

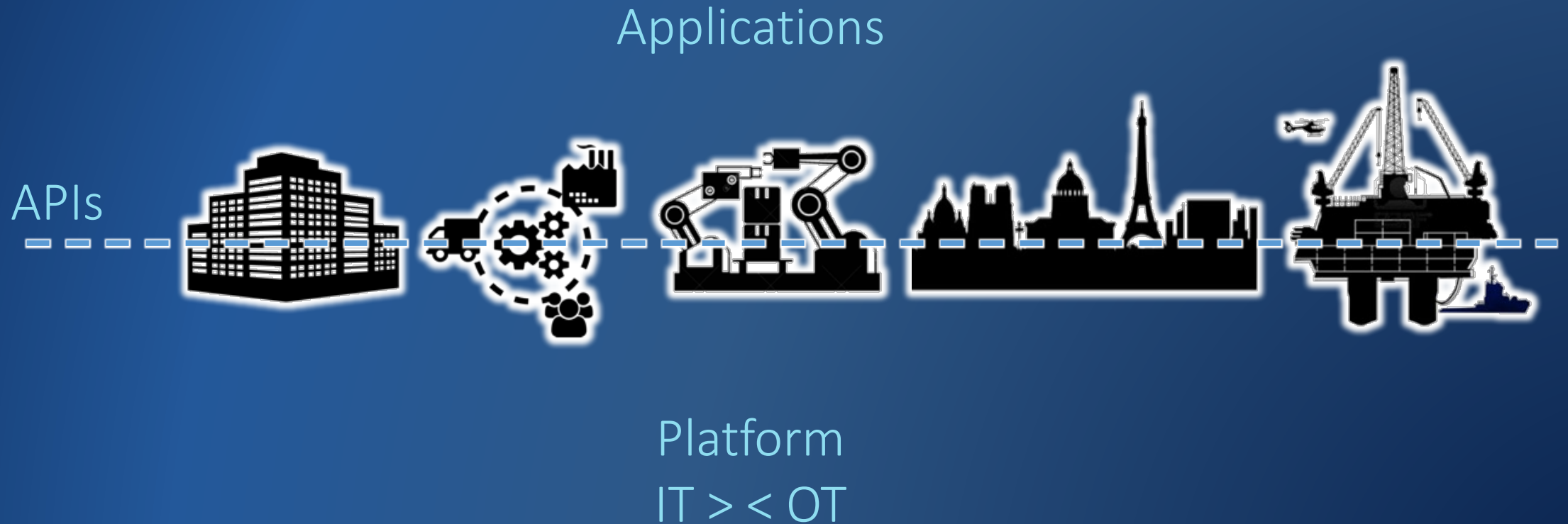


The emergence of cognitive architecture

TERATEC FORUM 2017 - Algorithms and Deep Learning, new paradigms and challenges?

Guillaume de St Marc
Sr Director, Engineering, Paris Innovation & Research Lab
June 2017

Digitization Age: The Rise of Programmable & Collaborative Infrastructures!



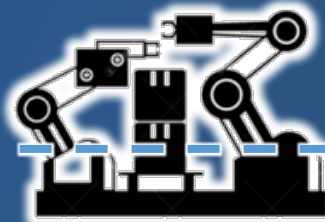
Digitization Age: The Rise of Programmable & Collaborative Infrastructures!

Software Defined Process

Virtualized Functions

DevOps & Automation

APIs

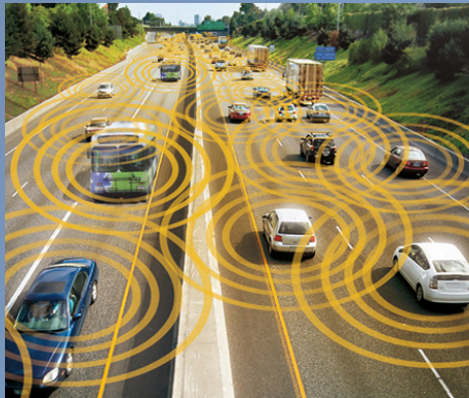


Wearable
Augmented Reality
Artificial Intelligence

Big Data Analytics
Vision & Sensor Fusion
Block Chain

Cloud to Fog Architectures
IoT Connectivity
IPv6, ICN, 5G, LPWAN

Digital Nervous System



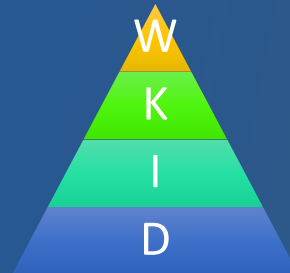
Connected cars will send 25 gigabytes of data to the cloud every hour



