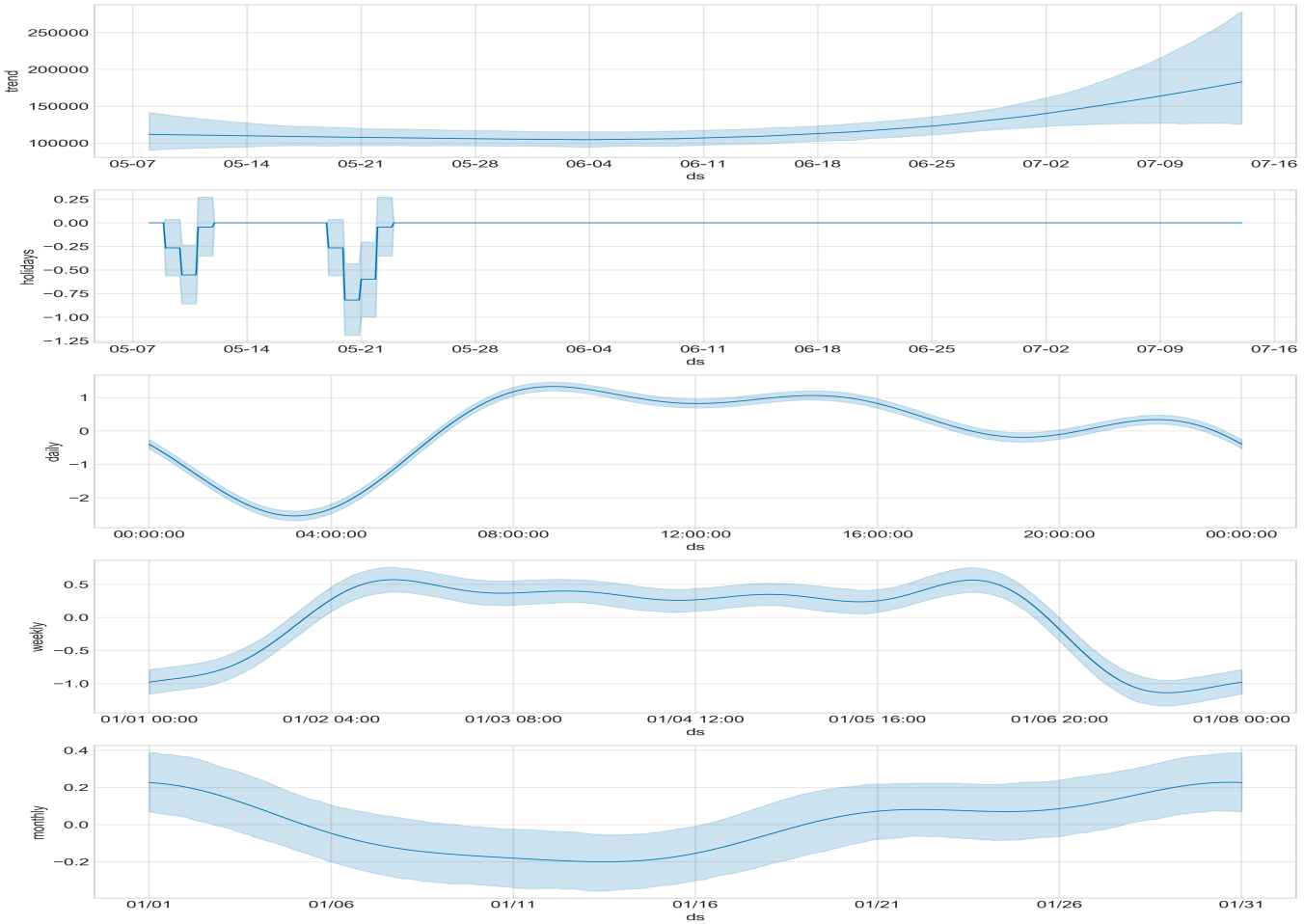
- Consider traffic going from ABNAMRO to other banks (the other direction is the next update)
- An Instant Payment transaction is limited to 15k Euros
- Only consider mobile and internet transactions
- Historic data contains all banks, we use reach-files to select transactions only to “Instant reachable” banks are selected
- Forecasts are based on past one year of data (few historical data in DIAL)
- To simplify transaction patterns, aggregate in blocks of 3 hours: For each target bank, transaction type and time-bin, we add up all transactions.

