Machine Intelligence for Telecom and Beyond

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- Adjunct Professor, Cyber-Physical Systems, KTH

- **Ericsson**
  - Mobile Infrastructure, Digital Services, Managed Services
  - 180 countries
  - 100K employees
  - 45000 patents
  - 1 bn subscribers on networks managed by us

- **Ericsson Research**
  - 2G, 3G, 4G and 5G were invented at Ericsson Research
  - 50% are PhDs
  - 40% of all Ericsson patents come from Ericsson Research

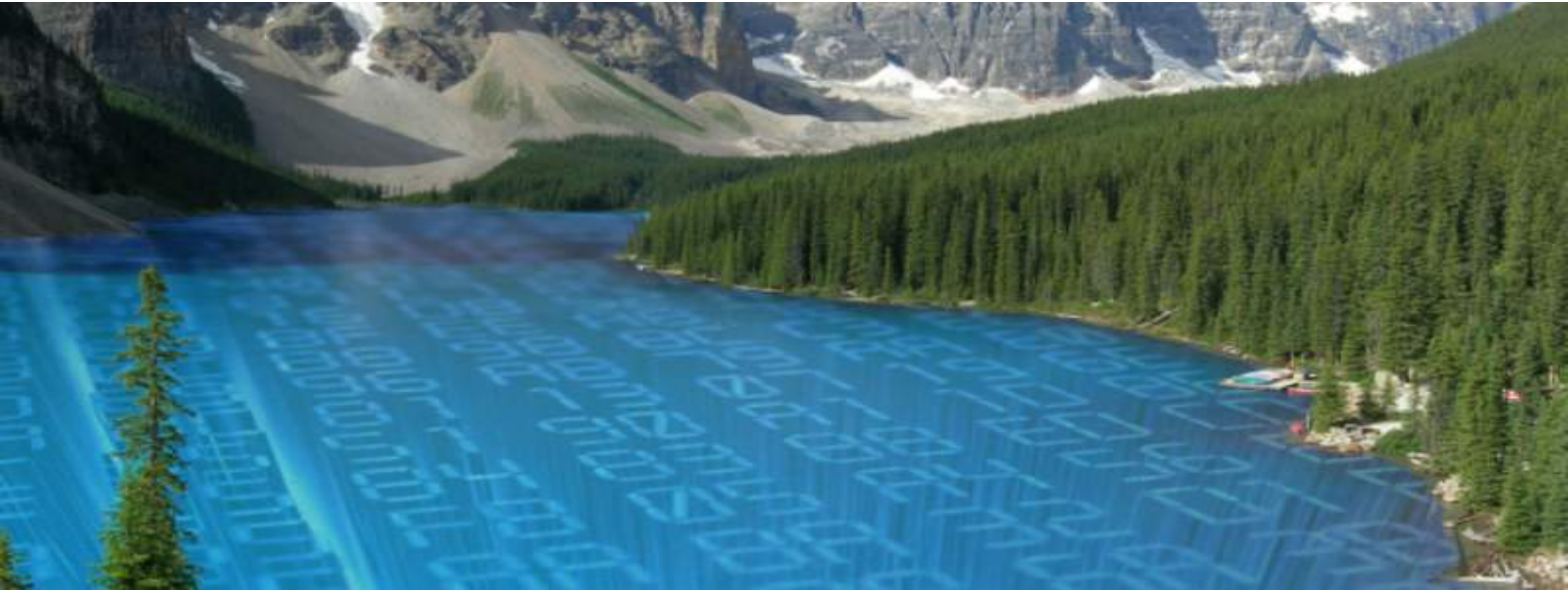
- **Elena Fersman**
  - Head of Research Area Machine Intelligence and Automation, Ericsson Research
  - Adjunct Professor in Cyber-Physical Systems specialized in Automation, KTH
  - fersman.blogspot.com, instagram: elenafersman

Do you know what’s common between these?

Cortana | Lucida | Mika | Amelia | Alexa | Siri | Watson

Data Lake

Cortana | Lucida | Mika | Amelia | Alexa | Siri | Watson



Hi, what is Machine Intelligence?

Hi Elena, according to Ericsson definition,
Machine Intelligence is a combination
of Machine Learning and Artificial Intelligence.

What’s MSDP?

MSDP = Multicast Source Discovery Protocol
MSDP = Multiservice Delivery Platform
MSDP = Managed Services Delivery Platform

What are your sources?

Ericsson Product Catalogue, CPI Store, Wikipedia, and your calendar

Tell me when site X is likely to require a preventative maintenance visit?

Judging from the site profile learned over time, and the current site behavior, the maintenance will be needed in Q3 2018.


TALK IS
CHEAP,
BUT
ACTIONS ARE
PRICELESS
LOVETHISPIC.COM

What actions did you do for Operator A’s network last month?

