

PI AF architecture as backbone of digital transformation & advanced analytics developments in MOL Downstream

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The MOL Group at a Glance

- ▶ MOL GROUP IS AN INTEGRATED, INTERNATIONAL OIL AND GAS COMPANY, HEADQUARTERED IN BUDAPEST, HUNGARY
 - ▶ ACTIVE IN OVER 30 COUNTRIES
 - ▶ INTERNATIONAL WORKFORCE OF OVER 25,000 PEOPLE
 - ▶ TRACK RECORD OF MORE THAN 100 YEARS IN THE INDUSTRY
- ▶ 4 REFINERIES, 2 PETROCHEM PLANTS
 - ▶ LOGISTICS INCLUDING 2,000 RETAIL STATIONS



MOL Process Information & Automation

- Closing the gap between process control and business
- Project and CR management
- Overall monitoring of refinery operation
- In-house developed PI solutions

- Team of 18 Process Information & Automation Engineers (APC/RTO/OTS & PI Systems)
- Report to Technology manager & group level
- IT in a supportive role...minimally involved – Operating Systems and SQL Servers

ADVANCED PROFITABILITY APPLICATIONS

- ADVANCED PROCESS CONTROL
- INFERENTIAL MAINTENANCE
- KPI BREAKDOWN
- SOLOMON CALCULATION
- ENERGY MONITORING
- NAPHTHA POOL OPTIMIZATION

REFINERY INFORMATION SYSTEMS

- NICE (NATURAL INFO CENTRE)
- PLANT INFORMATION (PI)
- SEMAFOR (KPI SYSTEM)
- SHAREPOINT DEVELOPMENTS
- SIGMAFINE (MATERIAL BALANCE)
- OPRALOG (E-LOGBOOK)

ADVANCED SAFETY & RELIABILITY APPLICATIONS

- ALARM MANAGEMENT
- INDUSTRIAL NETWORK
- HUMAN MACHINE INTERFACE
- OPERATOR TRAINING SIMULATOR
- CONTROL PERFORMANCE MONITOR

PI SYSTEM OVERVIEW

▶ 4 HA COLLECTIVES, ~400K TAGS

▶ USED BY MOL, MPC, LOGISTIC

▶ ELEMENTS:

▶ 350 ELEMENT TEMPLATES

▶ 23K ELEMENTS & GROWING (65X SCALE)

▶ EVENTS:

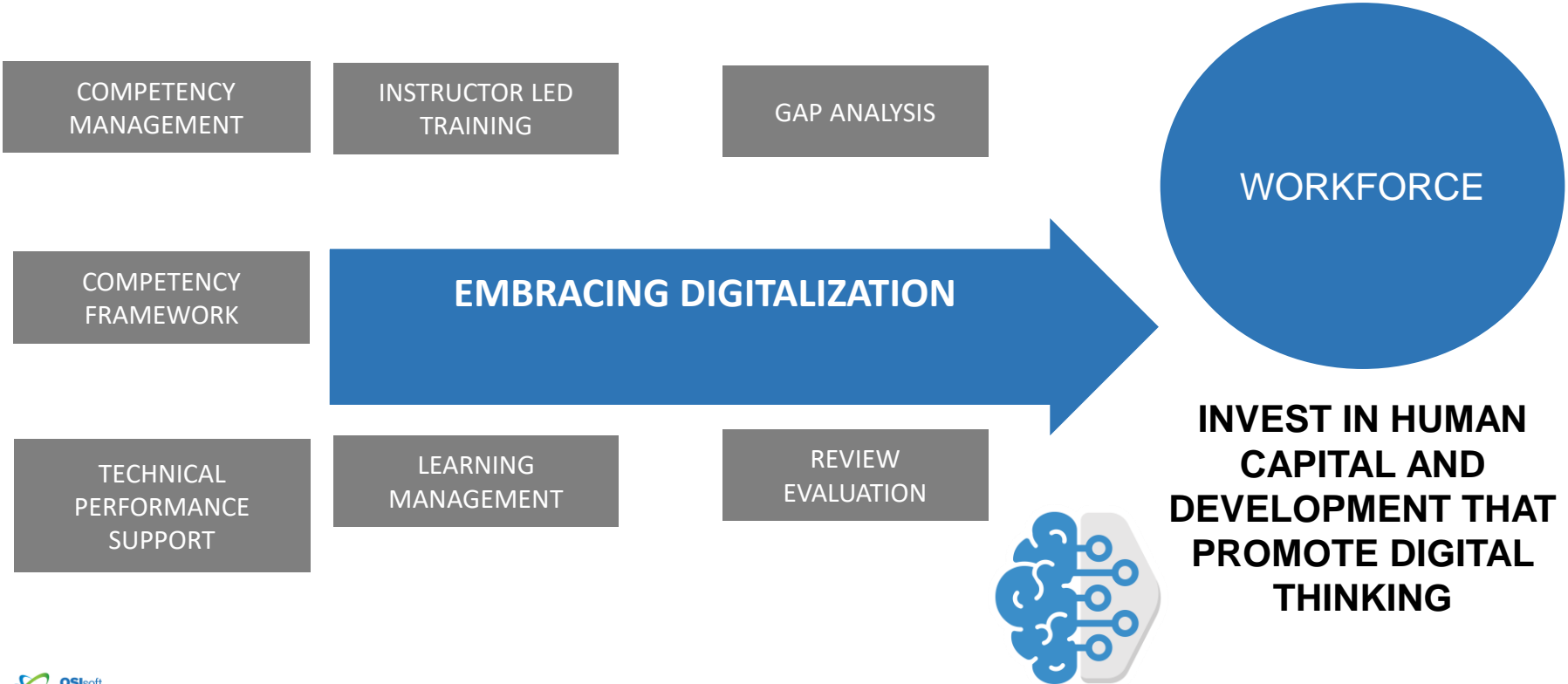
▶ 6K NOTIFICATIONS

▶ 10K EVENT FRAMES ANALYSES

▶ 50K EVENT FRAMES (EXCEPTION BASED OPERATIONS)

The screenshot displays the PI Vision interface, which is a comprehensive monitoring and control system. The top navigation bar includes the 'PI Vision' logo, a user profile icon, and the current date and time: '2019.07.16. 12:53:00'. The main area is a grid of 40 individual monitoring displays, each representing a different process or equipment. These displays are organized into four main categories on the left: 'DR Displays', 'DR Energy', 'DR PSM', and 'Folyamat Szabályozás'. Each display shows various data visualizations such as charts, gauges, and tables. On the right side of the dashboard, there are four vertical panels for system administration and maintenance, including 'Rendszerkezelés System Admin', 'Veszteség kezelés Loss treatment', 'Egyéb ábrák Other Displays', and 'Karbantartás Maintenance'. The interface is clean and professional, with a dark header and a light background for the displays.

INCREASING PROFICIENCY AND PRODUCTIVITY THROUGH DIGITALIZATION



PI SYSTEM DEVELOPMENT & PI VISION DISPLAYS

PI SYSTEM

- ORION TO PI INTERFACE
- NICE TO PI INTERFACE
- NOTIFICATION WEBSERVICE UPGRADE

PROCESS INFORMATION SYSTEMS

- UNIT BLOCK DASHBOARDS
- GROUP WHITE PRODUCT YIELD
- REFINERY N2 MONITOR
- PLAN FACT REPORT

ENERGY MANAGEMENT

- ENERGY KPI SYSTEM
- ENERGY MONITORING SYSTEM
- EFFICIENCY MONITORING

ADVANCED APPLICATIONS

- ADVANCED PROCESS CONTROL
- STATISTICAL QUALITY CONTROL
- TANK QUALITY INTEGRATOR

SCQ ÁTTEKINTŐ

Distilláció I

- AV1 készletben LVFP
- AV1 készletben ZVFP
- AV1 peremben VFP
- AV1 KOD T95
- AV1 VGO T95
- AV2 készletben KFP
- AV2 PS CS tart
- AV2 készletben VFP
- AV2 peremben VFP
- AV2 KOD T95
- AV2 KOD T95
- AV2 VGO T95

Motorhájtórendszer gyártás

- BIS COMBIPROD VFP
- AV3 PS CS tart
- AV3 készletben VFP
- AV3 peremben T95
- AV3 KOD T95
- AV3 VGO T95
- GOK3 párolás I, II, III
- GOK3 párolás T95
- GOK3 párolás ZP
- GFR NCG LCG tart
- GFR perem CS tart
- PEM N2 CS tart
- PEM oldal Tst tart
- PEM felül CX tart

Aromás

- ARO benzol benzol tart
- ARO toluol benzol tart
- ARO xilol CX tart
- ARO xilol toluol tart
- ARO oldószer I, II, III
- ARO oldószer KFP
- DCU 100 forrásformáló
- DCU párolás VFP
- DCU LCGO T95
- DCU HCGO CXFP
- DCU próbán propán I
- DCU próbán propán II
- HFA alulár VFP

Reformálás

- REF-100 RON
- REF-100 benzol I
- REF-100 benzol II
- GK1 párolás I, II

White Product Yield Monitoring

Utilization of Normal Capacity %

	Min	Actual	Max	Plan
Feed N-QA, v%h	-	78.3	74.9	
CQ-VAG, v%h	-	84.3	86.6	

DREF

	Min	Actual	Max	Plan
Feed N-QA, v%h	-	78.3	74.9	
CQ-VAG, v%h	-	84.3	86.6	

DESZTILLÁCIÓ BLOKK T4 SZINT

Block	Parameter	Value	Unit
DAV1	Flow	1000	m ³ /h
DAV2	Temp	150	°C
DBFR	Efficiency	95%	%
DDFR	Flow	500	m ³ /h
DPEM	Temp	120	°C
DKBK	Flow	200	m ³ /h

OTHER REFINERY SYSTEMS

- LABOR EQUIPMENT AVAILABILITY
- ONLINE PRODUCTION PROGRAM
- SULFUR STOCK AND SHIPMENTS
- CATALYST REPORTS
- CHILLER MONITORING

PROCESS SAFETY MANAGEMENT

- 30 DAYS ILOCK MONITORING

Refaktorok és Hidrogén QCS

Ütemzési adatok

Unit	Param	Value	Unit
Refaktor	Temp	150	°C
Hidrogén	Flow	100	m ³ /h

DUNAI FINOMÍTÓ TERMELEI PROGRAM TETEZ

Unit	Param	Value	Unit
Termelek	Flow	1000	m ³ /h
Temper	Temp	150	°C

DUNAI FINOMÍTÓ KÉNKÉSZLETEK

Process flow diagram showing units TK-2, TK-401, and TK-101.