# Model walkthrough

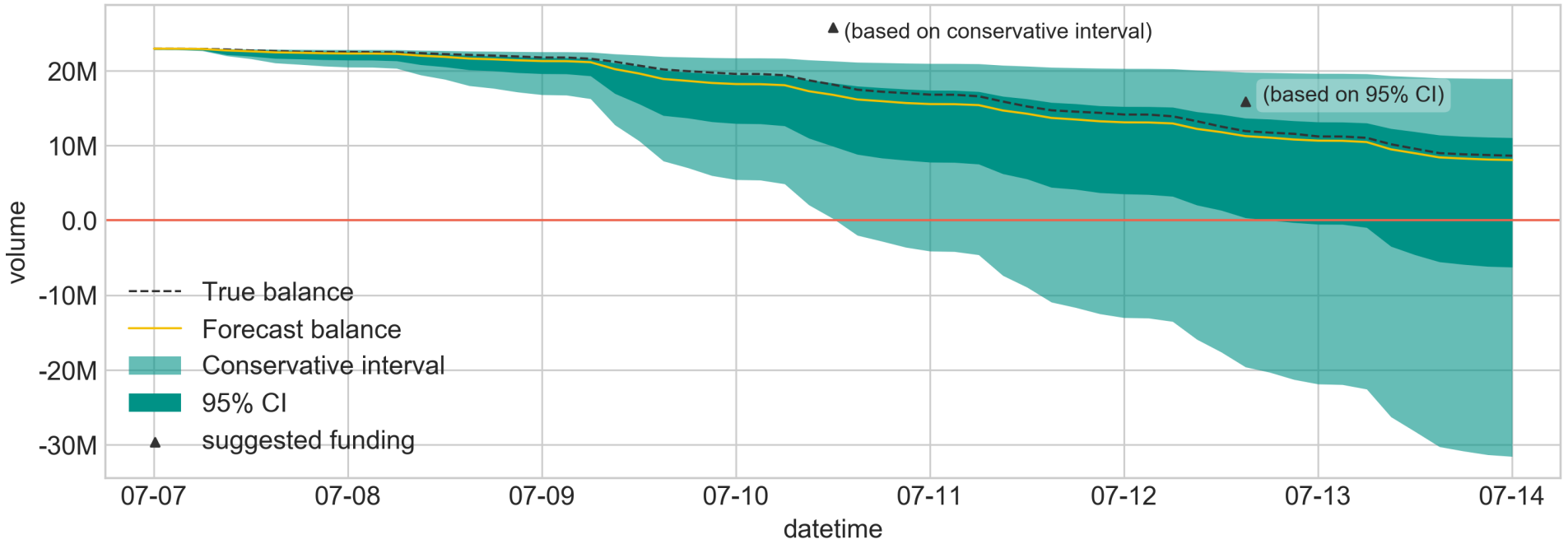
The forecasting algorithm is based on Facebook's Prophet python package, used within Facebook for many times series forecasting purposes

- Prophet automatically detects changes in trends by selecting change points from the data
- Prophet detects seasonal component using Fourier series decomposition of the time series.
- Prophet detects weekly seasonal component using dummy variables.
- The user may provide a list of important holidays (Sinterklaas, kerstmis, etc).