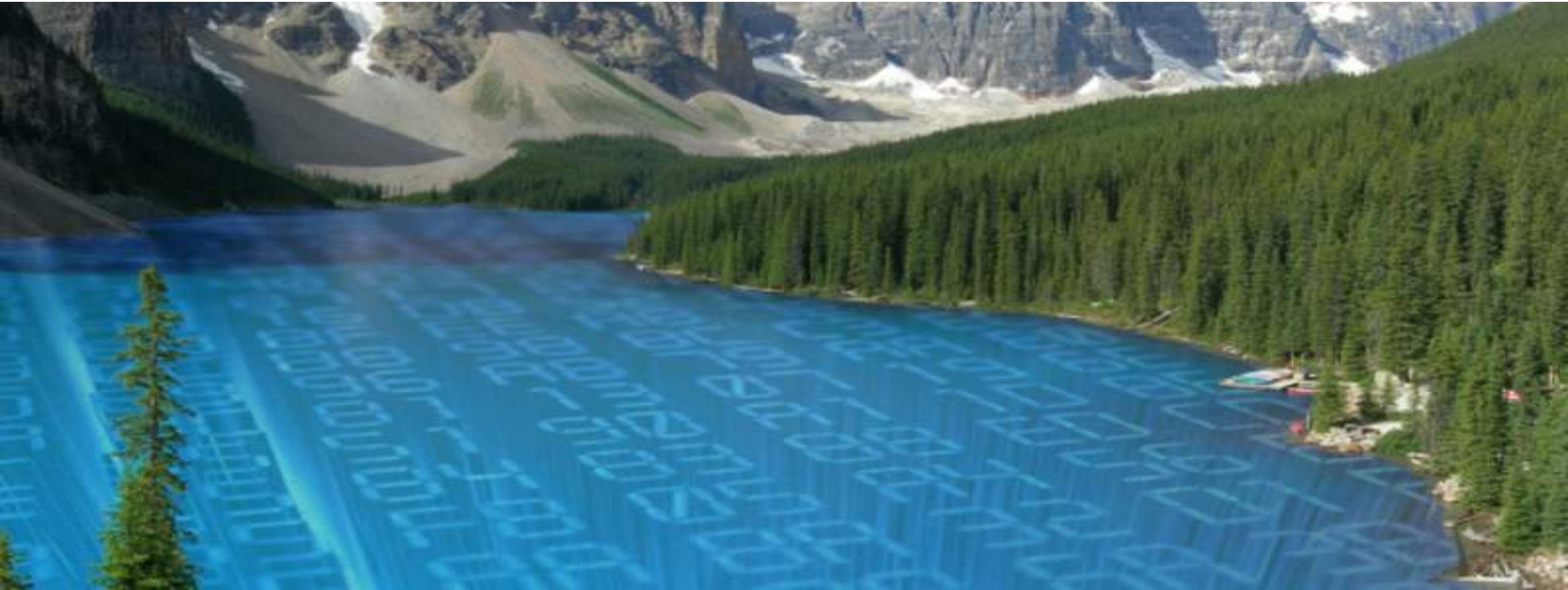
I changed parameter configuration in the 5G network nodes. I also sent offers to subscribers with high risk of churn.

Why?

Because we need to stay competitive towards our enterprise customers while keeping our subscribers happy.

The value is in data

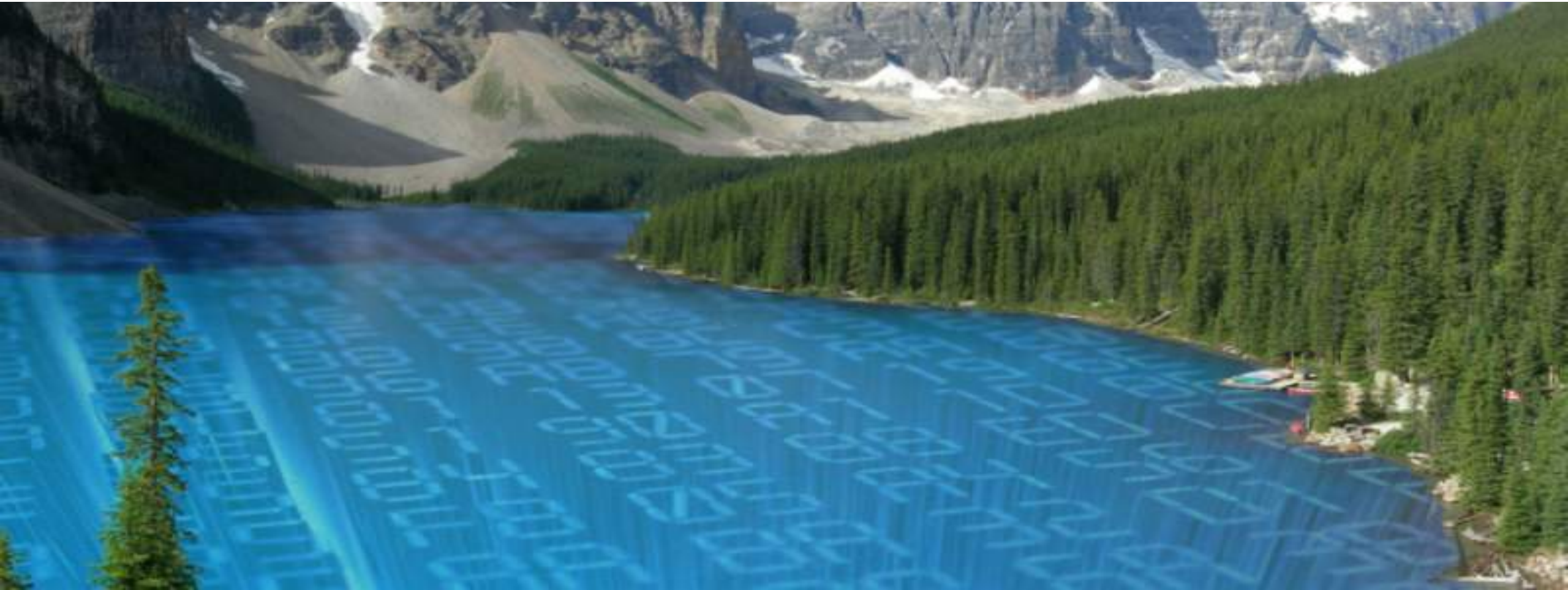
Cortana | Lucida | Mika | Amelia | Alexa | Siri | Watson



From raw data to action

Data and its processing

What’s in the data lake?

