Solving Connected Train Technology Obstacles with Open Architecture Computers

Valentin Scinteie

Kontron America Inc.,

Business Development Manager, Transportation

AGENDA

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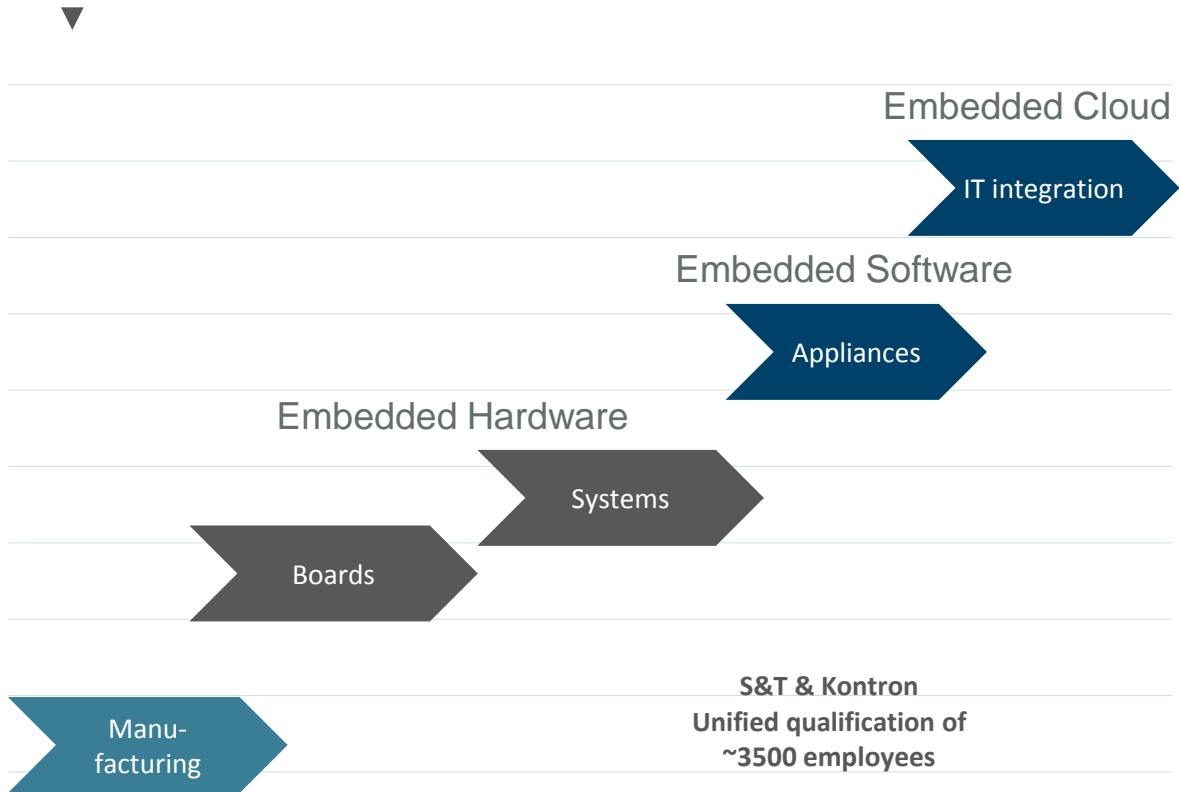**01** KONTRON COMPANY INTRODUCTION

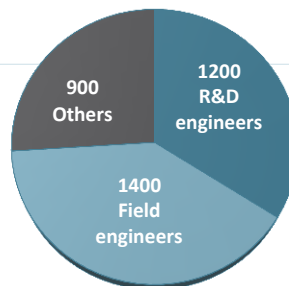**02** TECHNOLOGY CHALLENGES

03 EMERGING TECHNOLOGIES

04 INNOVATIVE RAIL SOLUTIONS

WHO WE ARE
E2E IOT SOLUTIONS FROM EDGE TO CLOUD TO ENTERPRISE

Embedded Cloud

IT integration

Embedded Software

Appliances

Embedded Hardware

Systems

Boards

Manu-
facturing

**S&T & Kontron
Unified qualification of
~3500 employees**

s&t

- Application Software (1800 Engineers)
- Security SW for IoT solutions and private cloud offering
- IoT head end Systems – Embedded Cloud
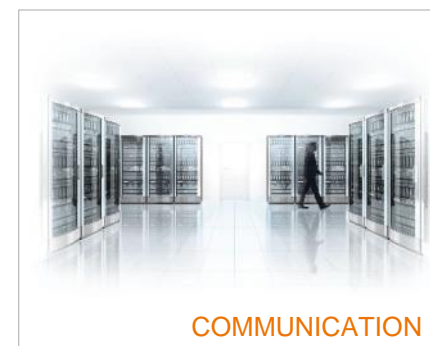
kontron

