ARTIFICIAL INTELLIGENCE & SOFTWARE

GABY ULJEE, CEO

TKH Innovations

TKH Capital Markets Day - 12 June 2019

SMART TECHNOLOGIES – TECHNOLOGY STRATEGY

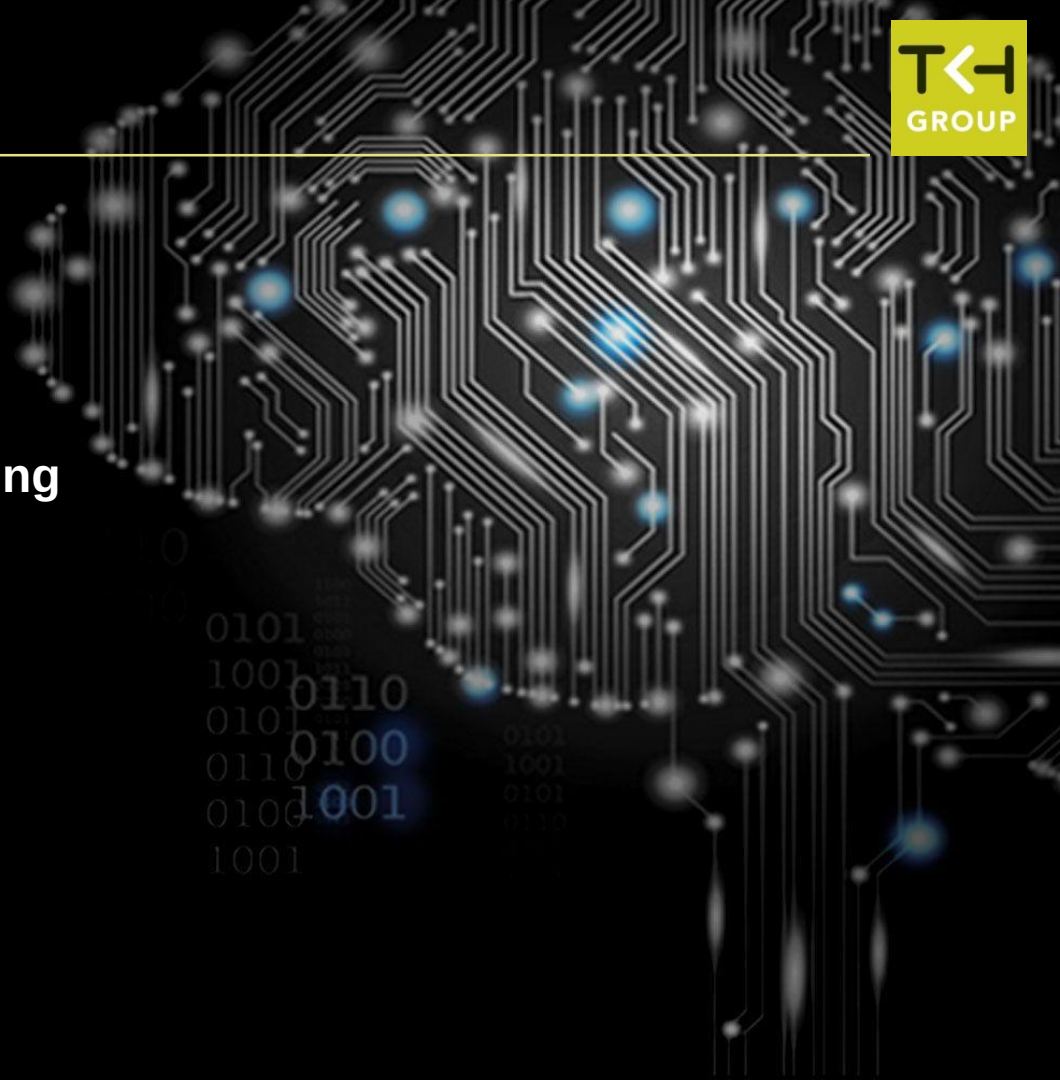
DEVELOPMENT FOCUS

- Artificial Intelligence (AI)
  - Distinct from and disrupt traditional solutions
- Cloud & Edge computing
  - Monolithic towards Microservices based architecture will bring us more scalability against lower costs
- Data processing
  - From data to more useful information and/or humanlike actions
- Data & Data-Exchange standards
  - Reusable data sources across our 4 core technologies will bring us more functionality and/or solutions