- PI Tag & AF structure establishment

- Bottom-up development
- Rapid roll out of solutions

EXAMPLES - TECHNOLOGICAL KARTY FOR ENERGY

Elements

- BaseOil Tanks Tracking
- Chiller Status Monitoring
- Control Loop Monitoring
- Corrosion Monitoring
- Danube Refinery
- Data Library
- DCS Privilege Monitoring
- DL1 Rotation Machines
- DR Energy KPI
- DR FG + HG Network
- DR H2 Balance
- DR LAB Equipments
- DR Online Production Program
- DR Plan Fact Report
- DR Status Monitoring
- Energy KPI System
- Flare Monitoring
- Integrity Operating Windows
- Interlock Monitoring
- NEW Integrity Operating Windows
- Other Minor Calculations
- PI Vision Training
- Process Control
- Quality Card
- Sensors
- Shop monitoring
- Solomon Calculations
- Capacity Utilization
- Compressor Curve
- Data collection
- Distillation Efficiency
 - DAREN Block
 - DAEDB
 - 101
 - 102
 - 106
 - 108
 - K1
 - Minimum reflux quantity
 - Normalized energy consumption
 - Normalized energy cost
 - Reflux feed rate
 - Toluene in bottom product
- K2
 - DDESTB Block
 - DMARA Block
 - DMOHA Block
 - DREHI Block
 - K1

K1

General Child Elements Attributes Ports Analyses Notification Rules Version

Filter

Name	Value	Time Stamp
Category: Difference calculation		
Energy Cost Difference	-4,2676	2019. 09. 10. 12:01:00
Energy Cost Difference Percent	84,701 %	2019. 09. 10. 12:01:00
Energy Cost Difference Previous Day	-4,1531	2019. 09. 10. 12:05:04.775
Energy Cost Difference Previous Day Percent	84,977 %	2019. 09. 10. 12:05:04.775
Energy Difference	-0,25391	2019. 09. 10. 12:01:00
Energy Difference Percent	84,701 %	2019. 09. 10. 12:01:00
Energy Difference Previous Day	-0,28243	2019. 09. 10. 12:05:04.779
Energy Difference Previous Day Percent	85,154 %	2019. 09. 10. 12:05:04.779
Category: Distillation Efficiency		
Expected Energy	1,9211 GJ	2019. 09. 10. 12:01:00
Expected Energy Cost	27,894	2019. 09. 10. 12:01:00
Expected Energy Cost Previous Day	27,645	2019. 09. 10. 12:05:04.775
Expected Energy Previous Day	1,9024 GJ	2019. 09. 10. 12:05:04.779
Normalized Energy	1,6272 GJ	2019. 09. 10. 12:01:00
Normalized Energy Cost	23,626	2019. 09. 10. 12:01:00
Normalized Energy Cost Previous Day	23,492	2019. 09. 10. 12:05:04.771
Normalized Energy Previous Day	1,62 GJ	2019. 09. 10. 12:05:04.775
Category: General Attributes		
Asset ID	K1	1970. 01. 01. 0:00:00
Block ID	DARENB	1970. 01. 01. 0:00:00
Unit ID	DAEDB	1970. 01. 01. 0:00:00
Category: KPI Calculation		
Asset KPI Evaluate	2	1970. 01. 01. 0:00:00

MSA Üzem - Technológiai kártyák

Segédlet Technológiai kártya áttekintő

DS Termelés MOL - IOW AV3

LOW MAIN

PROCESS

DANUBE REFINERY ENERGY EFFICIENCY OF DISTILLATION PROCESSING

DISP EFF MAIN START/STOP

DMOHA

DETB

V2 ●

V3 ●

V4 ●

DFCC

840 ●

DGK3

201 ○

202 ●

203 ●

501 ●

803 ●

DHDS

501 ●

803 ●

DLI6

501 ●

801 ●

DDESTB

DPEN

101 ●

DAV3

105 ●

DGFR

112 ●

118 ●

123 ●

DBFR

107 ●

DARENB

DAAB

101 ●

106 ●

108 ●

K1 ●

K2 ●

DREHIB

DGK1

124 ●

DRF4

V61 ●

DMARA

DDCU

106 ●

109 ○

201 ○

301 ○

KPI's Overview

Unit	Current	Actual	Target	A-T	A/T %	Average for previous day	Actual	Target	A-T	A/T %
Minimum reflux quantity	22.94	16.00	6.94	139.61	22.44	16.00	6.44	140.23		
Reflux feed rate	0.60	0.52	0.08	116.13	0.60	0.52	0.08	116.06		
Toluene in bottom product	0.44	0.40	0.04	110.85	0.47	0.40	0.07	118.01		
Normalized energy cost	27.26	32.12	-4.86	84.88	35.94	31.82	-4.89	84.64		
Normalized energy consumption	1.63	1.91	-0.28	85.17	1.61	1.92	-0.31	85.73		

DAEDB K1 Minimum reflux quantity

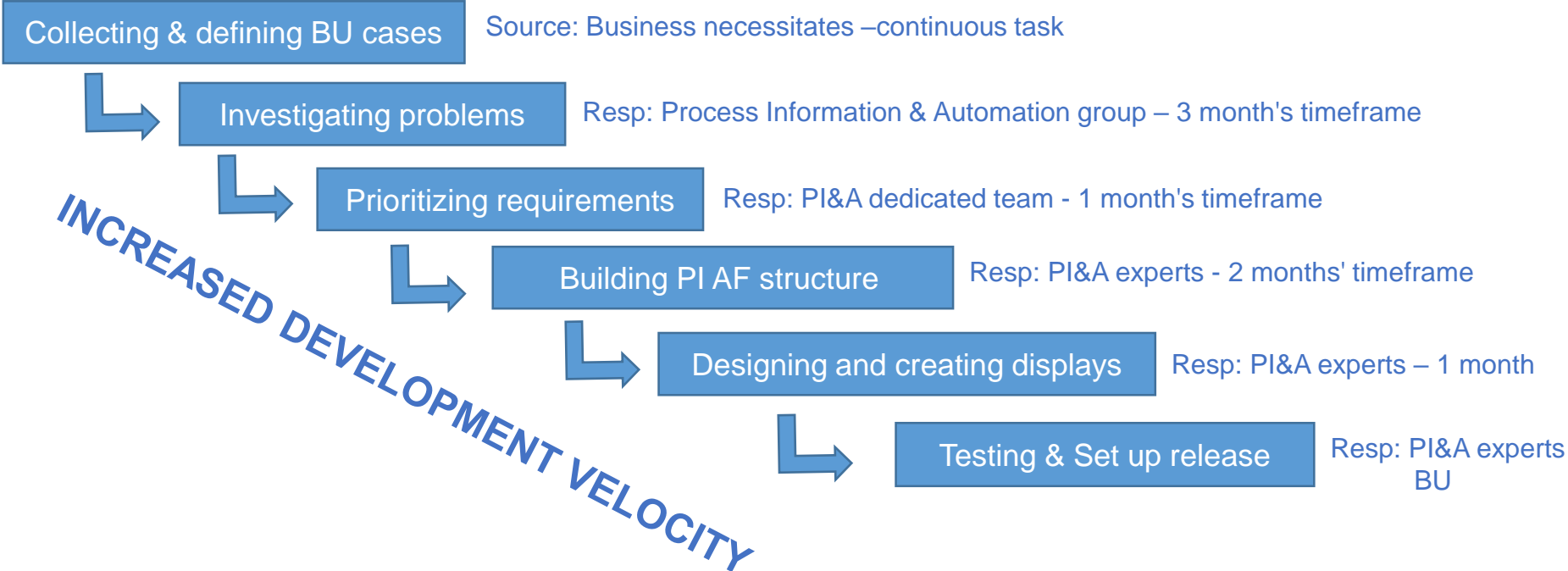
Minimum reflux quantity (KPI) Actual value: 22.94 m³/h
Minimum reflux quantity (KPI) Target: 16 m³/h

Unit	Value	Status
L1_MOS	NORMAL	
ZÁRVA MOS	NORMAL	
D.ZÁRVA MOS	NORMAL	
RELLELLI_MOS	144 SEL.GP.32INT.LL.MOS	NORMAL
L1_MOS	APZARVA MOS	NORMAL
D.ZÁRVA MOS	V2 IS. BENC. NYOMÁS MOS	NORMAL

Unit	Value	Status
DMBADT218.PV	400	ALERT 0.00 %
Patalator hõméréskifejezés (OT218) 2	426	ALERT 0.00 %
DMBADT219.PV	400	ALERT 0.00 %
Patalator hõméréskifejezés (OT219) 4	426	ALERT 0.00 %
DMBADT219.PV	400	ALERT 0.00 %
Patalator hõméréskifejezés (OT219) 6	426	ALERT 0.00 %
DMBADT219.PV	400	ALERT 0.00 %
Patalator hõméréskifejezés (OT219) 8	426	ALERT 0.00 %
DMBADT219.PV	400	ALERT 0.00 %

Unit	Value	Status
DMBADT218.PV	400	ALERT 100.00 %
Termék gáz hõméréskifejezés (OT218) 2	346	ALERT 0.00 %
DMBADT14.H108A.PV	-1.00000E+00	ALERT 0.00 %
Ust hõméréskifejezés (OT218) 4	190	ALERT 0.00 %
DMBADT214.PV	-1.00000E+00	ALERT 0.00 %
Vegyszerkezelési kódszám (OT218) 6	220	ALERT 0.00 %
DMBADT1108.PV	-1.00000E+00	ALERT 0.00 %

PI AF & PI Vision development workflow



BUILDING PI AF SYSTEMS STEP 1

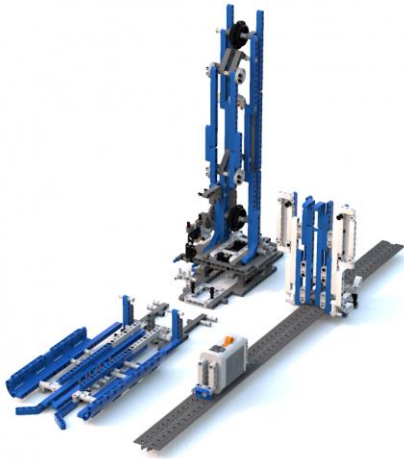
- DEFINING BUSINESS CASE → MONITORING OF FLARING ACTIVITIES:
- UNDERSTANDING PROBLEM → TOO MUCH FLARING ACTIVITY IN THE REFINERY
- DEFINING SCOPE → DETECT FLARING (AND SAFETY VALVE BLOW-DOWNS) IN THE REFINERY AND DOCUMENTING IT (IN E-LOGBOOK)
- WORKING OUT METHODOLOGY → VIA MEASUREMENT OF FLARE FLOWS (DIRECT) AND/OR VIA MEASUREMENT OF PRESSURES, TEMPERATURES, FLOWS, VALVE POSITIONS, ETC. (INDIRECT)