The current A350 model has close to 6,000 sensors across the plane and generates 2.5 Tb of data /day

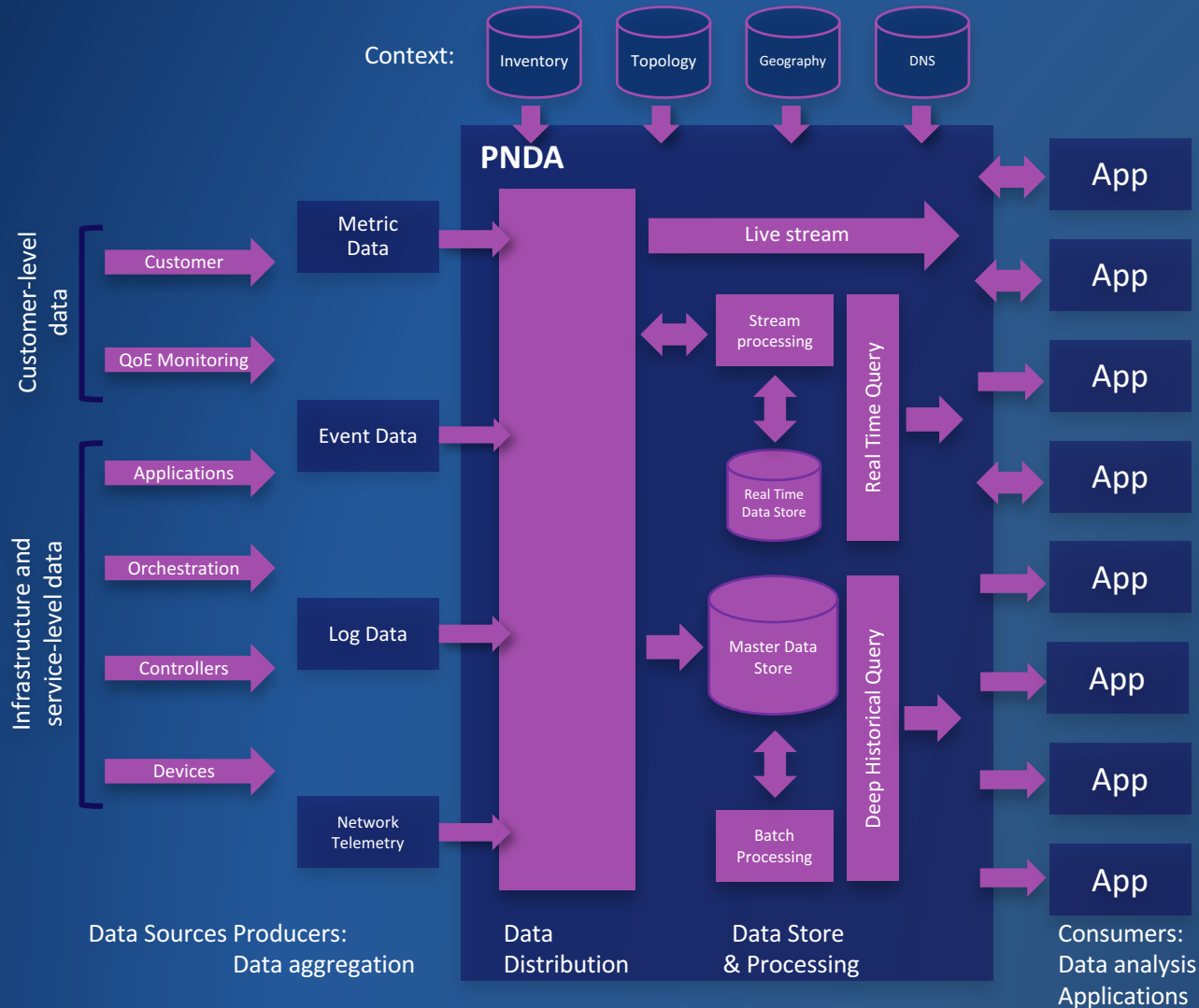


The total volume of data generated by IoT will reach 600 ZB per year by 2020



- What: Monitor/Detect
- Why: Analyze
- When: Predict
- What if: Optimize

www.pnda.io



- Simple, scalable open data platform
- Open architecture for data aggregation distribution and processing
- Horizontally scalable platform for analytics and data processing applications
- Support for near-real-time stream processing and in-depth batch analysis on massive datasets
- Leverages best current practise in big data analytics



Fog to cloud Architectures



Why Compute at the Edge?