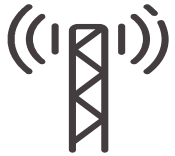


ONE DAY IN THE LIFE OF A MEDIUM SIZED NETWORK (~10M CUSTOMERS)

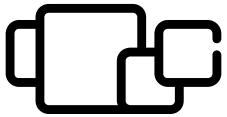
Web pages
700,000,000

Internet sessions (PDP)
66,000,000

Videos
40,000,000



Radio sessions (RAB)
120,000,000



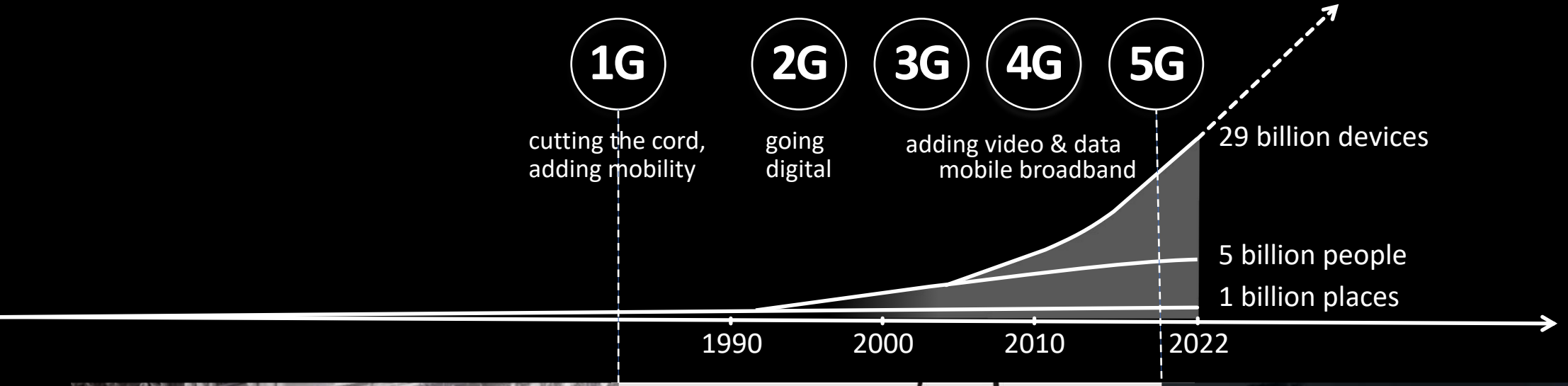
+200 more types of events

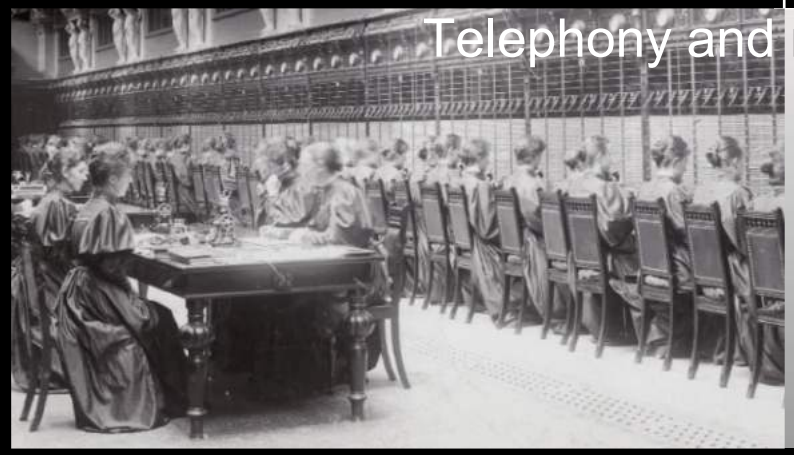
Handovers (HSDSCH-CC)
300,000,000

Sum data
10→100 TB/day

Real-time data rate
100,000→1,000,000 events/second

5G – a foundation for digitalization





Telephony and mobile broadband

A digital infrastructure for industrial and societal transformation

5g USE CASES


SENSORS EVERYWHERE
BROADBAND AND MEDIA EVERYWHERE
SMART VEHICLES, TRANSPORT
INFRASTRUCTURE, MONITOR AND CONTROL
CRITICAL CONTROL OF REMOTE DEVICES
INTERACTION HUMAN-IOT