BUILDING PI AF SYSTEMS STEP 2

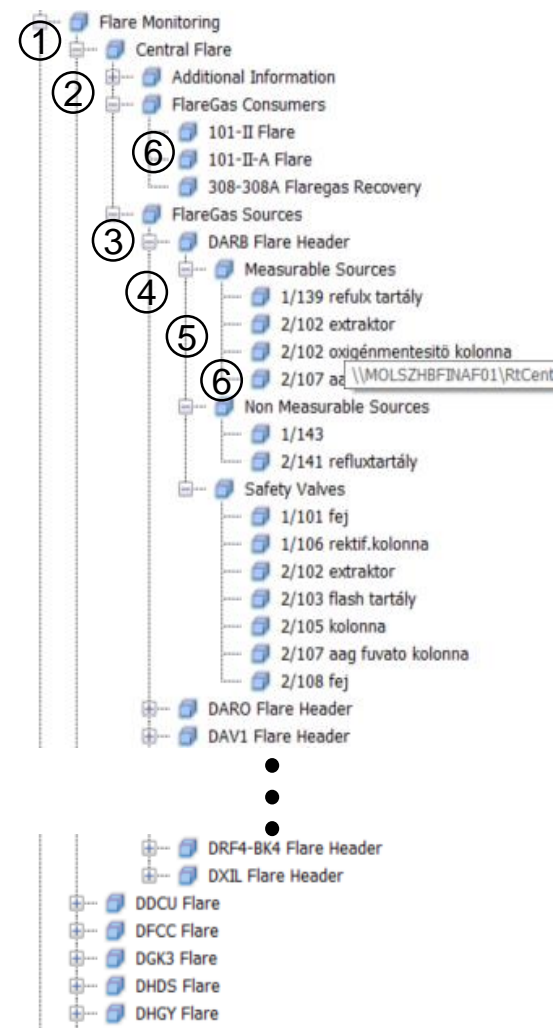
BUILDING UP AF STRUCTURE

- ▶ CREATING THE SKELETON
- ▶ FROM TOP TO BOTTOM



LAYERS:

1. SYSTEM
2. FLARES
3. CATEGORY
(CONSUMER/SOURCE)
4. UNITS
5. CATEGORY
(MEASURABLE OR NOT)
6. EQUIPMENT



BUILDING PI AF SYSTEMS

STEP 3

BUILDING IN FUNCTIONALITY

- ▶ CONFIGURING ATTRIBUTES, ANALYSES, NOTIFICATIONS, TABLES, ETC.
- ▶ FROM BOTTOM TO TOP (USUALLY)



Category: Auxiliary Attributes			
ElementID	46affc53-e62c-11e5-8bc5-54ee754f2805		1970. 01. 01. 0:00:00
Category: Configuration Parameters			
Flare Alerting Blocked	Nem		1970. 01. 01. 0:00:00
Measurement	DARIAPV009.OP		1970. 01. 01. 0:00:00
Category: General Attributes			
Equipment Name	1/105 oxigénmentesítő kolonna		1970. 01. 01. 0:00:00
Flare Connection Position	fej		1970. 01. 01. 0:00:00
Flare Header ID	DARB		1970. 01. 01. 0:00:00
Flare Header Name	DARB fáklyagerinc		1970. 01. 01. 0:00:00
Category: Information			
Blind	Nem		1970. 01. 01. 0:00:00
Bypass Valve	Nincs		1970. 01. 01. 0:00:00
Comment	-		1970. 01. 01. 0:00:00
Category: Limit			
HI Limit	60		1970. 01. 01. 0:00:00
LO Limit	-1000		1970. 01. 01. 0:00:00
Category: Process Data			
Measured Value	48,848		2019. 09. 06. 13:51:09
Category: Results Final			
Flare Source State	0		2019. 09. 06. 13:51:10
Category: Time Cumulated Data			
Flaring Ratio	0		2019. 09. 06. 13:51:53.062

Name	Backfilling	Description:
FlareSource Event Generation (AbsType)		Categories: FLAREGeneral:FLARESourceIndicator
Flaring State Calculation Measurable Flow	<input checked="" type="checkbox"/>	Analysis Type: <input checked="" type="radio"/> Expression <input type="radio"/> Rollup <input type="radio"/> Event Frame Generation

Name	Expression	Output Attribute
flareStateLogic	IF TimeGE('Measured Value', '*-6m', '*', 'HI Limit') > 350 OR TimeLE('Measured Value', '*-6m', '*', 'LO Limit') > 350 THEN 1 ELSE 0	Map
FlareStateResult	IF 'Flare Alerting Blocked' = "Igen" THEN 0 ELSE flareStateLogic	Flare Source State

BUILDING PIAF SYSTEMS STEP 4

CREATING I

► OVERVIEW

System

DARB Mérhető fáklyaforrások

Központi fáklya
DDCU Fáklya
DFCC Fáklya
DGK3 Fáklya
DHDS Fáklya
DHGY Fáklya

Fáklyázás áttekintő (Dashboard)

Közp

Fáklya

- DARB f
- DARB f
- DAV1 f
- DAV2 f
- DAV3 f
- DBFR f
- DBK2 f
- DBK3 f
- DGFR f
- DGK1 f
- DHDS f
- DKBI-C
- DKBI-H
- DKGU f
- DKOH f
- DPAM f
- DPBT L
- DRF4-C
- DXIL f

DARB

Fáklyamérés: DFK1FF231.PVA
0.8

Mennyiségmérés

Fáklyázás folyamatban

Mérés azonosító: DARBSLH046.PVA

Fáklyagerinc alapján fáklyázás	0%
Források alapján fáklyázás	1%

Mérhető források
Nem mérhető források

Mérhető források	Kerülő	Fáklyázás Aránya	Riasztás Blokkolva
1/139 reflux tartály tartály	Nincs	0,00%	Nem
2/102 extraktor fej	Nincs	0,00%	Igen
2/107 aag fuvato kolonna fej	Nincs	1,04%	Nem

Biztonsági szelepek	Nyomás MPa	Unit level overview	Kerülő	Blind	Fáklyázás Aránya
1/101 kolonna fej	0,34 3,5		Nincs	Nem	0,00%
1/106 rektif. kolonna fej	0,40 2,0		Nincs	Nem	0,00%
2/102 extraktor fej	8,50 13,3		Nincs	Nem	0,00%
2/103 flash kamra	1,83 3,4		Nincs	Nem	0,00%
2/105 specbenzin kolonna fej	1,20 5,0		Nincs	Nem	0,00%
2/107 aag fuvato kolonna fej	0,84 1,5		Zárt	Nem	0,00%
2/108 kolonna fej	0,45 2,0		Nincs	Nem	0,00%

RATIONALIZATION OF ANALYTICS TECHNIQUES

BUSINESS OPERATIONS

- Ubiquitous data streams
- Advanced analytics techniques
- Establishment of a digital connection between refinery operation & IoT devices
- Collaborating & leveraging refinery knowledge

TRANSFORMATION

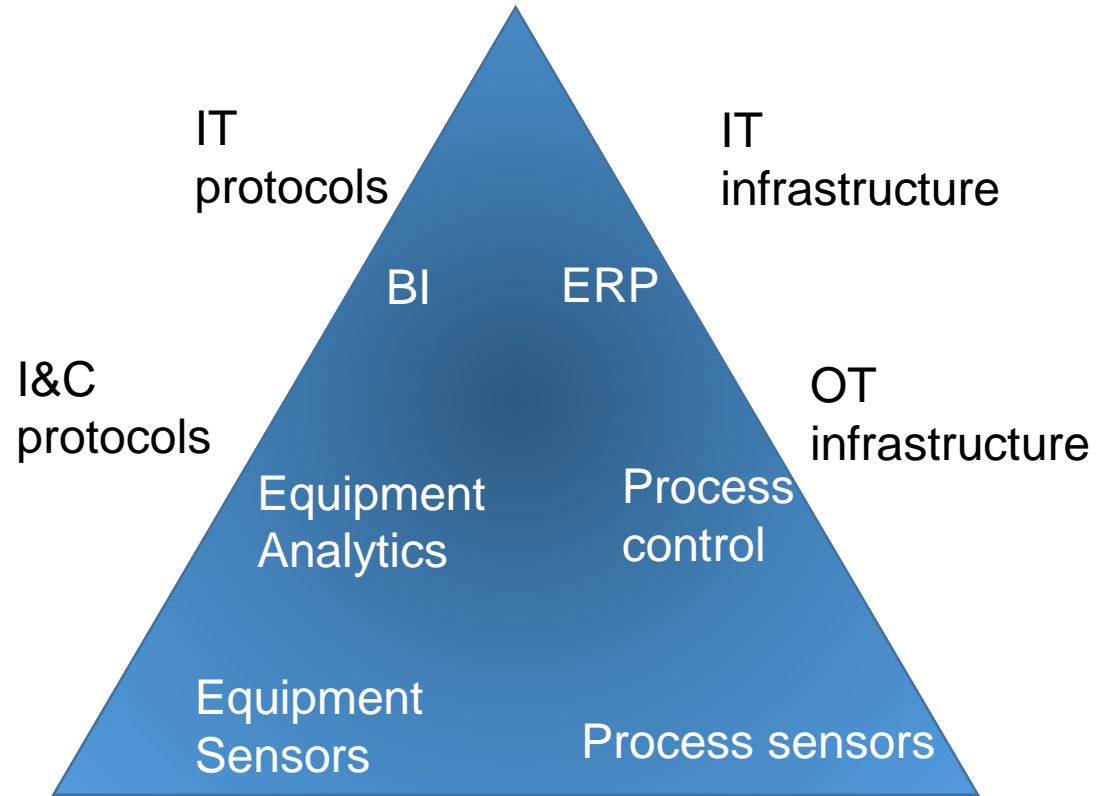
- Rich digital representation of processes
- Identification of new system integration & development opportunities
- Commissioning good practices

PRODUCTIVITY IMPROVEMENTS

- Maximized asset utilization
- Minimized unit shut-down times
- Driving direct energy efficiency
- Reach mechanical integrity in every level
- Smooth operation

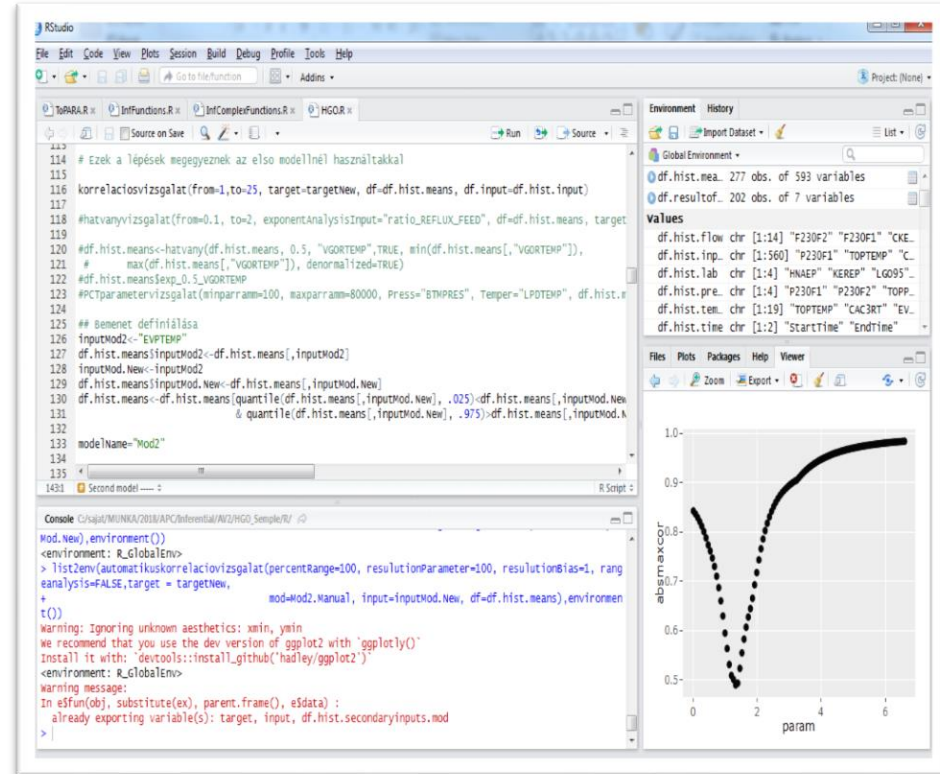
IT / OT CONVERGENCE

- ▶ ESTABLISHING ELABORATED PRODUCTION SCHEDULE
- ▶ OPTIMIZING OPERATION PROCESSES VIA SUPERVISOR AND AUTOMATIC CONTROL SYSTEMS
- ▶ INCREASING THE MECHANICAL AVAILABILITY