There may not be enough network bandwidth

 **Data Reduction**

Most of the data is not interesting

 **Filtering**

The use of data may be at the edge

 **Latency Optimization**

Computation can be optimized for some purposes

 **Partitioning**

Data normalization

 **Application Simplification**

Data redirection based on the content of the data

 **Dynamic Changes**

Data time stamping for later forensic analytics

 **Analytic Support**

General Patterns

2 Tier

IoT Device

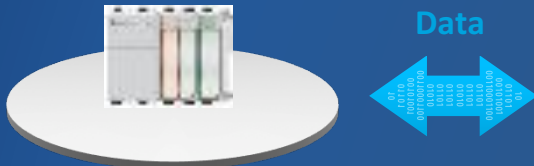


Cloud



3 Tier

Factory Device



Local Feedback

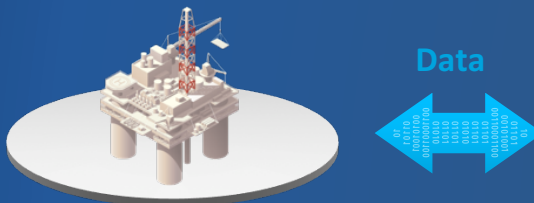


Data Center



4 Tier

Oil Rig



Edge Processing



Aggregation Node



Data Center



Methodology

5



Cloud

Converge to a single common global interface



(IoT Cloud Services)