- Installed base > 4 Mio. embedded Computers (operating)
- Strong embedded computer portfolio
- Security SW for IoT solutions and private cloud offering

innoconn
An Innovative Foxconn Member

- #1 electronic assembly
- Strong Hardware Engineering
- Leader in Server farms (embedded Cloud)

**900
Others**

**1200
R&D
engineers**

**1400
Field
engineers**

PUSHING THE BOUNDARIES OF POSSIBILITIES

ACROSS THE WORLD'S LEADING INDUSTRIES

▼

AVIONICS

TRANSPORTATION

DEFENSE

COMMUNICATION

MEDICAL

AUTOMATION

APPLICATION-READY RAIL PLATFORMS
TRACe™ PRODUCT FAMILY

COTS RAIL COMPUTERS	INTEGRATED HEALTH MANAGEMENT	RUGGED, MODULAR DESIGN	CONNECTED PLATFORM
▶ Ready for customization ▶ A single EN50155 platform for all rolling stock applications	▶ Standalone health management unit ▶ Permanent remote and local monitoring ▶ Easy maintenance	▶ Fanless, passive cooling ▶ Maintenance free, health management	▶ LoRa-MQTT Gateway ▶ COTS standalone IoT Gateway

TRACe B304-TR   TRACe G304-TR   TRACe M304-TR   TRACe V304-TR   TRACe V407-TR   TRACe HMID104-CK

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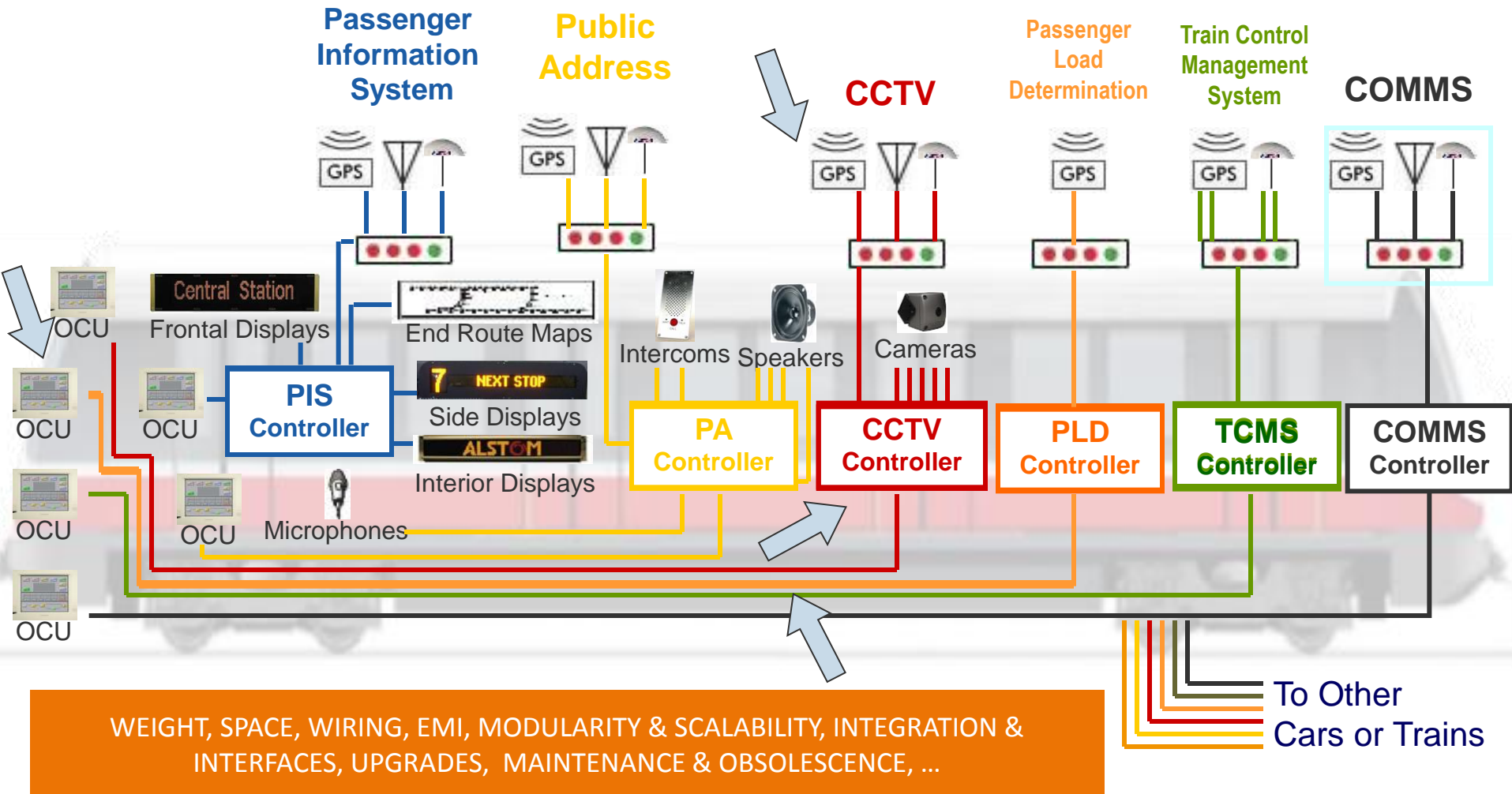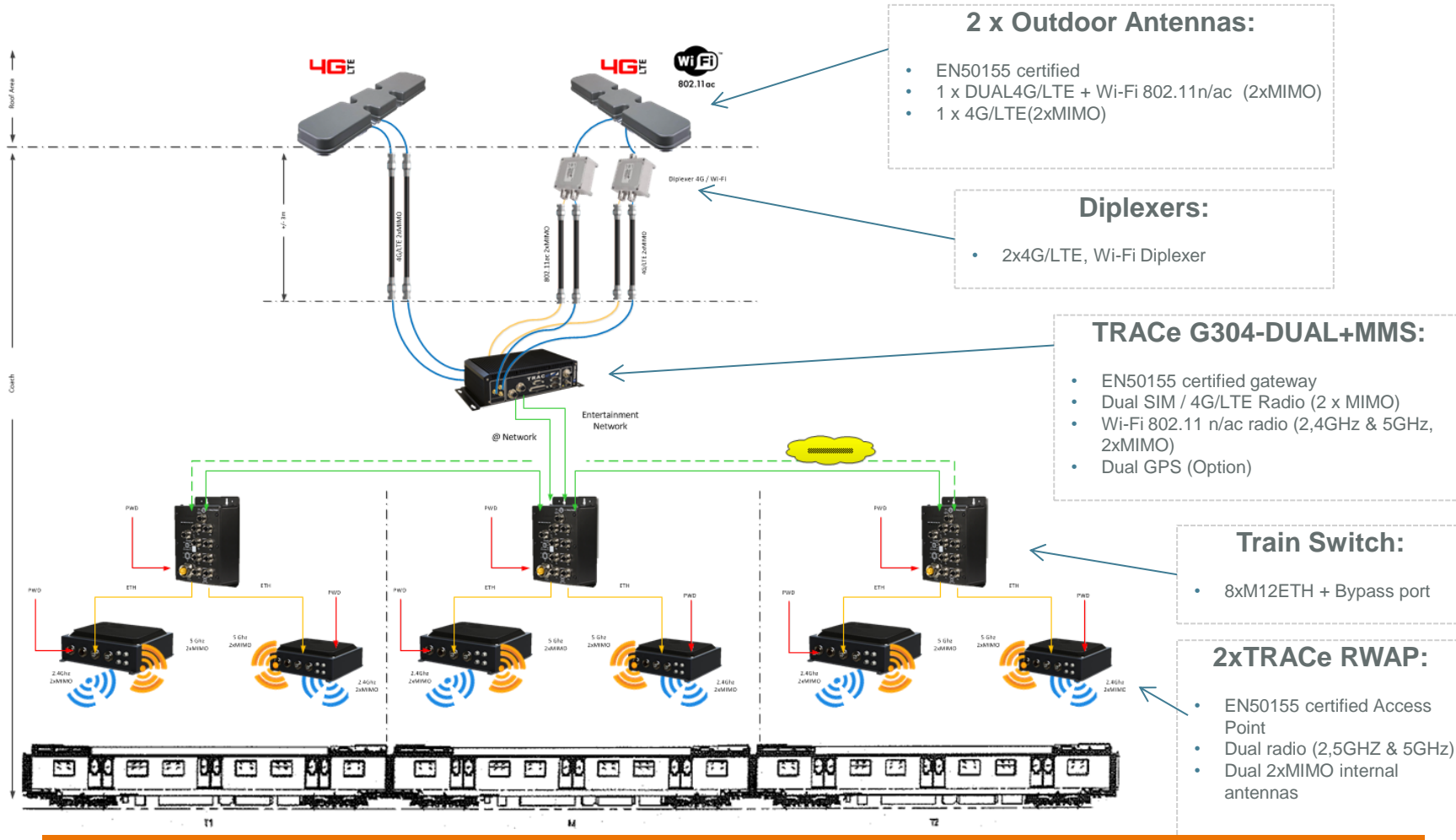| 01	02	03	04
KONTRON COMPANY INTRODUCTION	TECHNOLOGY CHALLENGES	EMERGING TECHNOLOGIES	INNOVATIVE RAIL SOLUTIONS