THE IMPORTANCE OF HAVING AN OT DATA INFRASTRUCTURE

- ▶ RAPID DEVELOPMENT AND SCALABILITY OF APPLICATIONS
- ▶ REINFORCE THE USE OF DATA AND ANALYTICS BASED DECISION MAKING
- ▶ SUPPORT CULTURAL CHANGE AND NORMALIZATION
- ▶ LEVERAGE ADVANCED TECHNOLOGIES INCLUDING ADVANCED ANALYTICS AND IOT TO ACCELERATE BUSINESS VALUE
- ▶ ENABLE SUSTAINABLE BUSINESS VALUE



ADVANCED ANALYTICS & IOT

- ▶ UTILIZE OPERATIONAL DATA TO DRIVE PROACTIVE E&P DECISION-MAKING THAT WILL REDUCE COST AND IMPROVE RECOVERY RATE.
- ▶ INJECT CONFIDENCE IN YOUR DECISION-MAKING BY CAPITALIZING ON DATA SCIENCE TO STATISTICALLY PREDICT PRODUCTIVITY IN A QUICK AND COST-EFFICIENT MANNER.
- ▶ INCREASE PRODUCTIVITY AND EFFICIENCY ACROSS ALL MAJOR BUSINESS UNITS THROUGH THE BEST PRACTICES FOR DATA HARMONIZATION.
- ▶ DEEPER UNDERSTANDING OF TECHNOLOGICAL PROCESSES -ALTERNATIVE CRUDE OIL USAGE AS FEED

Strategic Machine Learning/Big Data/Advanced Analytics
Enabled by the OT Infrastructure

Tactical Machine Learning/Big Data/Advanced Analytics
Enabled by the OT Infrastructure

Real-time Analytics –
In the OT Infrastructure

Human Analytics
Enabled *and* in the OT Infrastructure

“OPERATIONAL DATA HUB” TYPICAL APPLICATIONS



KPI monitoring

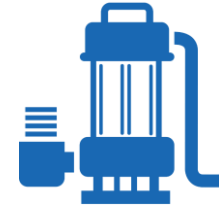
- White product yield
- Energy consumption
- APC utilization



Asset monitoring

+notification

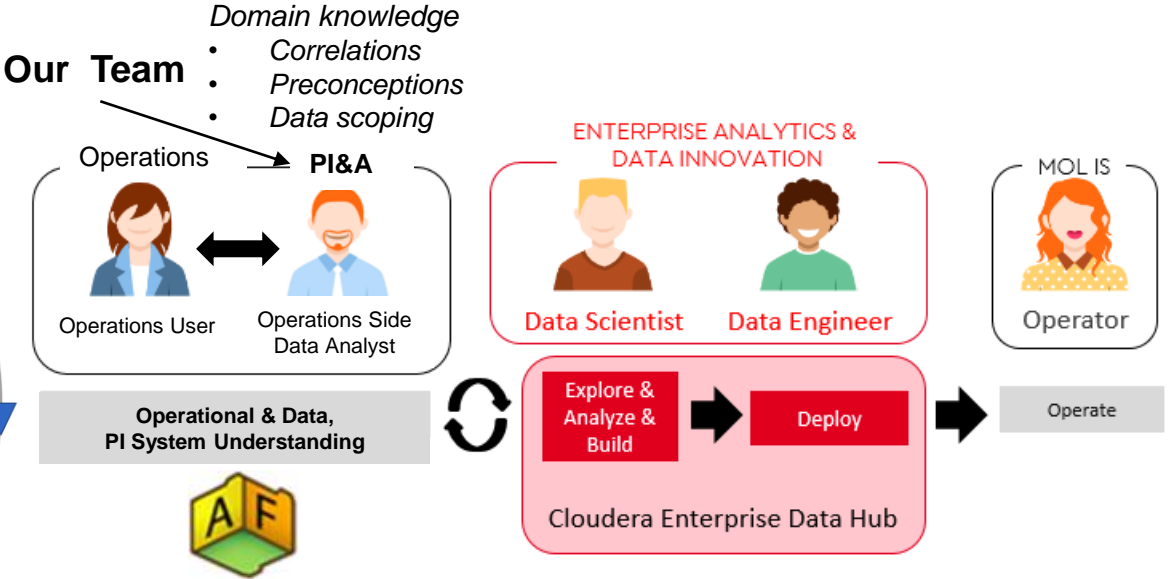
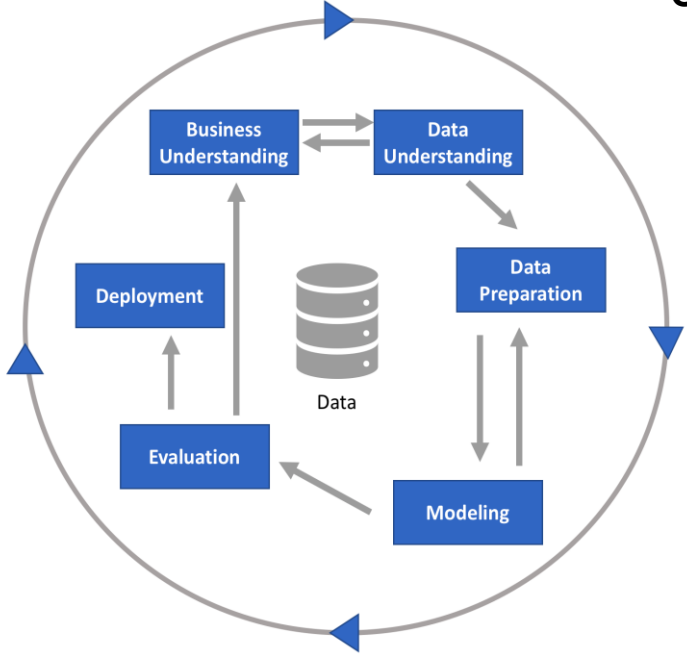
- Operation envelope
- IOW monitoring
- HTHA monitoring
- Analyzer validation
- SAP PM integration for CBM
- Flare monitoring
- Environmental reporting
- Control loop mode monitoring
- Failsafe mode monitoring
- Natural gas consumption forecasting (Predictive analytics)



Equipment / Asset models

- Pump efficiency
- Exchanger Fouling
- PSA valve monitoring
- DCU feed composition calculation