4



Data Center

Converge to a common location



3



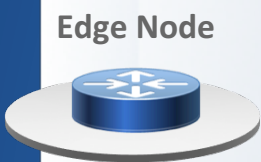
Fog Node

Converge to a common data format



Edge & Fog Fabric

2



Edge Node

Converge to a common protocol

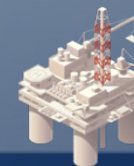


1



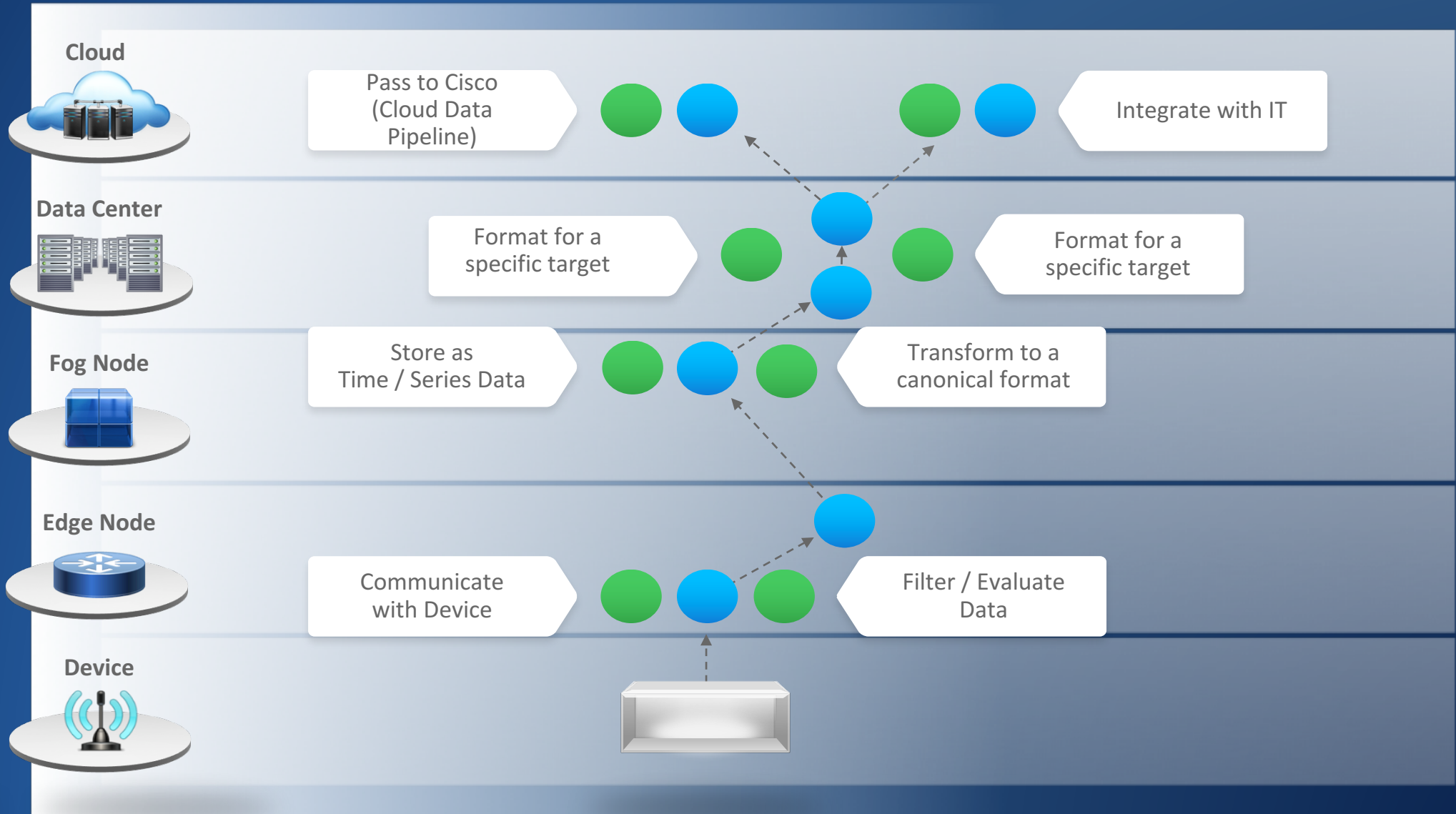
Device

Many interfaces, protocols, data formats

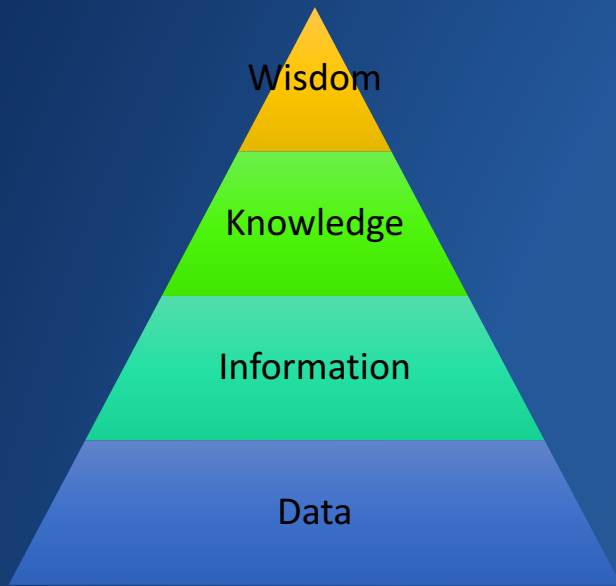


Edge and Fog "Fabric" example

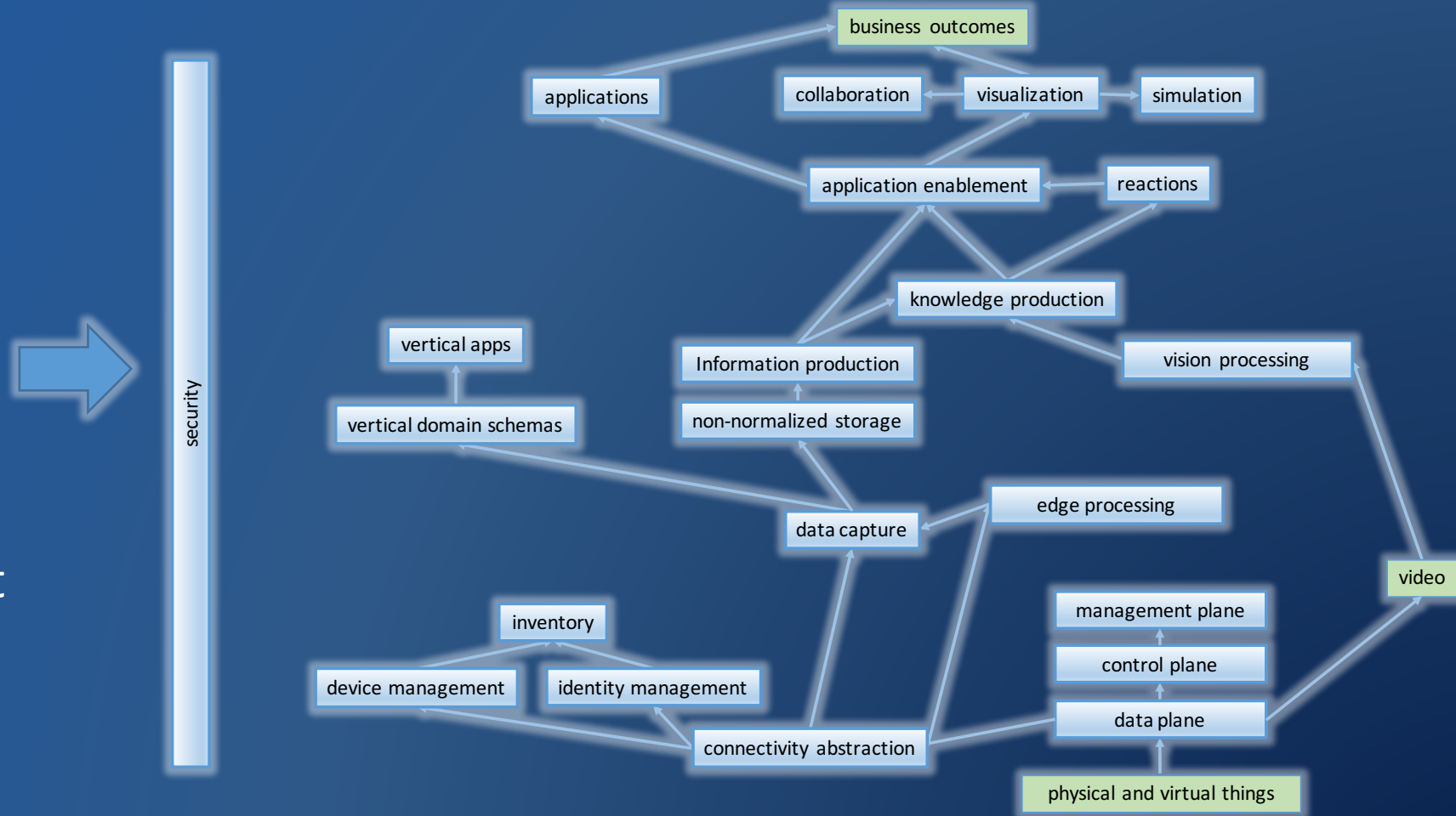
5
4
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2
1