Fred Wilson - venture capitalist

"Artificial Intelligence has inserted itself into our every day lives. Whether its a home speaker system that we can talk to, or a social network that already knows what we are about to go out and purchase, or a car that can park itself and change lanes on the highway automatically, we are seeing AI take over tasks that we used to have to do ourselves."

ARTIFICIAL INTELLIGENCE



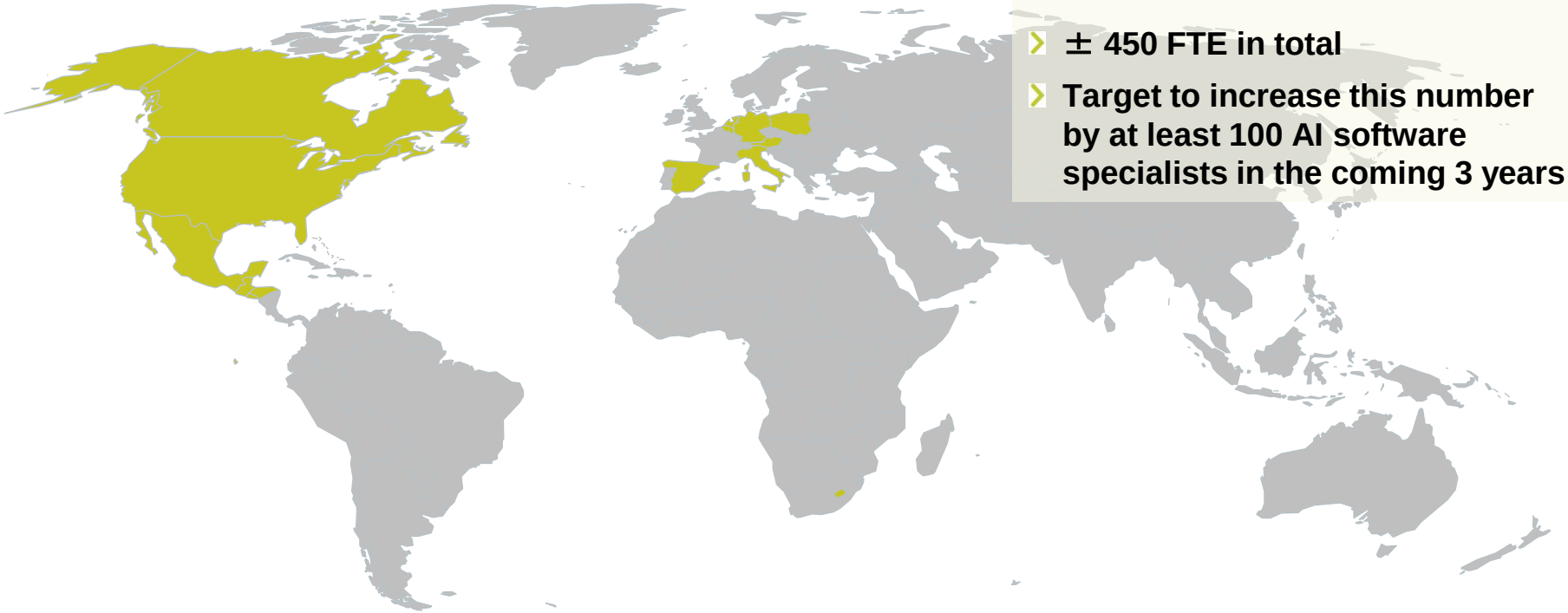
- We are in the age of AI
- It is not something that is coming
- It is here!