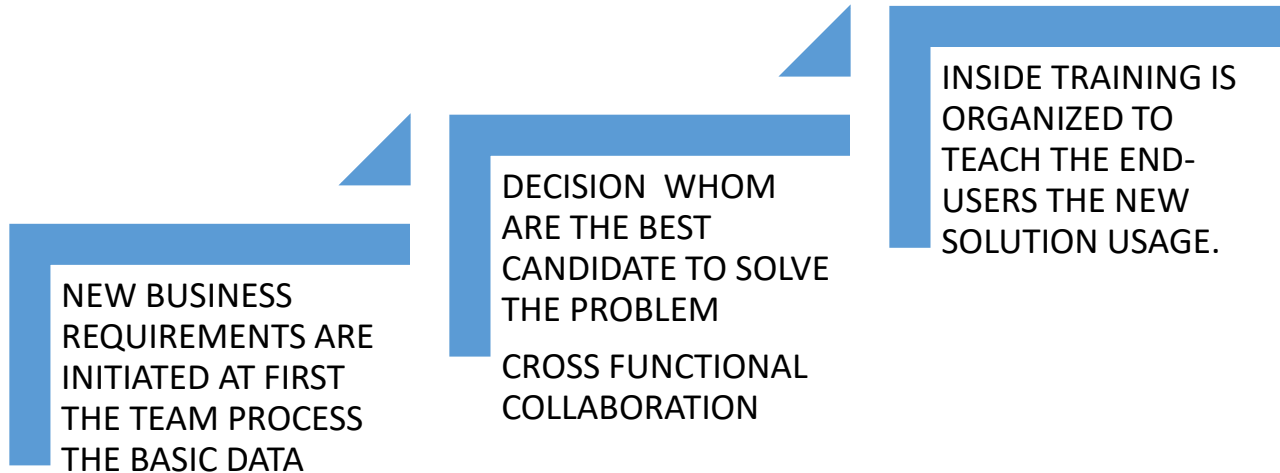
ANALYSIS PROCESS – A PARTNERSHIP BETWEEN OT AND IT



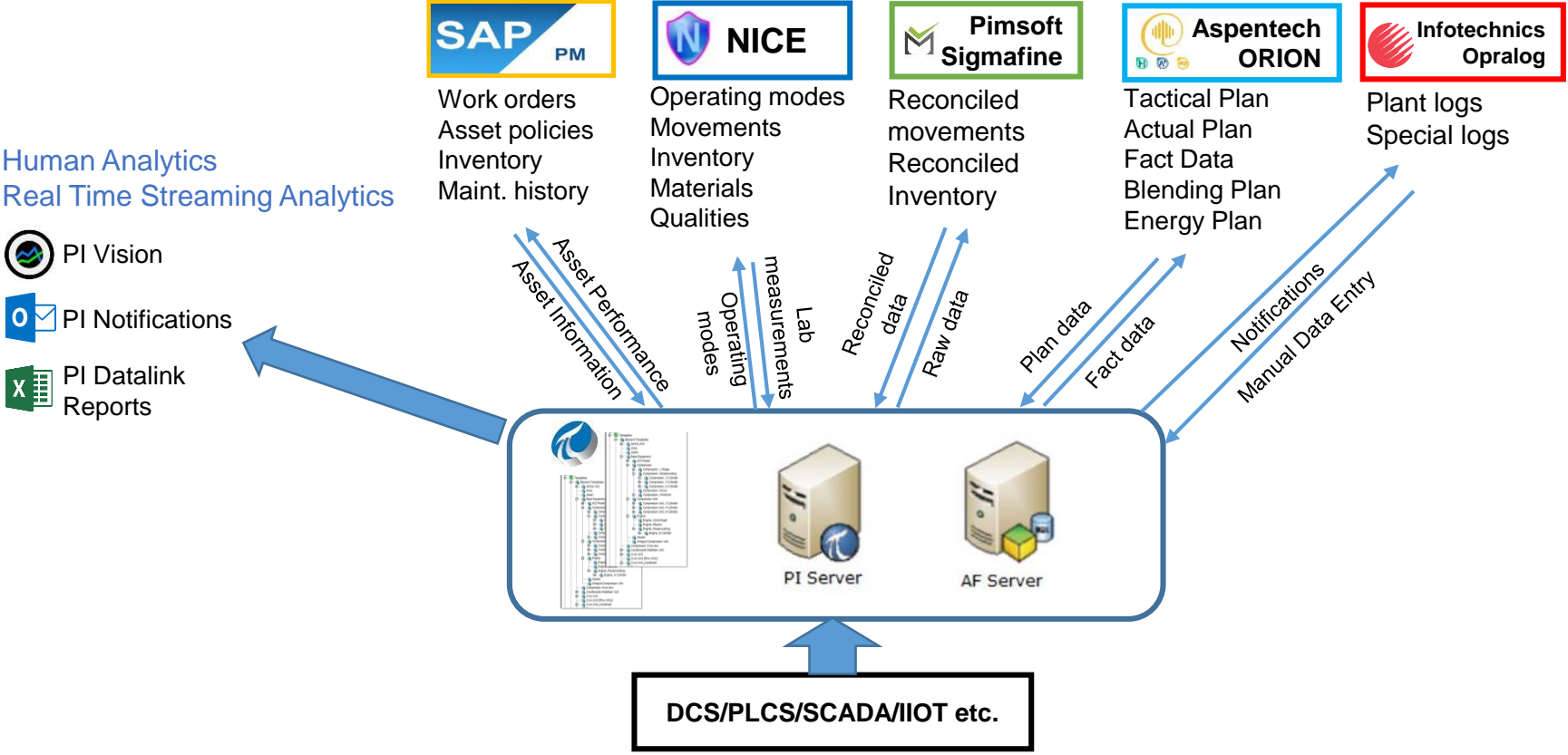
Expected **Defined Business** Case Delivery Time <3 months 

DIGITAL TRANSFORMATION APPROACH

- ▶ PARTICIPATION IN OFFICIAL OSISOFT TRAINING TO LEARN THE BASIC TECHNIQUES OF THE PI CLIENT APPLICATION'S USAGE.
- ▶ SHARE MATERIALS WITH THE REFINERY WORKERS AS A SIMPLIFIED PI TRAINING SESSION
- ▶ DEVELOPMENT TEAMS ARE DIVIDED TO GROUPS BASED ON INFORMATION TECHNOLOGY INTEREST AND STRENGTH



TYPICAL SITE “OPERATIONAL DATA HUB”




NEW ADVANCED BI IMPLEMENTATION PROGRAM IN MOL REFINING

Architecture Stream

Design, procure and implement on-premise data storage system.

Technology: Cloudera Enterprise Data Hub (Hadoop technology)

Early 2018

Primary system integration and data ingestion setup: 

- **Sensor Data**
- **Laboratory Measurements**
- **Operating modes**
- **Reconciled Data**
- **Plan Data**
- **Smart Data**

2018

Deployed all scheduled jobs to production, handover for operation team

Early 2019

Integration of Opralog and NICE systems to

- **Movements**
- **Inventory**
- **Materials**
- **Daily Unit Logs**
- **Dispatcher Log**
- **Special Entries**



Development and deployment of an energy nomination support application

2018

New Analysis Cases (Ongoing)

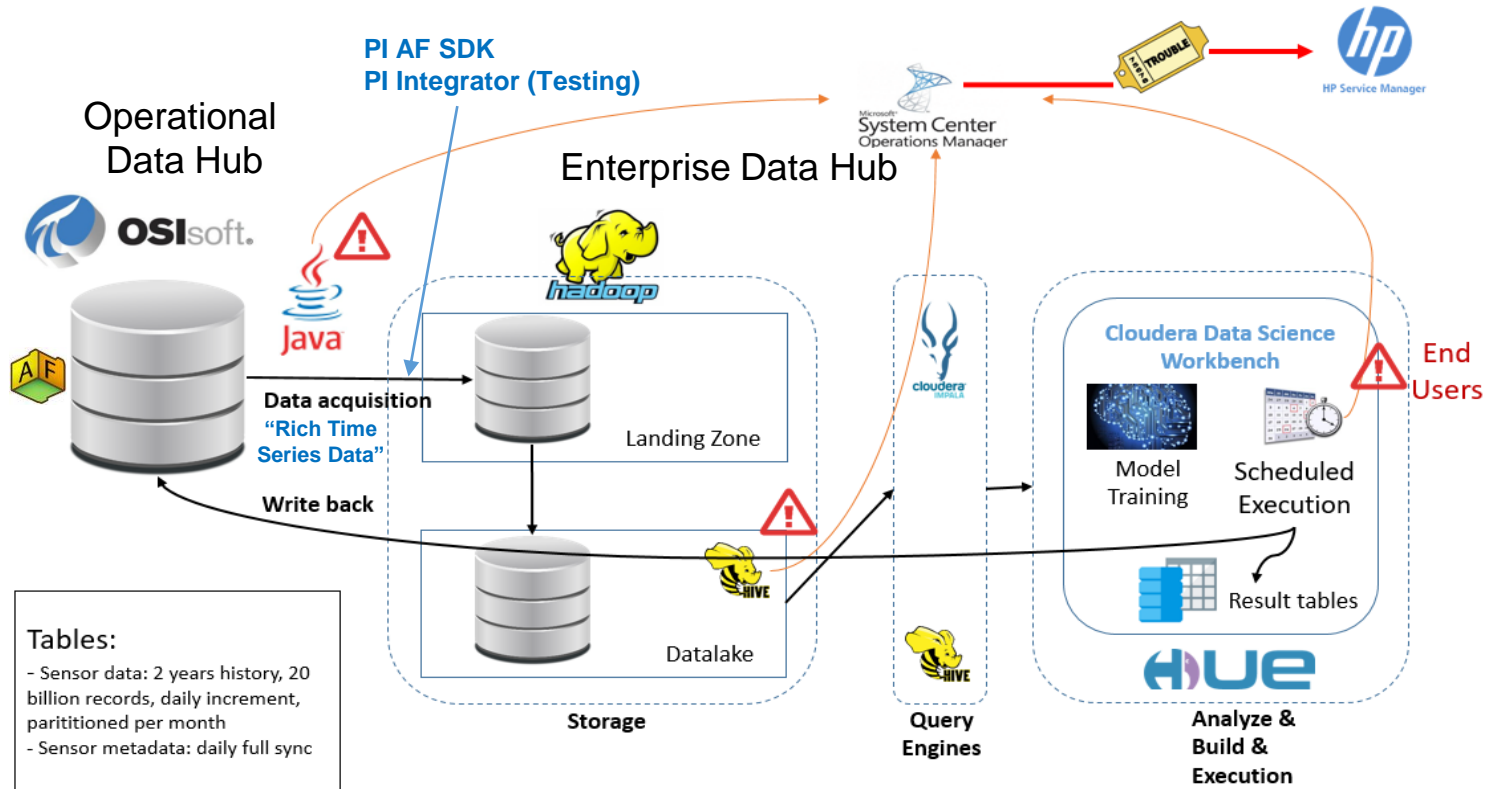
2019

Design and implement production management related reports, dashboards

2020

Analytics Stream

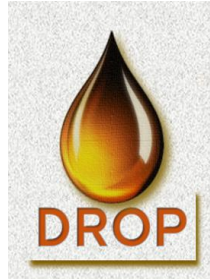
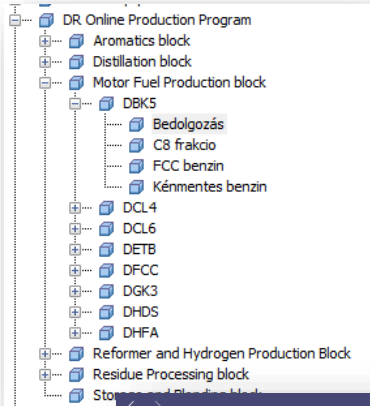
INTRODUCING THE 'ENTERPRISE DATA HUB'



Features

- Daily upload
- Streaming
- Model Building
- Model Execution
- Supervised by IT
- PI&A enabled

DROP - DANUBE REFINERY ONLINE PROGRAM



SYSTEM IS PROVIDING THE LATEST PLANNING DATA (THROUGHPUTS, YIELDS, QUALITY REQUIREMENTS) FROM PLANT-FLOOR LEVEL (OPERATORS, SHIFT LEADERS) TO OPERATIONAL MANAGEMENT LEVEL TO FACILITATE TRACKING OPERATIONAL DIRECTIVES CHANGES IN REAL-TIME.

PI SYSTEM COLLECTS THE PLANNING DATA FROM ORION DATABASE, THE OPERATIVE EEM DIRECTIONS FROM OPRALOG AND QUALITY REQUIREMENTS FROM QUALITY MANAGEMENT SYSTEM

Aromás üzem termelési program		FIR kódok bla bla bla			
Termelési ütemezési adatok					
Dátum	6/13/2019	6/14/2019	6/15/2019		
	t/nap	t/nap	hozam%	t/nap	hozam%
Bedolgozás	1150				
PEM fejtermék	1				
BT frakció	1				
PEM oldaltermék	1				
NMF feldolgozás	1				
benzol	1	1%			
toluol	1	1%			
orto-xilol	1	1%			
xilol-elegy	1	1%			
C9+	1	1%			

IT INNOVATION – IT & BU COOPERATION TO PROCESS OPERATIONAL DATA



▶ PROJECTS



▶ CHANGE REQUESTS





▶ PROOF OF CONCEPTS >
INNOVATION

- ▶ PART OF MOL GROUP IT CTO TEAM
- ▶ PROOF OF CONCEPTS
- ▶ 1-3 MONTHS RUN (+ PREPARATION)
- ▶ TESTING IDEAS, INTRODUCING TECHNOLOGIES AND SOLUTIONS – **BASED ON PI DATA**
- ▶ PROJECT GENERATION
- ▶ MARKETING (PRESENTATIONS, GROUP PORTAL, YAMMER, LINKEDIN)

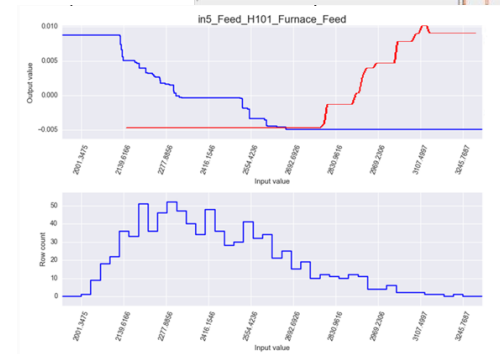
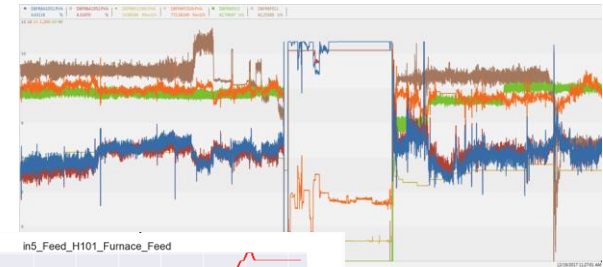
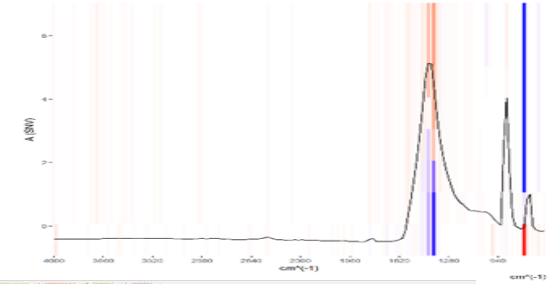
INNOVATION TOPICS

▶ 2017-2018: BIG DATA AND MACHINE LEARNING, IOT/IIOT, CHATBOT

- ▶ REFINERY PRODUCTION PLANNING AND OPTIMISATION 
- ▶ ADVANCED DOCUMENT MANAGEMENT
- ▶ UPSTREAM SPECTRA ANALYSES AND ROCK TYPING
- ▶ COKE YIELD AND STEAM ERUPTION ANALYSES 
- ▶ BUTADIENE ANOMALY DETECTION
- ▶ RETAIL AND HELPDESK CHATBOT
- ▶ ...