Supervising Complex Systems of Systems



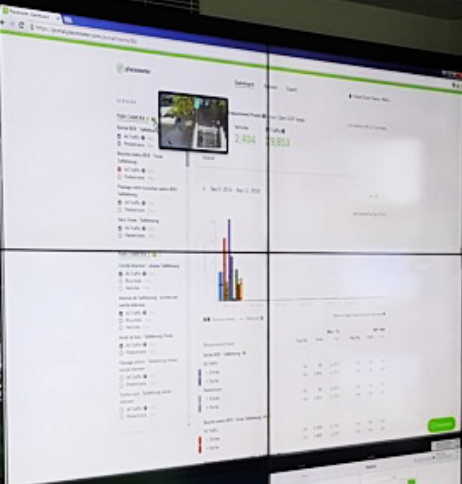
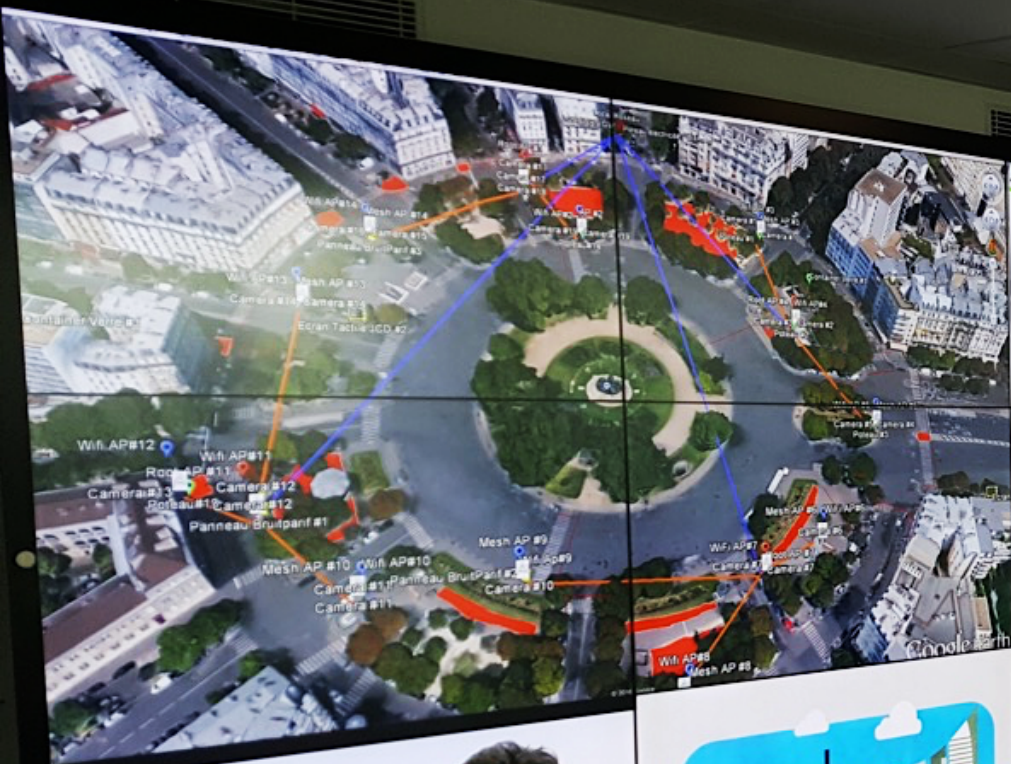
- What: Monitor/Detect
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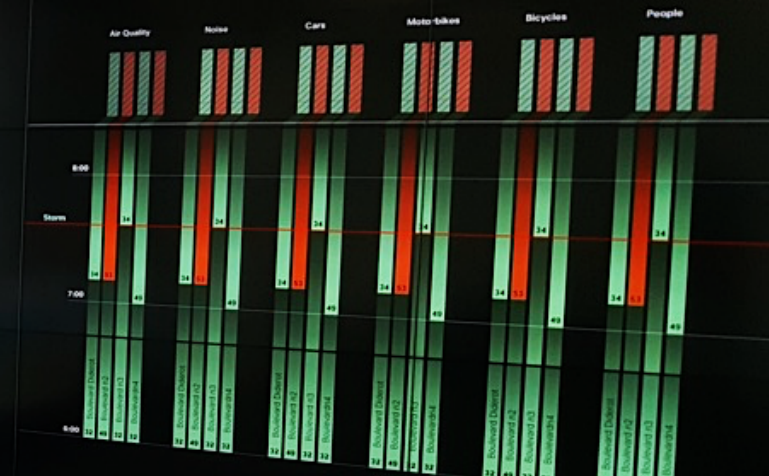
Digitizing Systems of Systems



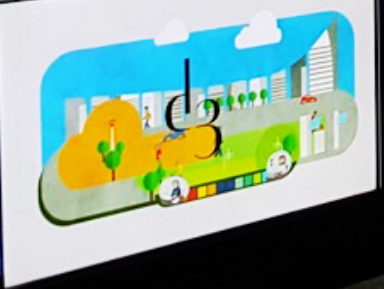
- What: Monitor/Detect
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A vertical panel with three images and text. The top image shows a metro station with the text "1,5k METRO". The middle image shows a bus with the text "1,5k BUS". The bottom image shows a weather scene with the text "1,5k WEATHER". Below the images is a small social media-style post with a profile picture and the text "Ya une arène Pokemon Go sur la place de la nation !!".