Evolution to 5G will see increase in network complexity

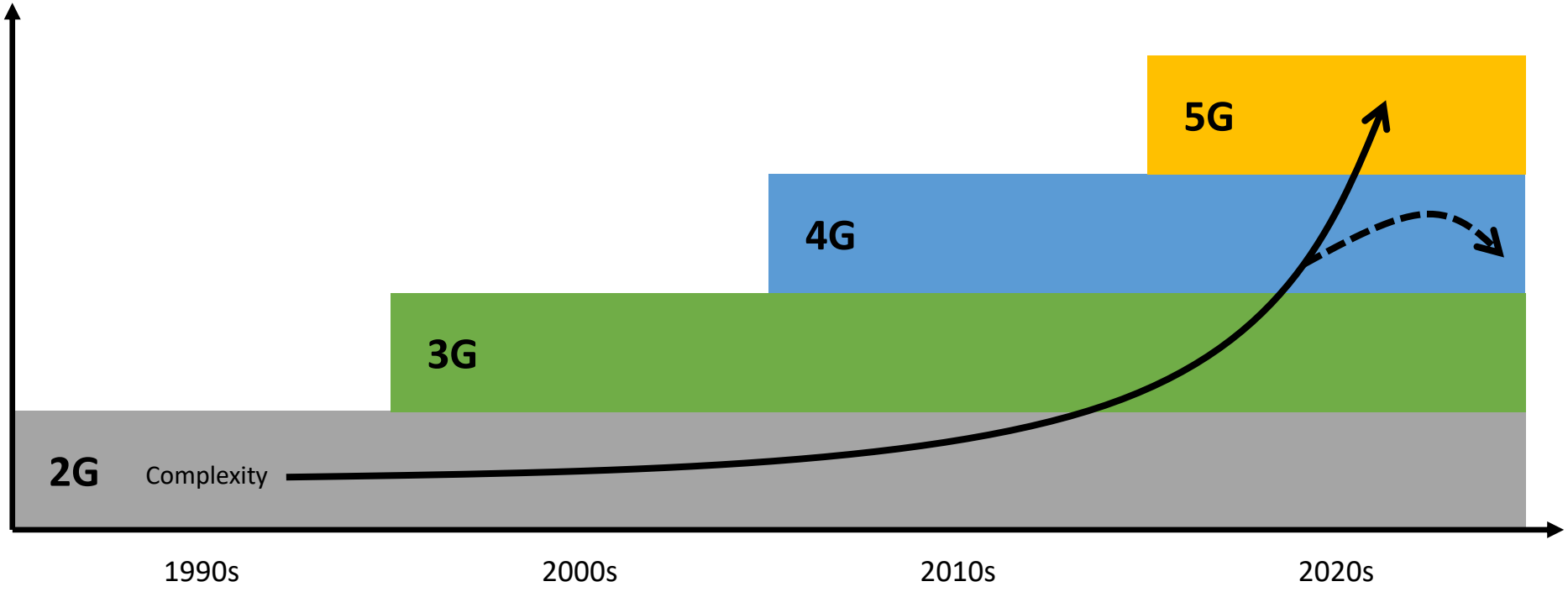
Multiple coexisting technologies

Network function virtualization

Vast differences in terminal capability

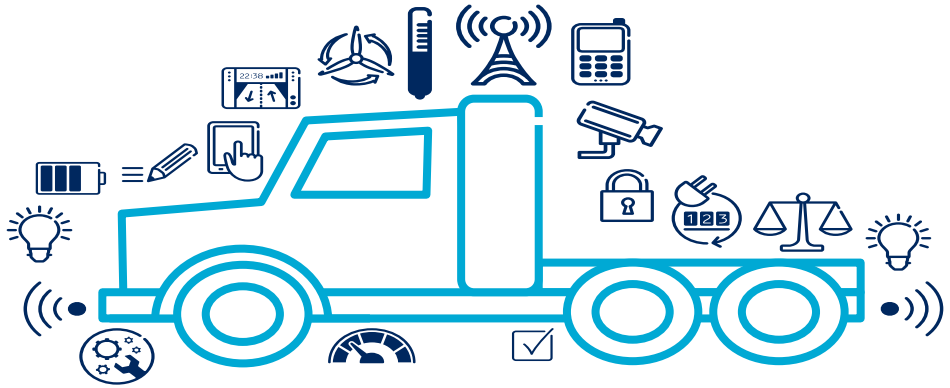
Significant variation in traffic demand

Completely new & varied use cases

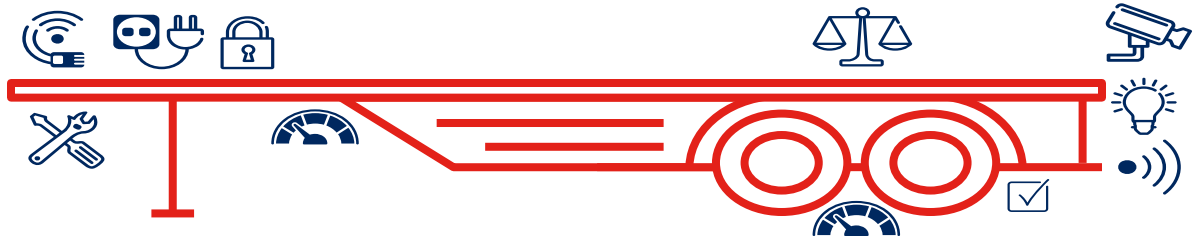


Dealing with opex and network performance in this environment will go beyond the reach of humans