TKH AND ARTIFICIAL INTELLIGENCE

Inspection & Identifying	Automation	Optimize & Protect	Self-learning

SMART TECHNOLOGIES – TECHNOLOGY STRATEGY

CURRENT SITUATION DEVELOPMENT HUBS



- ± 450 FTE in total
- Target to increase this number by at least 100 AI software specialists in the coming 3 years

35% of our proposition comes out of software related solutions

TKH INNOVATIONS, AI & DATA COMPETENCE CENTER

- Established in 2012 to support OPCOs with:
  - Developing new concepts, like who-is-who, who-is-where, etc..
  - Enhancing (portfolio) synergies, like style-guides, data-exchange, data collection, way-of-working, etc.
  - Preventing double work, like the generic software ARC library
  - Supports OPCO with shift to new technologies, like migration to micro-services and implementing AI
  - **Provides framework for AI related applications incl. ML models**
  - Provides DevOps cultural philosophies, practices and tools

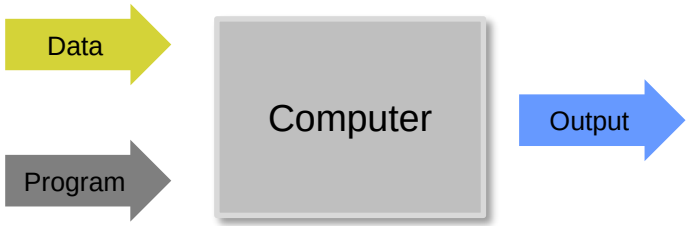
- Team
  - Team of highly skilled AI scientists and senior developers
  - Close corporation with OPCO development programs
    - Advise, Research, Proof of Concepts and Development of Algorithms

What is Artificial Intelligence?

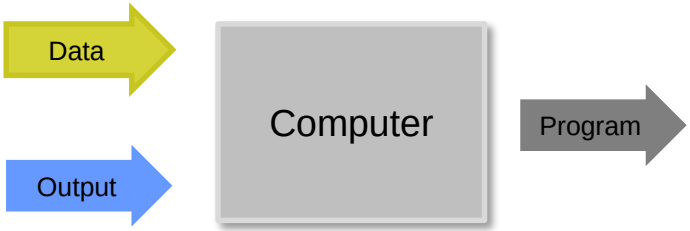
WHAT IS ARTIFICIAL INTELLIGENCE?