▶ 2019: AUGMENTED AND VIRTUAL REALITY, BLOCKCHAIN

- ▶ HIDDEN WORKS VISUALISATION
- ▶ MOL CAMPUS VISUALISATION
- ▶ POLYOL PLANT VISUALISATION
- ▶ RETAIL SHOP VISUALISATION
- ▶ ...



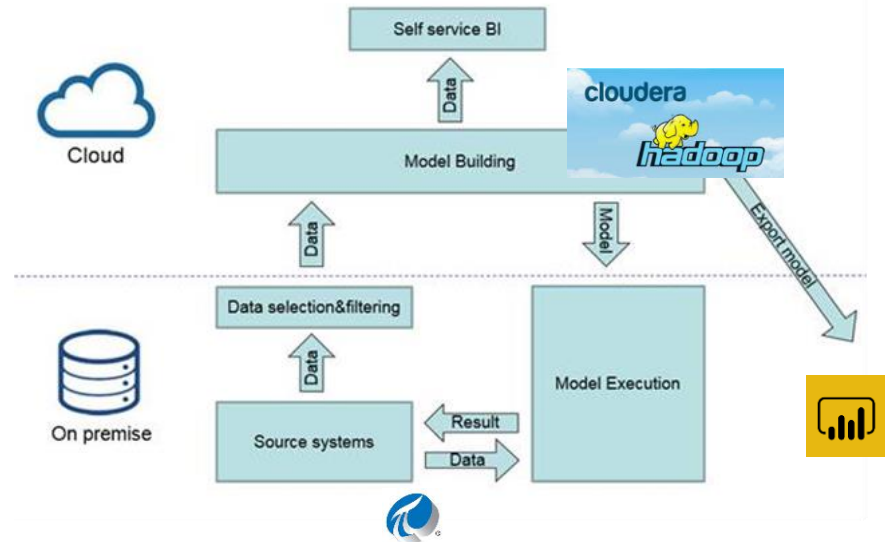
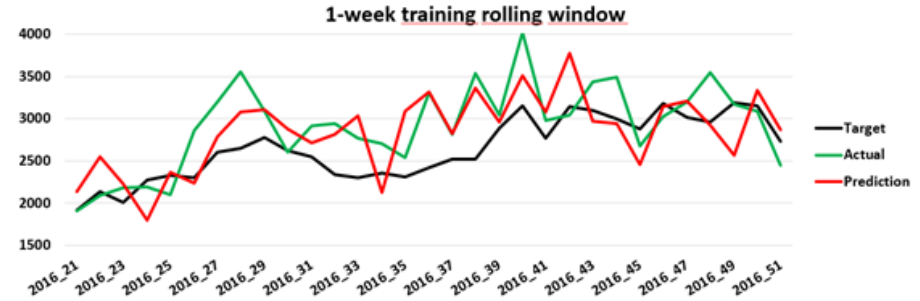
FOLLOW-UPS

▶ PROJECTS

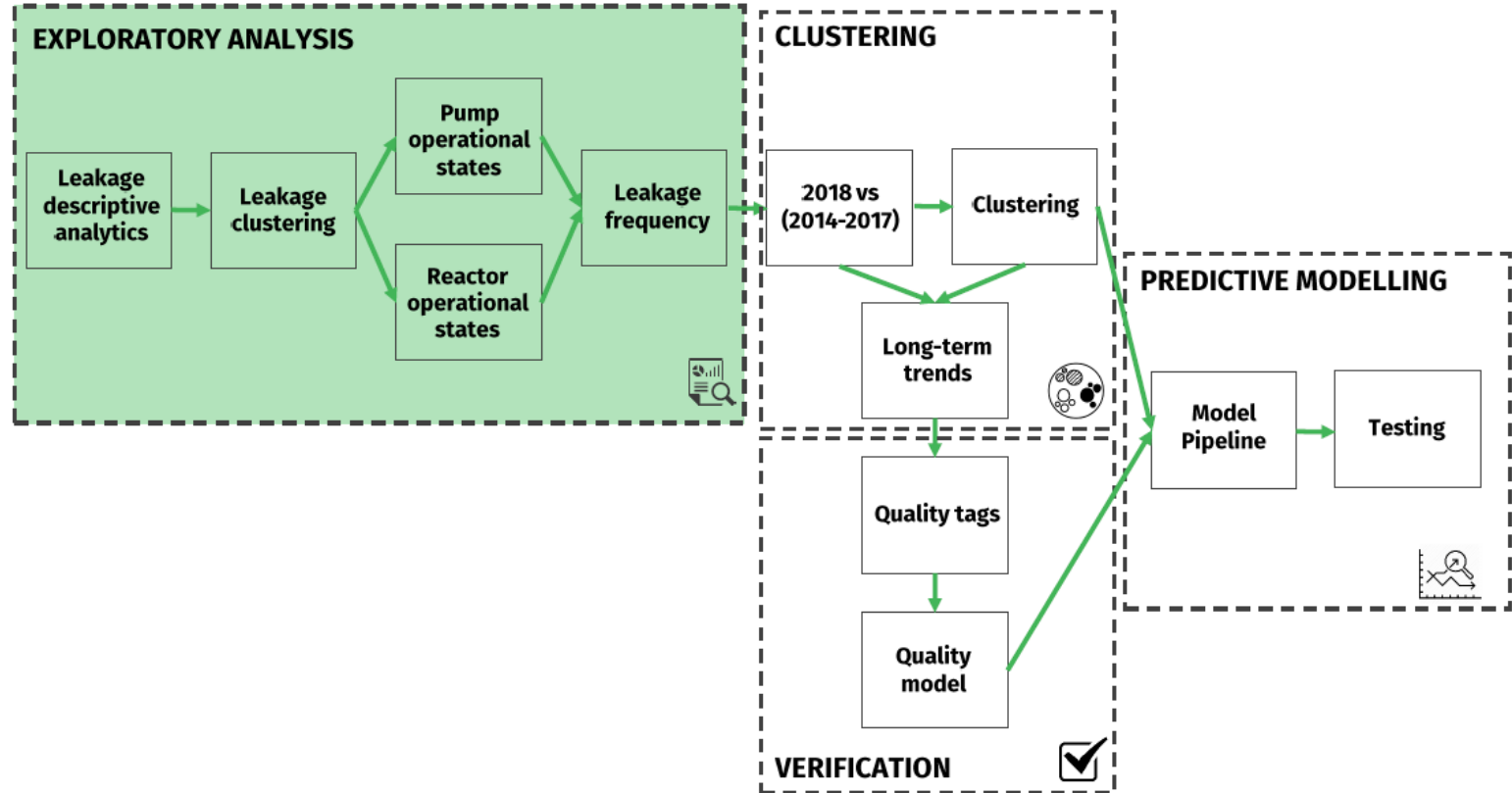
- ▶ SALES DEMAND PREDICTION
- ▶ DANUBE REFINERY ADVANCED ANALYTICS
- ▶ ...

▶ STRATEGY

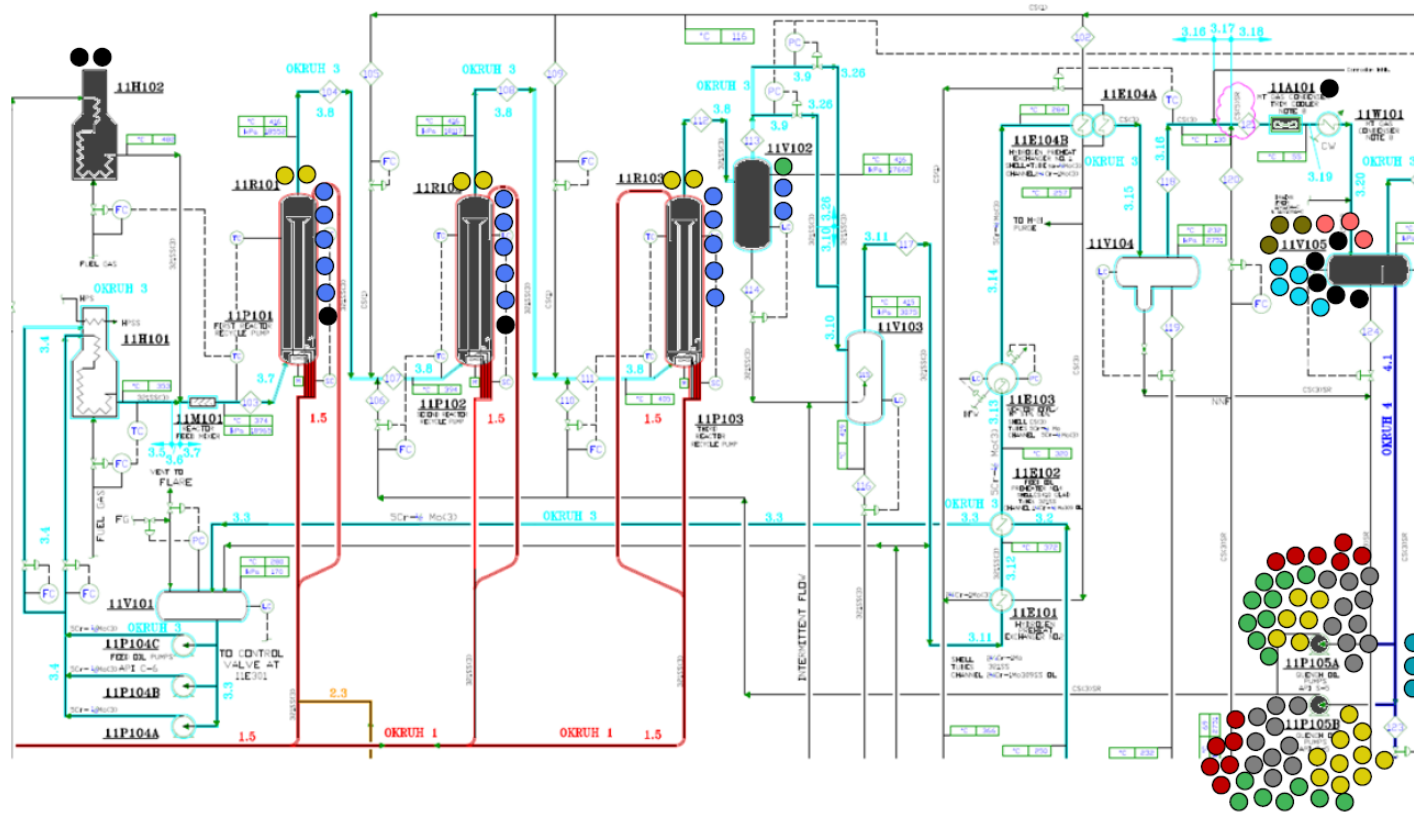
- ▶ PI SYSTEM AS DATA SOURCE OPTION
- ▶ CLOUDERA HADOOP – BIG DATA PLATFORM
- ▶ CLOUDERA DATA SCIENCE WORKBENCH – MACHINE LEARNING PLATFORM
- ▶ MICROSOFT POWER BI – VISUALISATION PLATFORM
- ▶ CHATBOT – NEW COMMUNICATION CHANNEL
- ▶ ...