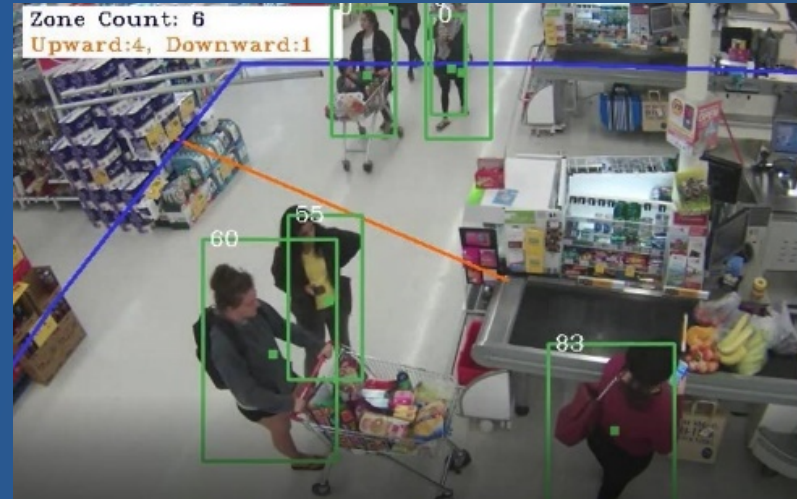
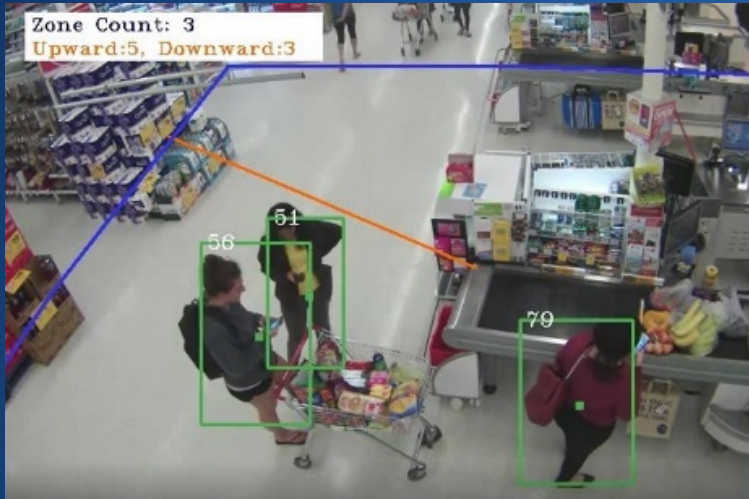
An advertisement for LoRa Alliance. It features a man in a dark suit and glasses speaking. The text reads: "actility Making Things Smart LoRa Alliance Our first large CDA win". The background shows a city skyline.



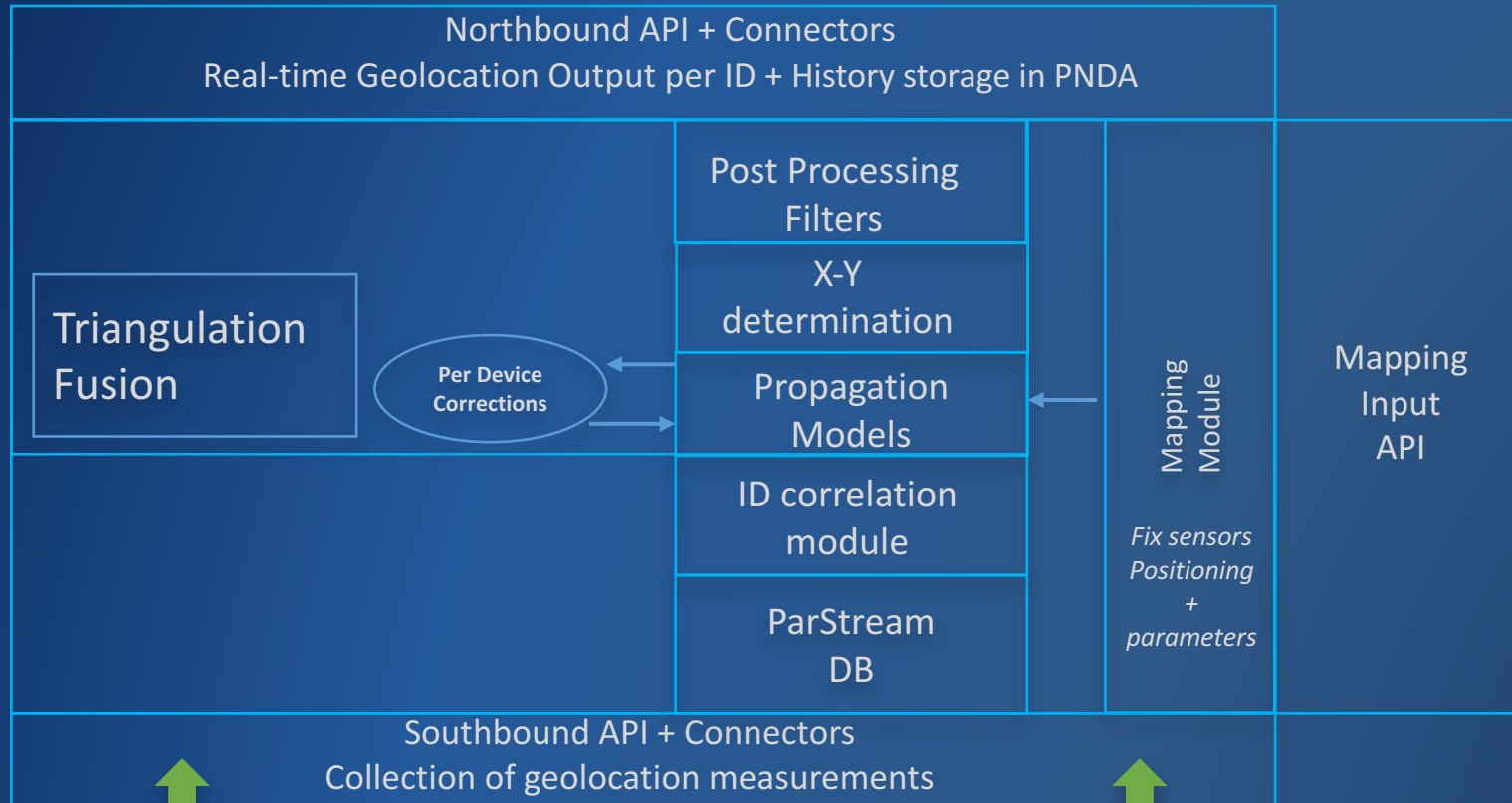
A recommendations panel with the title "Recommendations". It features four icons: a bicycle for "Ride Bike", a shopping bag for "Shop", a basketball hoop for "Hoops", and a playground for "Visit Playground". The panel is simple and easy to read.