Thinking humanly	Thinking rationally
Acting humanly	Acting humanly

Traditional programming

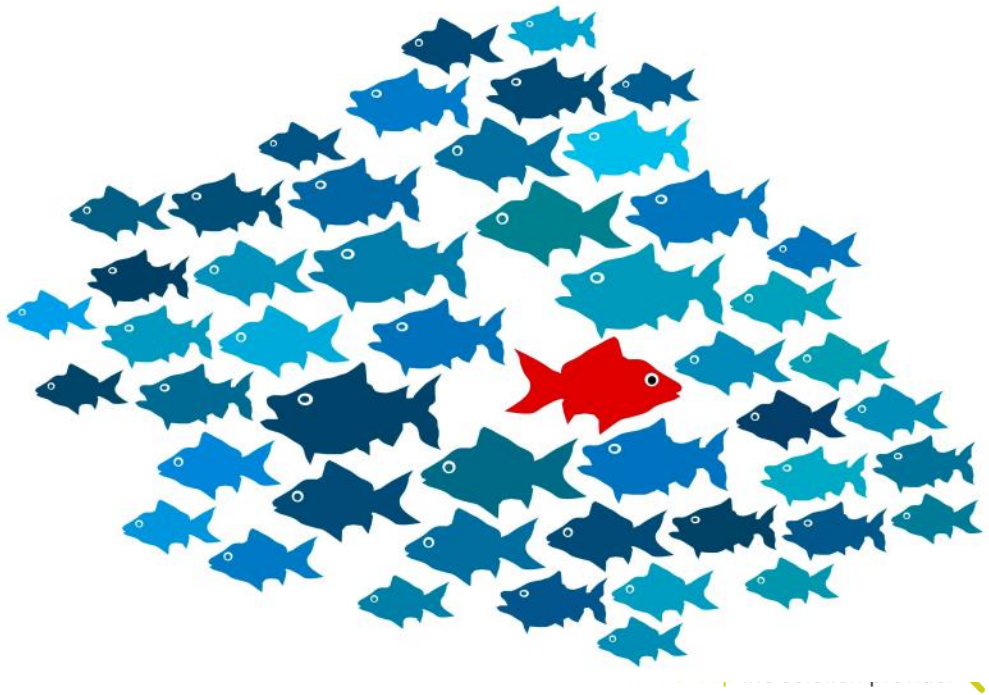


Machine learning

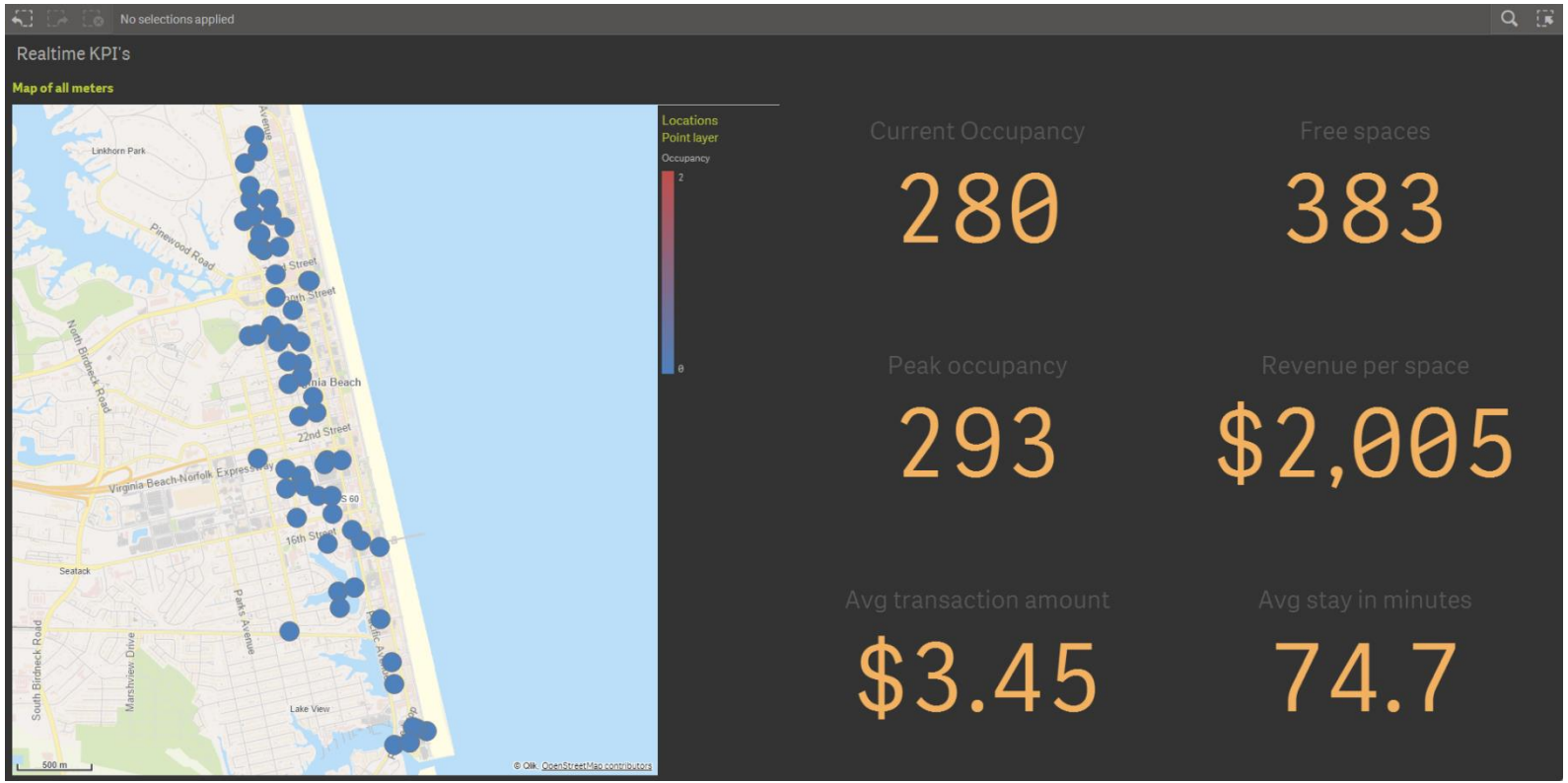


SOLUTION DIRECTIONS

- We focus on solutions in 2 different directions
  - Machine Learning and
  - Cognitive applications



PARKING EXAMPLE



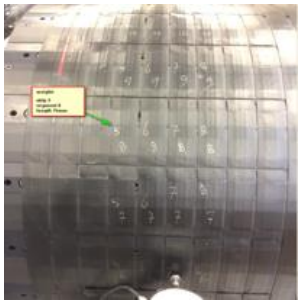
PARKING EXAMPLES

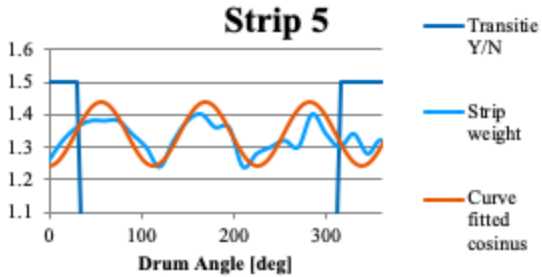
PARKING

VMI - ANTI PULSE CHALLENGE

TIRE BUILDING INDUSTRY

- Current situation:
  - Weight variation during stripwinding