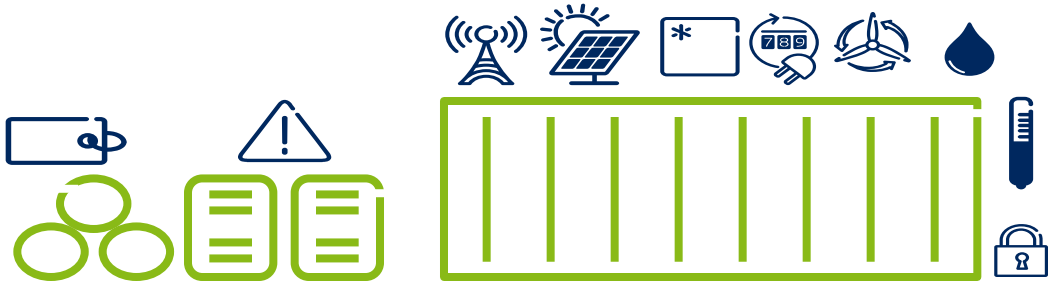
Complexity in the connected world

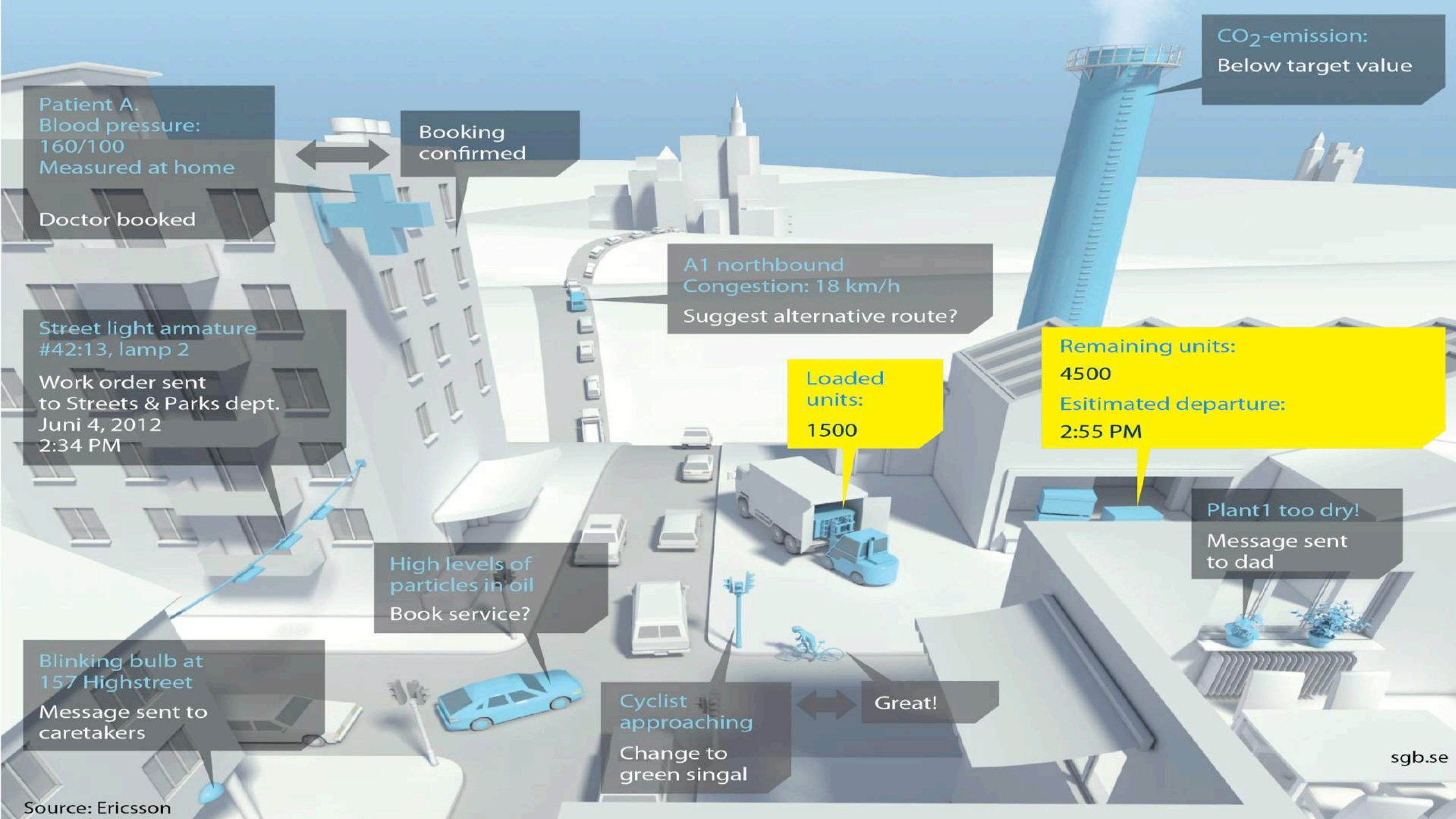


e.g. transportation systems are increasingly complex and full of sensors, smart devices and steered by multiple services running on both devices and cloud