ANALYSIS APPROACH

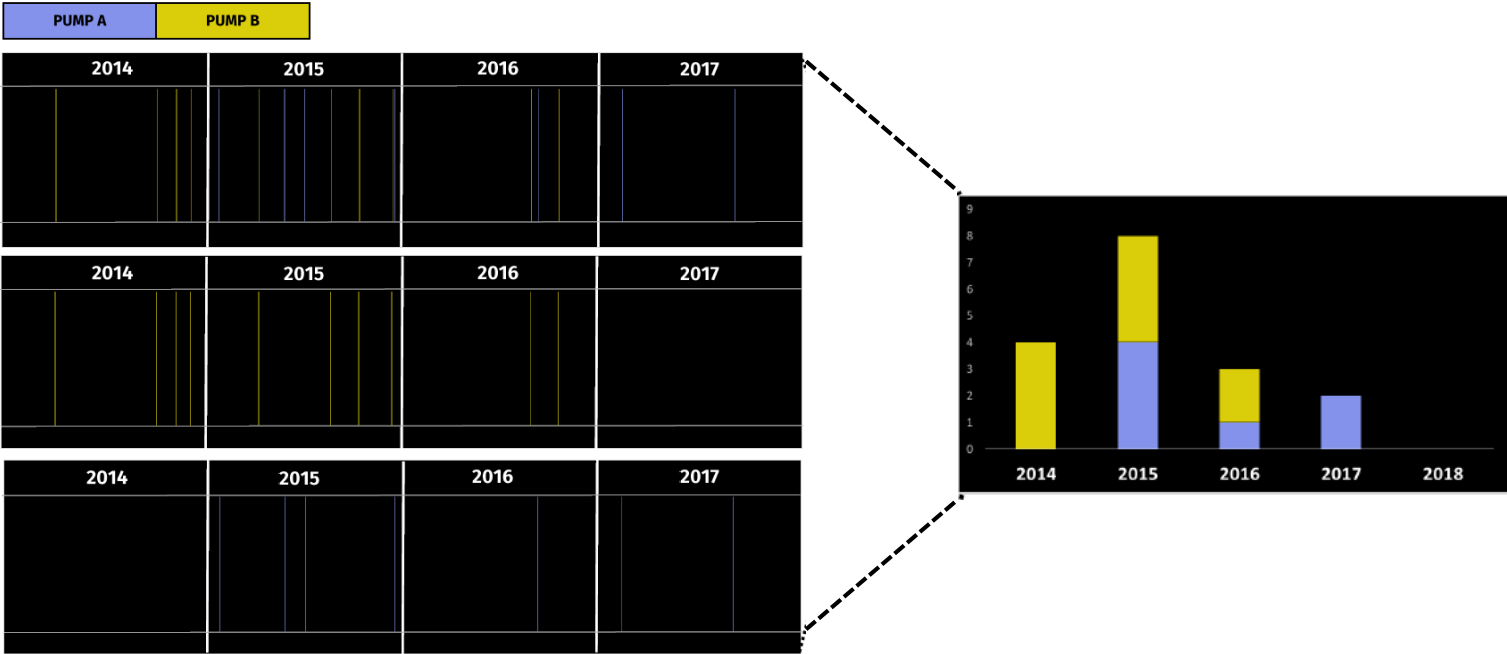


SYSTEM DIAGRAM

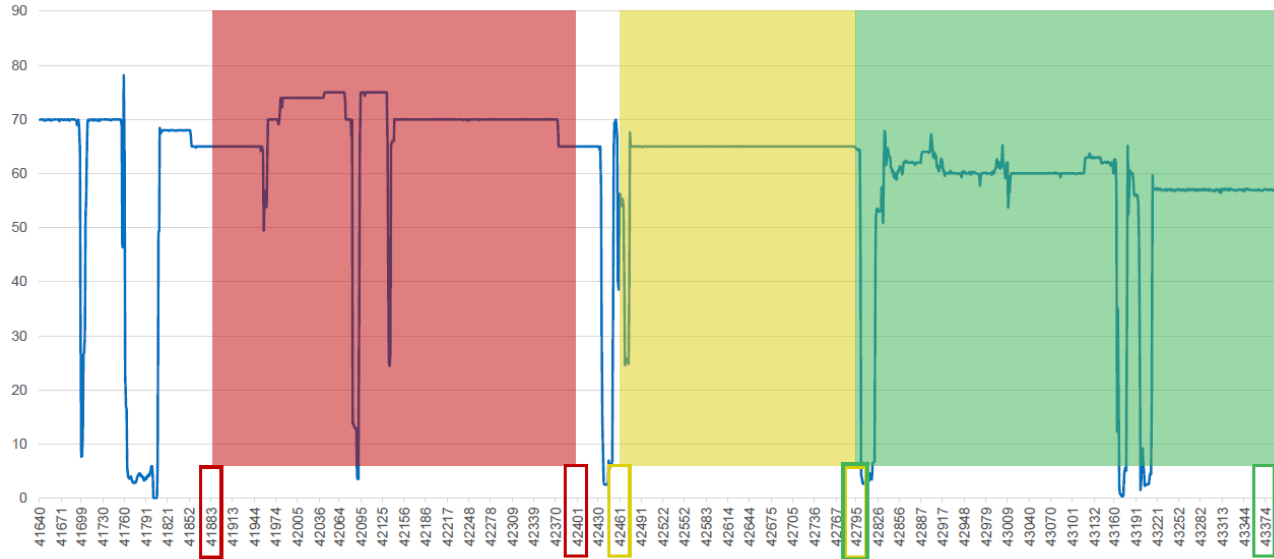


- Temperature
- Vibration
- Densitometer
- Operation
- Seal
- Interface
- Quench oil
- Vapors
- Suction
- Other

LEAKAGE FREQUENCY



LONG-TERM TRENDS – CLUSTERS OF DAYS

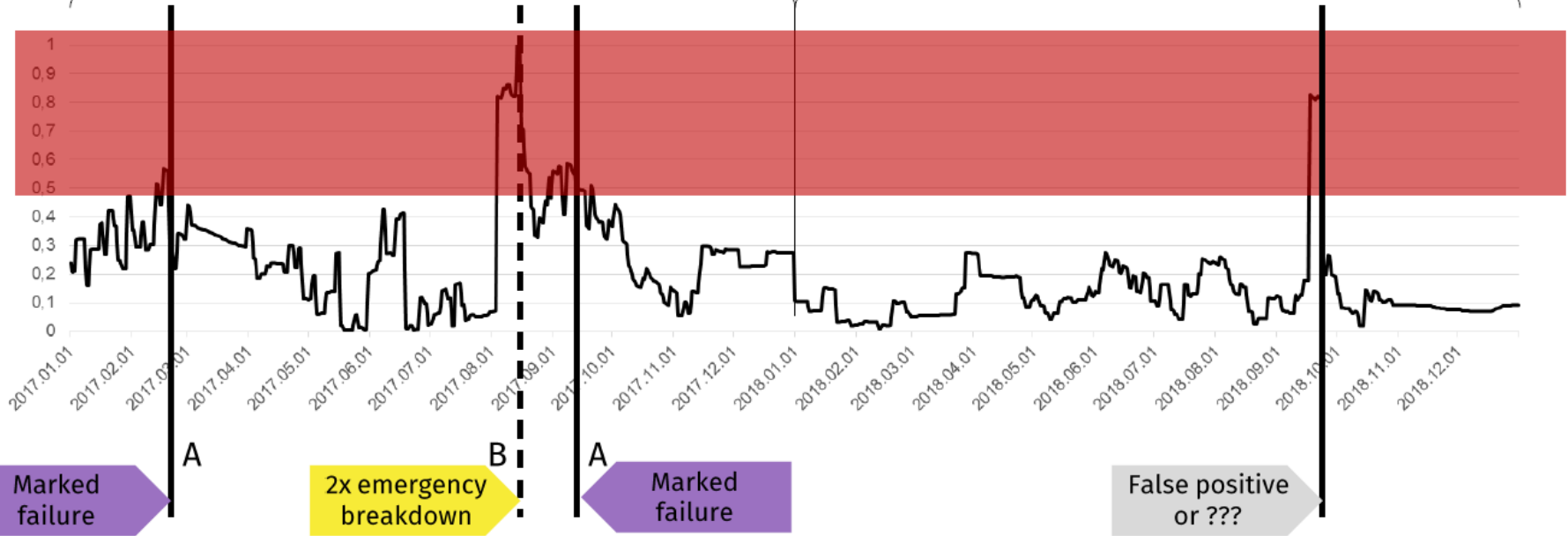


PERIOD	2014.sep-2016.feb	2016.apr-2017.mar	2017.mar-2018.oct
NR OF DAYS	475	318	509
NR OF LEAKAGE FAILURES	13	4	1
RATIO OF LEAKAGE FAILURES	2,7%	1,3%	0,2%