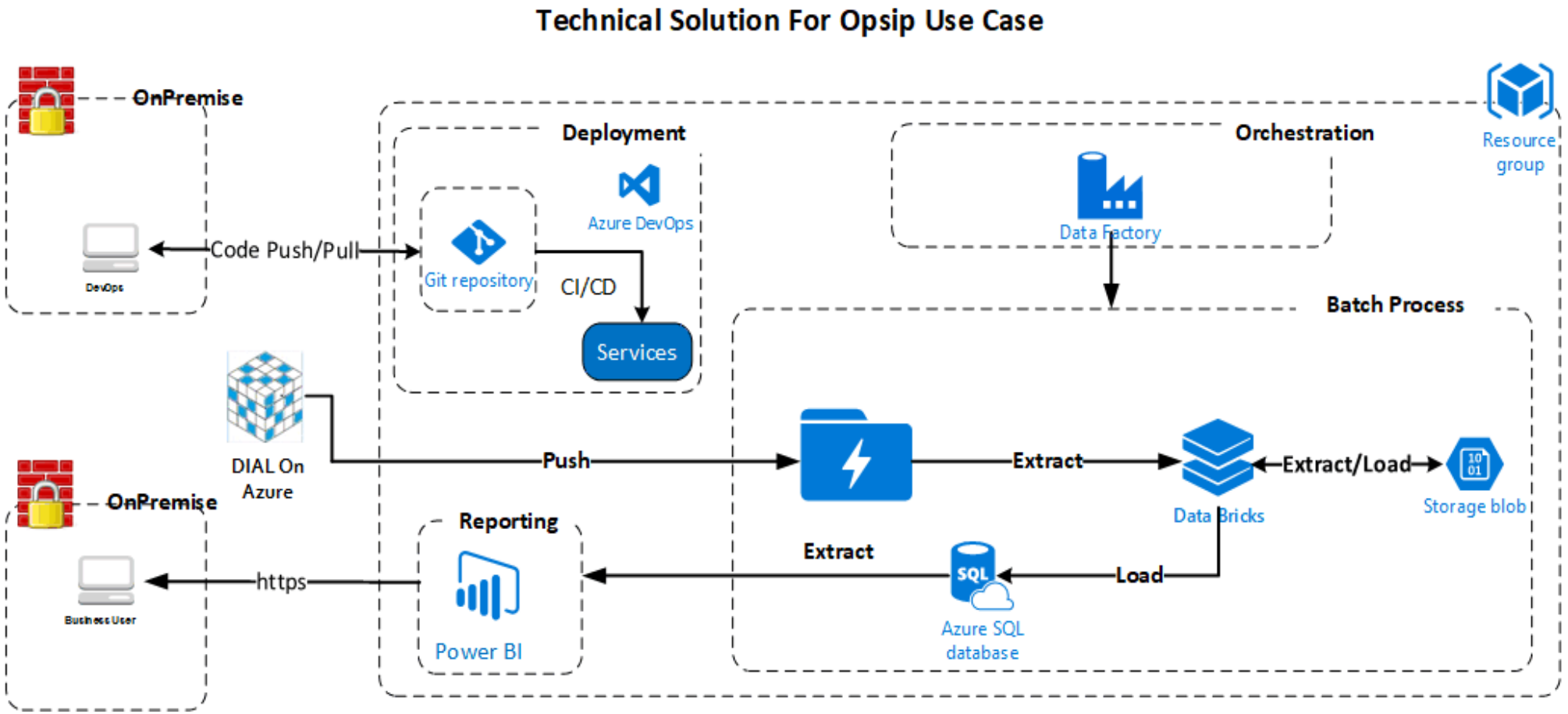
# Model walkthrough



# Model Account balance forecast



# Solution architecture

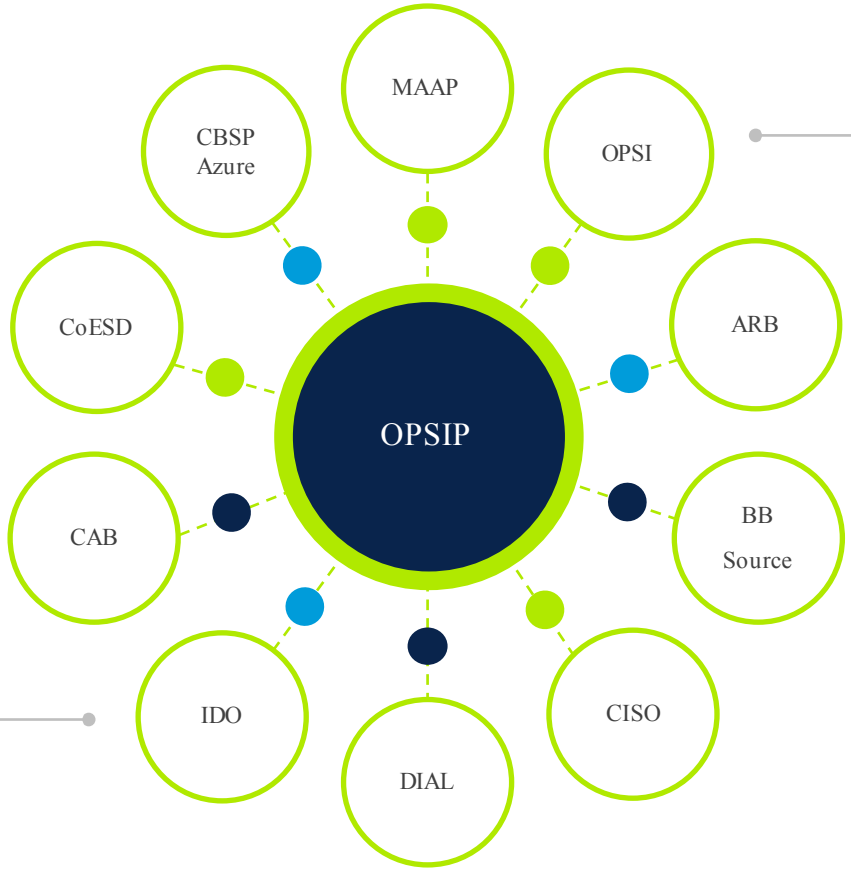


# Business value

~= 1-5M EUR/Year

Solution Maintenance Cost ~= 2K EUR/Year

# Stakeholder/Collaboration




Operations DevOps team.

Data science/expert team operations

# Lessons learned

- Enterprise Machine Learning is top team sport
- Enterprise Machine Learning needs data driven leadership
- Enterprise Machine Learning drives business decisions and creates value
- ABN-AMRO is on the right track to become a data driven bank

“In God we trust, all others must bring data”

Never said by W. Edwards Deming, though he would have appreciated it.