Cisco PIRL Immersive Lab - Paris Innovation & Research Lab

Deep Fusion: Queue management



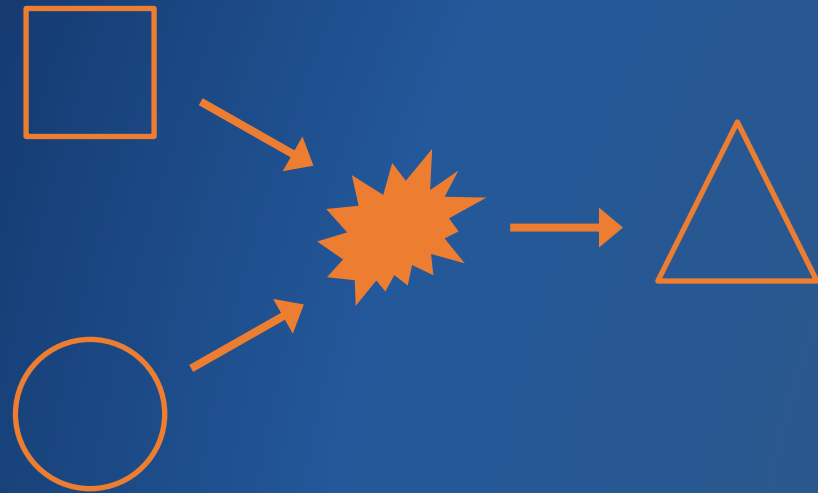
In-door geo-location



Sensor Data Fusion Frameworks

□ Fusion of Numerical Properties

- Kalman filter



□ Fusion of Symbolic Properties

- Symbols represents abstractions
- Abstractions represent categories, relations, actions, events and knowledge
- Knowledge is represented by (hyper)-graphs with (hyper)-edges connecting relations-to-relations or (hyper)-relations connecting relations with nodes

Behavioral emergence at scale

100 IPv6 ADDRESSES FOR EVERY ATOM ON EARTH

IP V6

340,282,366,920,938,463,463,374,607,431,768,211,456



4,294,967,296

IP V4

SIMD vs MIMD processing

SIMD

- GPU
- Deep Learning processing

MIMD

- Mostly relying on CPU to date
- Fit Complex Graph Topology Operations

Agent supervision