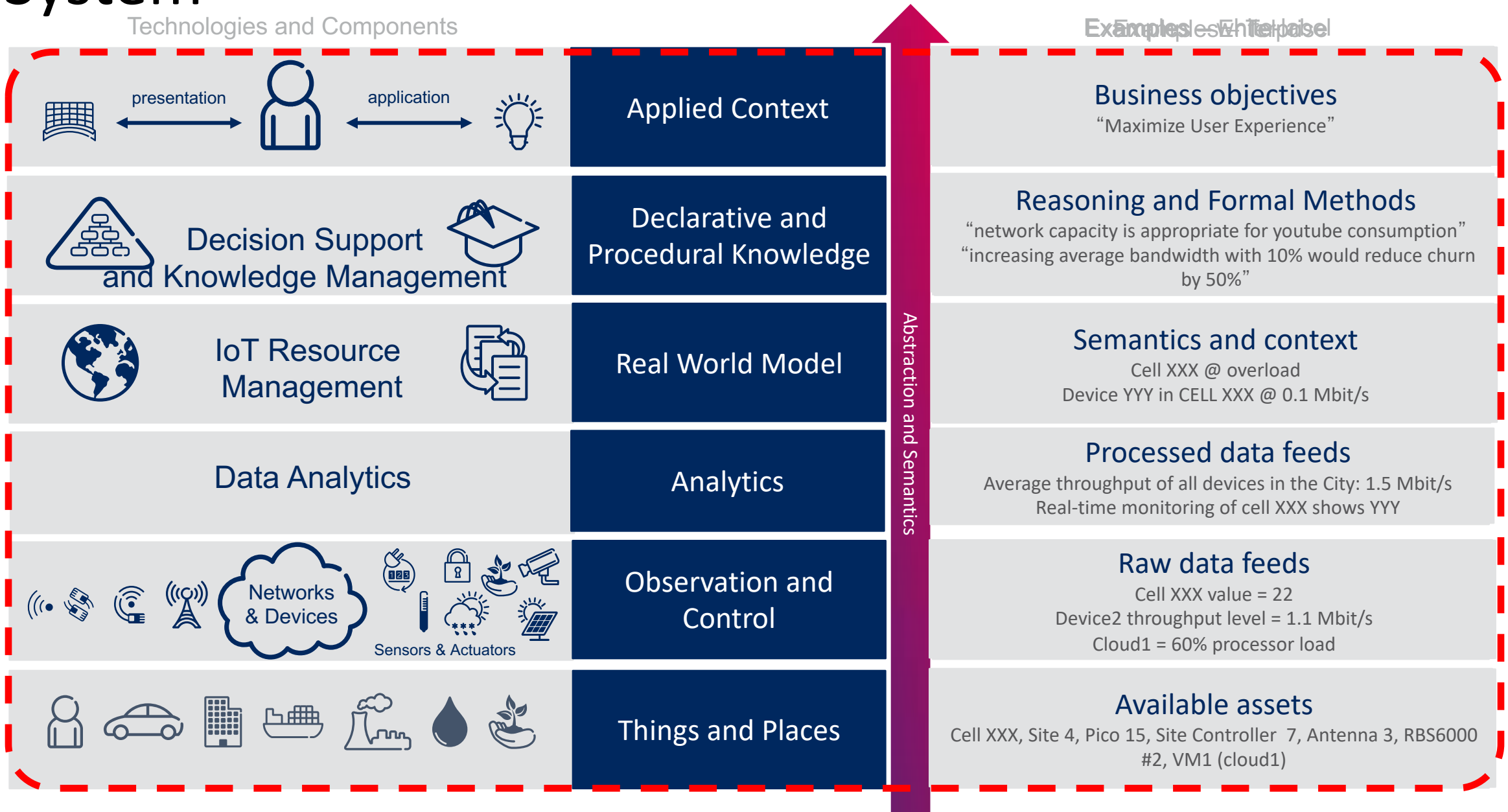


the integration of components like trucks, trailers and containers shall be simple