  - Weight difference in correlation with gear pump speed
  - **Pulsation in pressure of rubber valve has direct relation to tire quality**
  - Reduction of pulsation has been implemented through an anti-pulse
  - **Anti-pulse is hand-made and evaluated by eye**

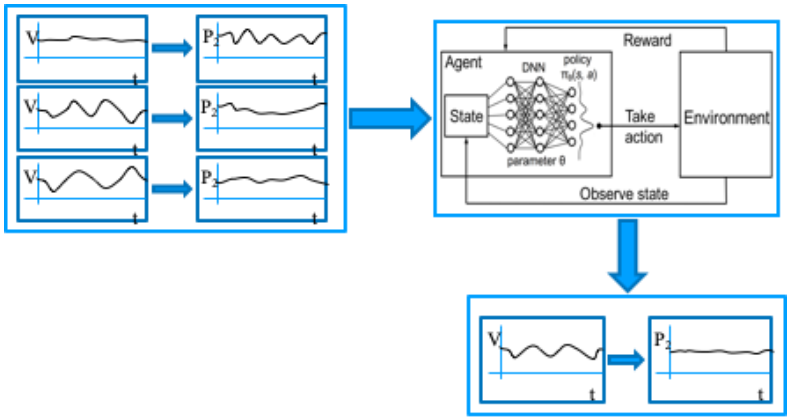




VMI - ANTI PULSE

TIRE BUILDING INDUSTRY

- Development scope:
  - Determine optimal anti-pulse AI model
    - Train model with historical data
  - Design a control algorithm
  - Implement and fine-tune in a test setup
  - Release for use in customer machines