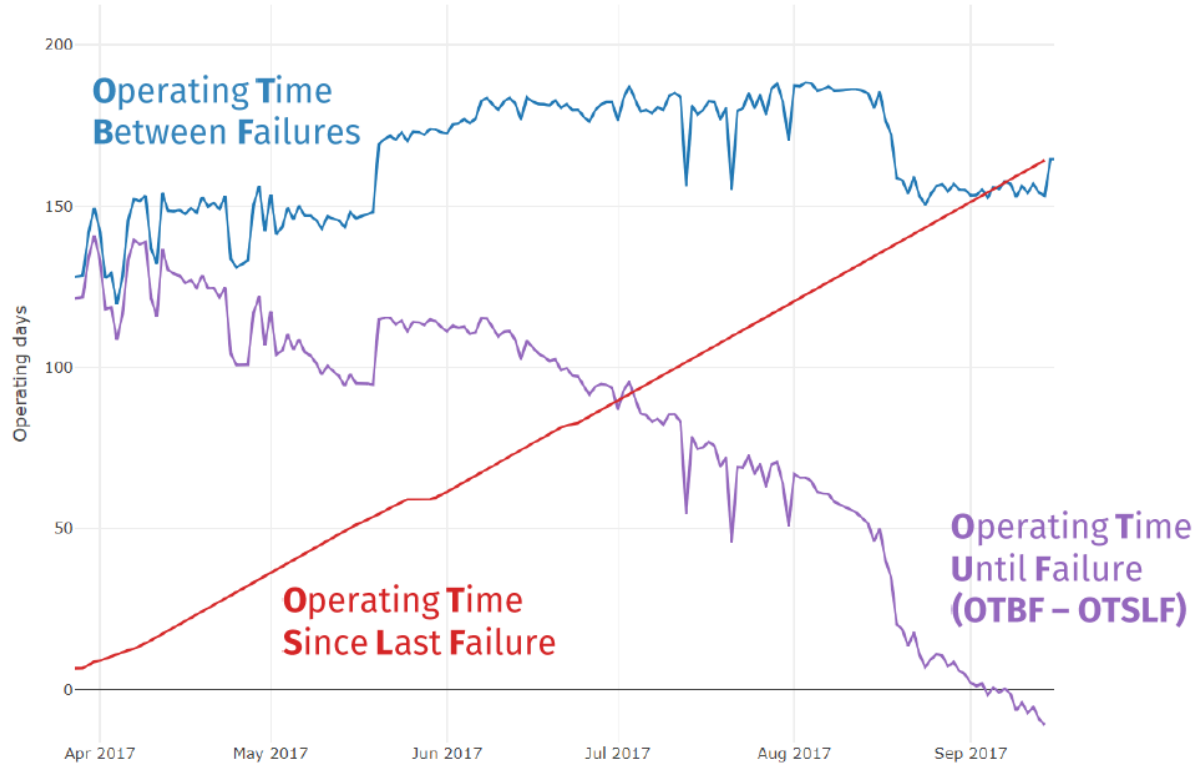
MODEL TRAINING

Trained on 2014-2016

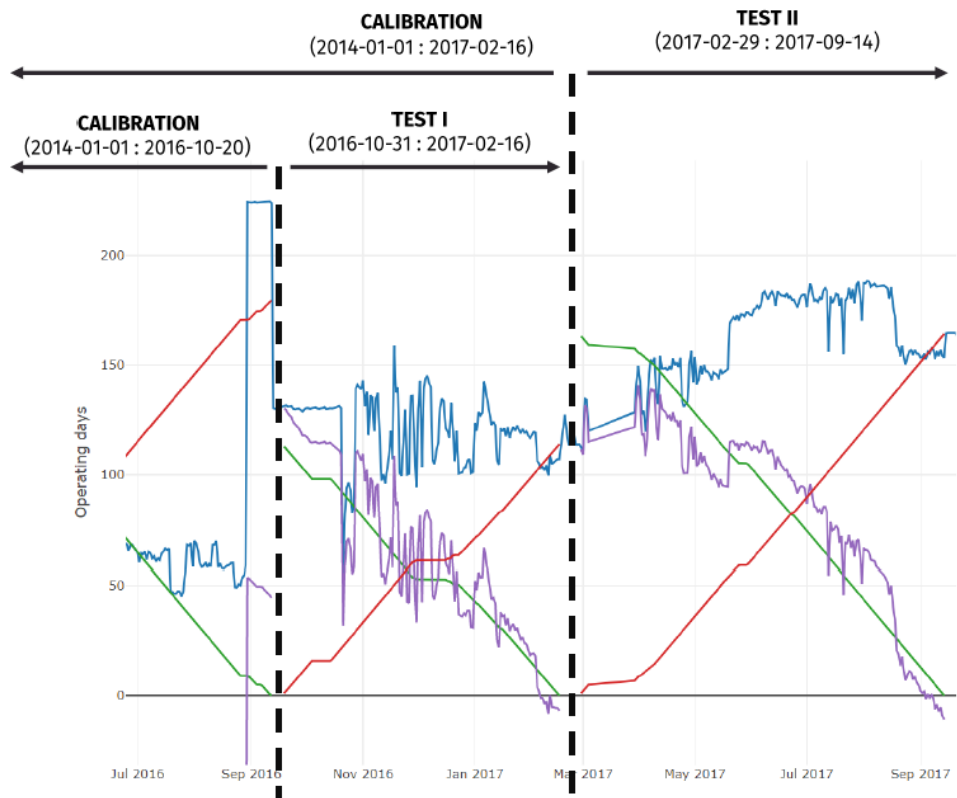
Trained on 2016-2017



PREDICTION METRICS

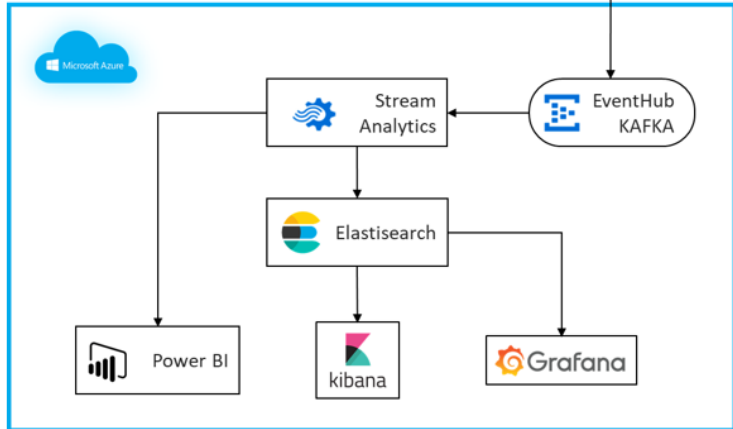
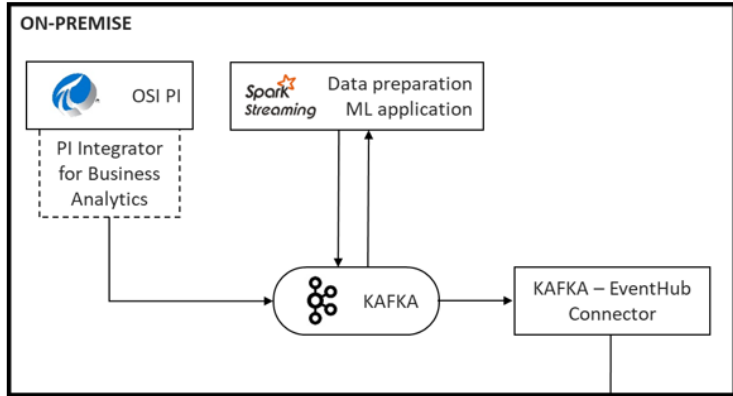


PREDICTIONS



	TEST I	TEST II	Overall 2017
Accuracy	0.94	0.97	0.96
F1	0.80	0.88	0.84
Precision	1.00	0.78	0.85
Recall	0.67	1.00	0.83
Specificity	1.00	0.96	0.98

STREAMING SOLUTIONS AND VISUALIZATION



- SELF-SERVICE BI TOOL
- PART OF THE MS STACK
- DESKTOP VERSION (NOT APPLICABLE)
- POWER BI EMBEDDED + MOBILE APP
- TO BE USED WITH STREAM ANALYTICS AS DATA SOURCE

MS POWER BI

- ELASTICSEARCH DATA VIS PLUGIN
- OPEN-SOURCE
- PART OF THE ELASTIC STACK (ELK)
- ELASTICSEARCH AS THE ONLY SOURCE
- SaaS, TRAINING, SUPPORT, CONSULTING

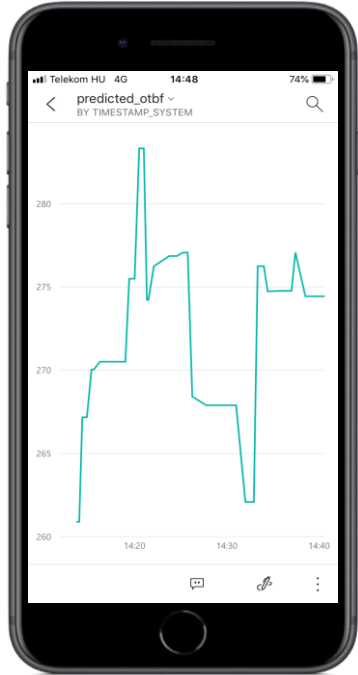
KIBANA

- DATA VIS FOR MONITORING
- OPEN-SOURCE
- HANDLES 30+ DATA SOURCES
- GRAFANA CLOUD, GRAFANA ENTERPRISE
- TRAINING, CONSULTING

GRAFANA

OSIsoft PI Advanced Integrator connected PI to Kafka and Hadoop

COMPARISON OF INTEGRATION TOOLS



VISUALISATION IN
SMART PHONE

FEATURE	CUSTOM-MADE INTEGRATOR	PI INTEGRATOR
DEVELOPMENT/SETUP TIME	10+ days	1 day
LOAD FREQUENCY	Daily	Minutely
COMPLEXITY	Predefined tags	Selected tags
PRICE	\$	\$\$\$

”For testing purpose and short-term solutions custom-made integrator can be enough.

For long-term solution PI Integrator is suggested.”



CHALLENGES

- Volatile Business Environment
- New business request - > waiting quick fix
- Competition situation about digitalization world-wide and region
- Difficulty of cleansing business data to Advanced analytics engineer

SOLUTION

- **Rapid application development with PI AF** - > Quick solution for business pain points
- **Collecting smart data** (cleansing) in PI AF -> Easy handover and collaboration between Business Analyst and subject matter expert
- Innovative thinking - **Quick proof of concepts**

BENEFITS

- Effective **solution covers all business area and processes**
- **Optimize yields, energy, asset health**
- **Mitigate risk** in processes
- Valuable **digital transformation**



The goal is to turn data into information, and information into insight.



Carly Fiorina

Presenters



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- kott@mol.hu

Questions?

Please wait for
the **microphone**

State your
name & company



Please remember to...

Complete Survey!

Navigate to this session in
mobile agenda for survey

An advertisement for the OSISOFT PIWorld app. The background is a dark blue gradient with a subtle pattern. On the left, the text "TO DOWNLOAD APP, SEARCH OSISOFT" is written in white, bold, sans-serif font. Below this text are two black buttons: "Download on the App Store" with the Apple logo and "GET IT ON Google Play" with the Google Play logo. On the right, a smartphone is shown vertically, displaying the OSISOFT PIWorld logo on its screen. The logo consists of a stylized white atom symbol above the text "OSISOFT PIWorld".