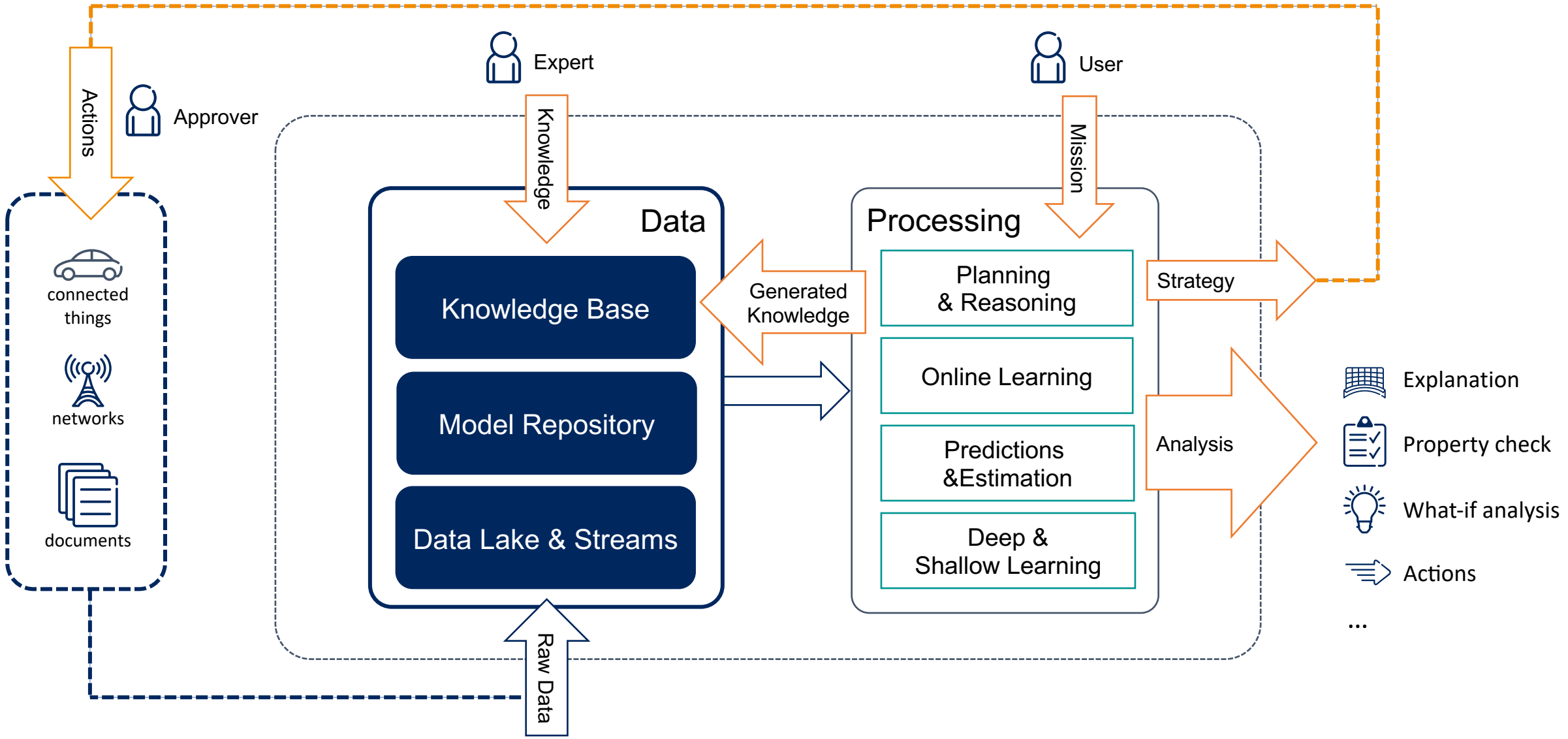



Patient A.
Blood pressure:
160/100
Measured at home
Doctor booked
Booking confirmed
A1 northbound
Congestion: 18 km/h
Suggest alternative route?
CO_2-emission:
Below target value
Street light armature
#42:13, lamp 2
Work order sent
to Streets & Parks dept.
Juni 4, 2012
2:34 PM
Loaded units:
1500
Remaining units:
4500
Esitimated departure:
2:55 PM
Plant1 too dry!
Message sent to dad
High levels of particles in oil
Book service?
Blinking bulb at
157 Highstreet
Message sent to caretakers
Cyclist approaching
Change to green singal
Great!
sgb.se
Source: Ericsson

Management and Operations of a Cyber-Physical System



Technologies behind the scenes



Intelligent Site

Power failures detection

Prediction accuracy

- 85% in combined prediction of site down
- 85% in battery degradation
- 90% in grid outage

Sleeping cells prediction*

7 out of 10

Sleeping cells correctly predicted up to 24h in advance

Field dispatch prevention

9 out of 10

unnecessary site visits predicted correctly

Digital Twin - site profiling

At least 1

anomaly detected in

44% of sites

over a month

SLA/ KPI degradation*

KPI accuracy

Throughput : 80%

Latency : 85%

Use Case – Sleeping Cell Prediction

Description

Identify the patterns or triggers that predict the likelihood of a site going to sleeping/silent mode, and automate actions to resolve the issue.

Data Requirements

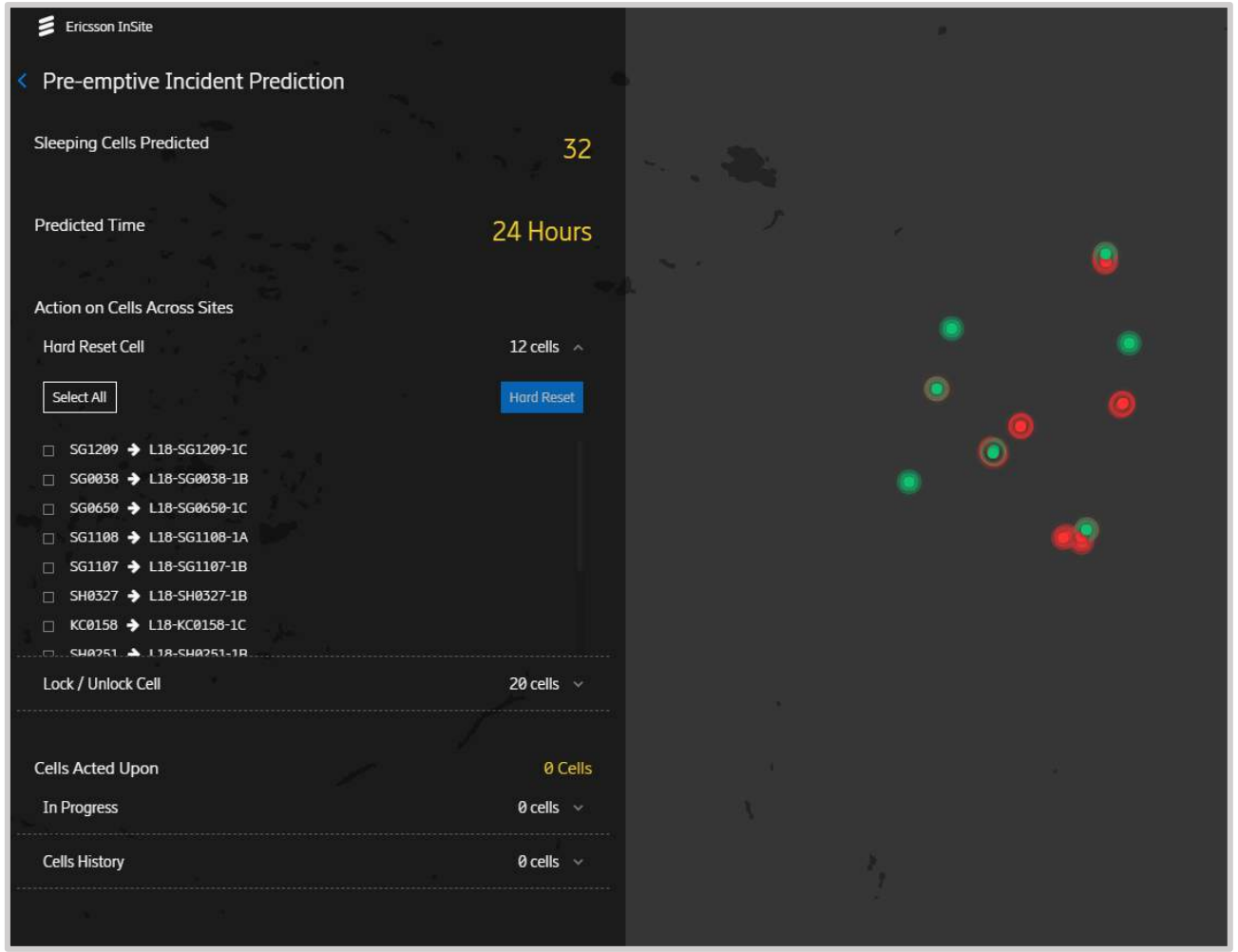
PM Counters, Site Parameters (incl. physical locations), Configuration Management, CTUM, Cell Trace and Automation logs