Result

No additional effort needed for different machines/rubbers

Improved tire quality

EVACUATION SYSTEMS, COST & TIME REDUCTION PROGRAM

TUNNEL & INFRA

- Current situation:
  - Manually find optimum settings for Public Announcement system in tunnels to maximize speech intelligibility
  - Labour intensive; **up to a week per 750m of tunnel**
- Proof of Concept:
  - Simulate tunnel with noise and create algorithm to:
    - determine Audio Playback Delays for individual speakers
    - determine optimal synthesizer settings to emphasize import audio frequencies
    - verify speaker locations and if wiring is correct (speakers are not switched)
    - Algorithm designed such that the simulation can be replaced with real hardware in a real tunnel

Result

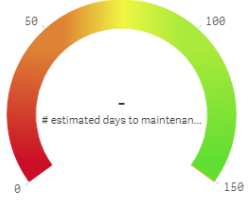
Week of manual labour can be replaced with AI software that does the job in 10 hours

PREDICTIVE MAINTENANCE

No selections applied

Days to maintenance

Estimated days to maintenance

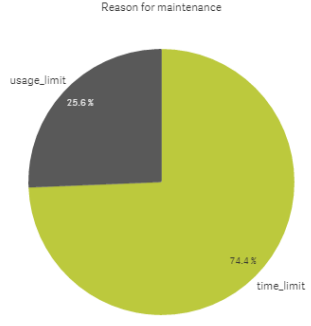


Date picker

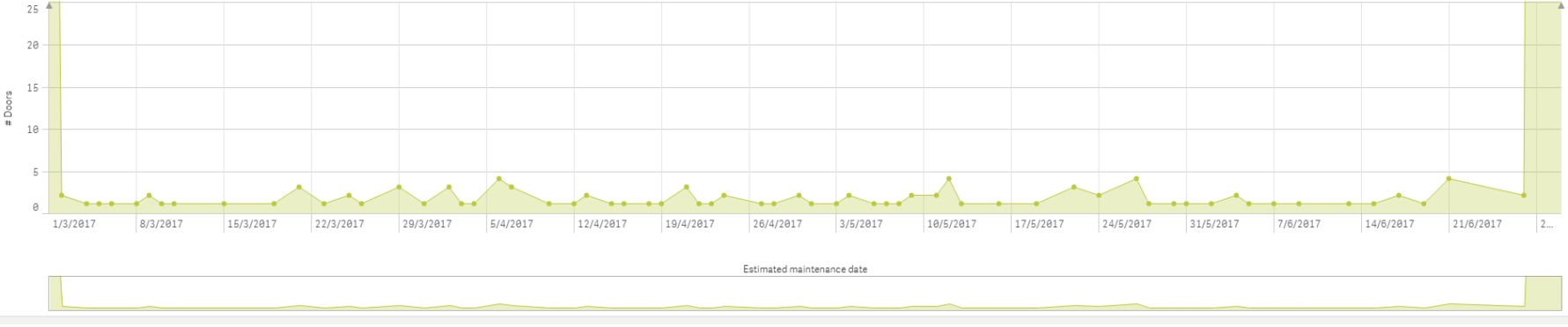
Estimated days to maintenance per door

door ID	description	reason of mainte...	# estim... days to	estim... date of maint...	date last maint...
335_344	4.02 - Draaideur Gng > Lft (07.10.3.1)_['4.09 - Tr.hs midden > Gng (07.10.7.1)']	usage_limit	0	01-03-2017	01-01-2017
235_53	3.03 - Draaideur Gng > Lft (07.06.3.1)_['3.19 - Draaideur NOS > NPO (07.05.7.2)']	usage_limit	0	01-03-2017	01-01-2017
130_132	06.BG Container IN Bin.d (06.08.5.2)_['06.BG Container UIT Bin.d (06.08.5.1)']	usage_limit	0	01-03-2017	01-01-2017
216_92	06.BG Trappenhuis West In (06.06.8.2)_['06.BG Trappenhuis West Uit (06.06.8.1)']	usage_limit	57	27-04-2017	01-01-2017
110_86	1.10 - P.Garage>Gr. Klima (07.18.6.2)_['1.11 - Gr. Klima>P.Garage (07.18.6.1)']	time_limit	121	30-06-2017	01-01-2017
207_62	06.2 Trappenhuis West In (06.05.7.2)_['06.2 Trappenhuis West Uit (06.05.7.1)']	time_limit	121	30-06-2017	01-01-2017
81_83	6.01 - Tr.Hs>Gng Evenm. (07.14.8.1)_['6.02 - Gng Evenm.>Tr.Hs (07.14.8.2)']	time_limit	121	30-06-2017	01-01-2017
261_262	6.12 - Tr.Hs >Evenm. IN (07.14.1.1)_['6.13 -	time_limit	121	30-06-2017	01-01-2017

Doors to maintain per reason



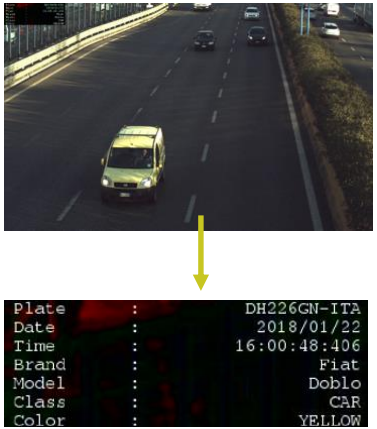
Doors per estimated maintenance week



TATILLE - BRAND CLASS COLOR AND MODEL

TUNNEL & INFRA PARKING

- Business goal:
  - **Increase the added value in the security business** (ANPR + BCC with the same camera)
- Functionality:
  - Vision-based detection of brand, class, color and model for travelling vehicles
- Solution:
  - AI model for image analysis
  - Completely vision-based
  - Travelling vehicle, no check point needed



Result

AI solution provides complete vehicle information and simplified vehicle retrieving process

TATILLE - AUTOMATIC TRAFFIC ANALYSIS

Traffic Density

Stop

Smoke

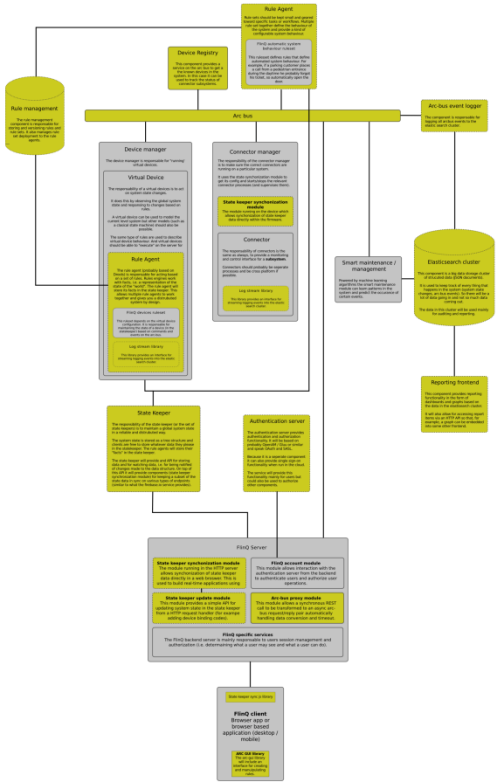
Wrong Way

Lost Cargo

Pedestrian

TKH SECURITY - FLINQ FORESIGHT

- Dot on the horizon
  - **Fully automated & cognitive control room solution**
- Technology
  - Microservices based Architecture
    - scalable, reliable, traceable and secure
  - 70% of all the software components are reusable for other TKH OPCOs
- AI
  - Trace and learn behaviours from human operators
  - AI Model for automated event prediction and handling
  - **Cognitive awareness**



TKH CAPITAL MARKETS DAY

Thank you for your attention

12 June 2019

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