Data Models & Algorithms

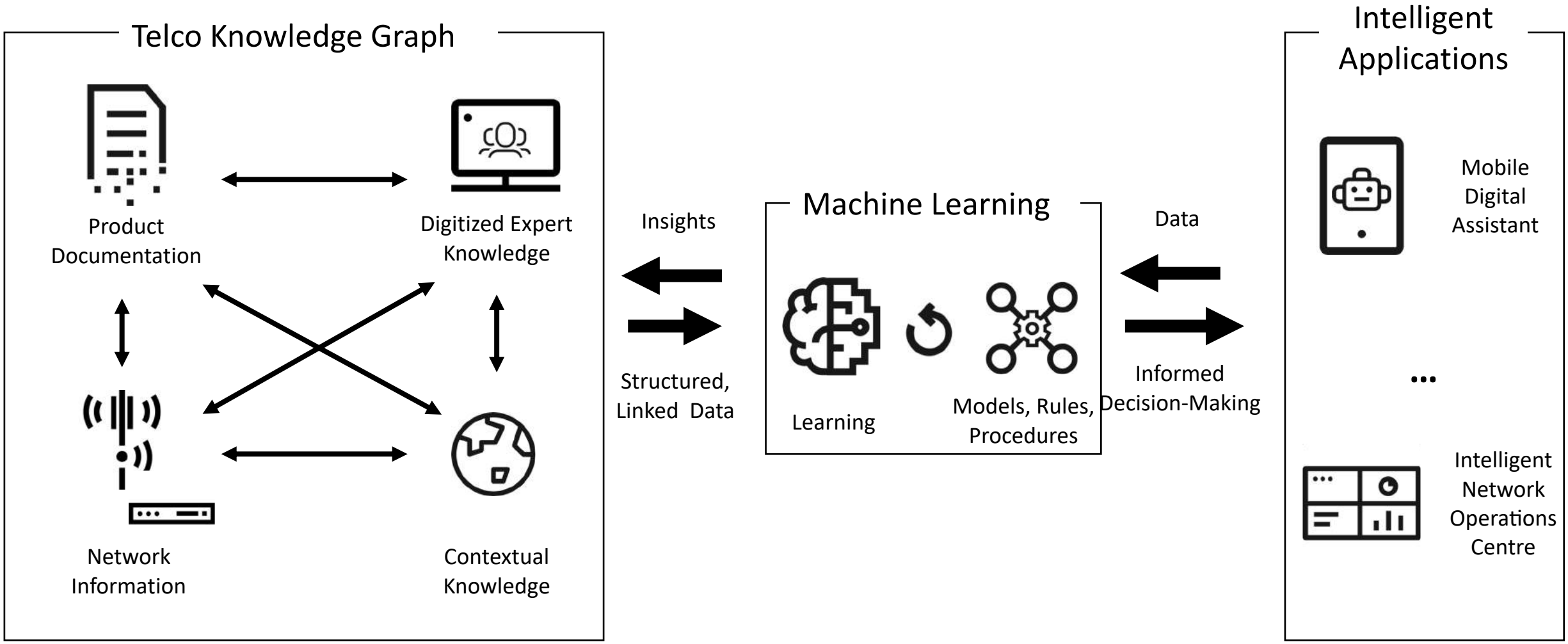
Conditional Inference Tree

Automations

Trigger pre-defined runbooks in an Automation tool to perform remedial tasks (e.g. unlock)



Telco Knowledge Graph



Key insights

Data-driven and data-centric research

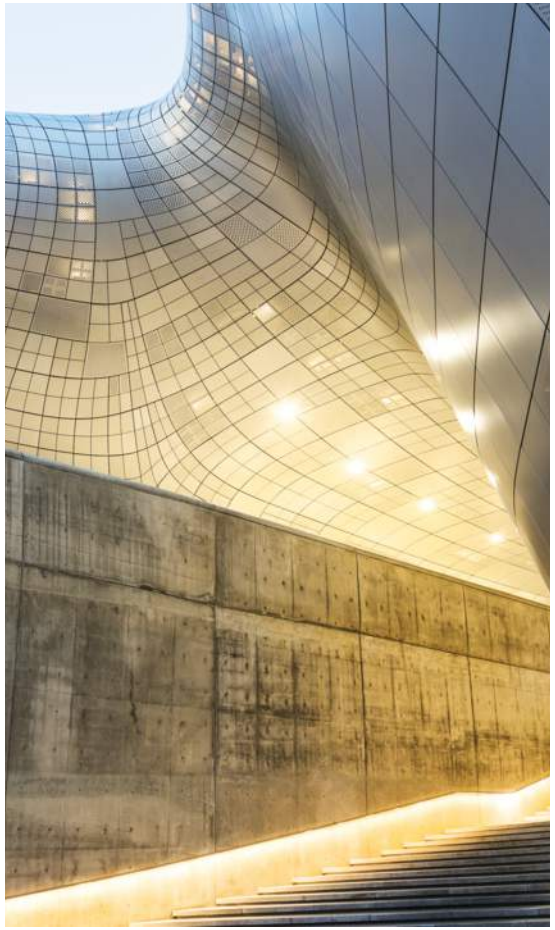
- Dealing with heterogeneity though semantics
- Right data at right time and place
- Keeping the global state together

Mix of MI approaches and techniques

- ML meets Reasoning
- Declarative meets Procedural
- Collaborative Intelligence

Frameworks will be needed for success of MI applications

- Safety
- Trust
- Transparency
- Explainability
- Privacy




Questions &
Answers

www.ericsson.com/research