MANY LEGACY TRAINS HAVE MULTIPLE INDEPENDENT PROPRIETARY SYSTEMS AND PROPRIETARY NETWORKS

Source: IT-Trans 2010 Alstom – STM conference presentation

WEIGHT, SPACE, WIRING, EMI, MODULARITY & SCALABILITY, INTEGRATION & INTERFACES, UPGRADES, MAINTENANCE & OBSOLESCENCE, …

MOST MODERN TRAINS HAVE EVOLVED TOWARDS IP BASED & INDUSTRY STANDARD WAN/LAN ARCHITECTURES

2 x Outdoor Antennas:

- EN50155 certified
- 1 x DUAL4G/LTE + Wi-Fi 802.11n/ac (2xMIMO)
- 1 x 4G/LTE(2xMIMO)

Diplexers:

- 2x4G/LTE, Wi-Fi Diplexer

TRACe G304-DUAL+MMS:

- EN50155 certified gateway
- Dual SIM / 4G/LTE Radio (2 x MIMO)
- Wi-Fi 802.11 n/ac radio (2,4GHz & 5GHz, 2xMIMO)
- Dual GPS (Option)

Train Switch:

- 8xM12ETH + Bypass port

2xTRACe RWAP:

- EN50155 certified Access Point
- Dual radio (2,5GHZ & 5GHz)
- Dual 2xMIMO internal antennas

BUT UNLIKE IN THE IT INDUSTRY STILL USE PROPRIETARY BASED HW/SW SYSTEMS AND MANY OPERATORS ARE LOCKED INTO A LEGACY OF AGEING, INCOMPATIBLE SYSTEMS THAT ARE COSTLY TO UPGRADE

AGENDA

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KONTRON COMPANY
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TECHNOLOGY
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EMERGING
TECHNOLOGIES

04

INNOVATIVE RAIL
SOLUTIONS

EMERGING TREND TO ADOPT
COTS BASED ONBOARD RAIL HW/SW SYSTEMS

▼

▶ Get access to **best of breed Commercial-Off-The-Shelf (COTS) SW and HW** platforms providing a much more contemporary and open environment

▶ **More affordable** way of taking advantage of industry leading edge technologies and applications

▶ Standards-based solutions, unlike previous proprietary ones ensure **long-term scalability and interoperability**

BEST OF BREED COTS LEADING EDGE SW AND HW PLATFORMS

OTHER EMERGING TECHNOLOGIES THAT STARTED TO IMPACT THE RAIL INDUSTRY

▼

- ▶ IoT gateways with Edge, Fog and Central Cloud Analytics and Big Data processing

- ▶ HPEC HW platforms with AI/ Deep Learning / Data Fusion SW engines

- ▶ Network Functions Virtualization (NFV) and Software Defined Networking (SDN)

- ▶ Maas (Mobility as a Service)
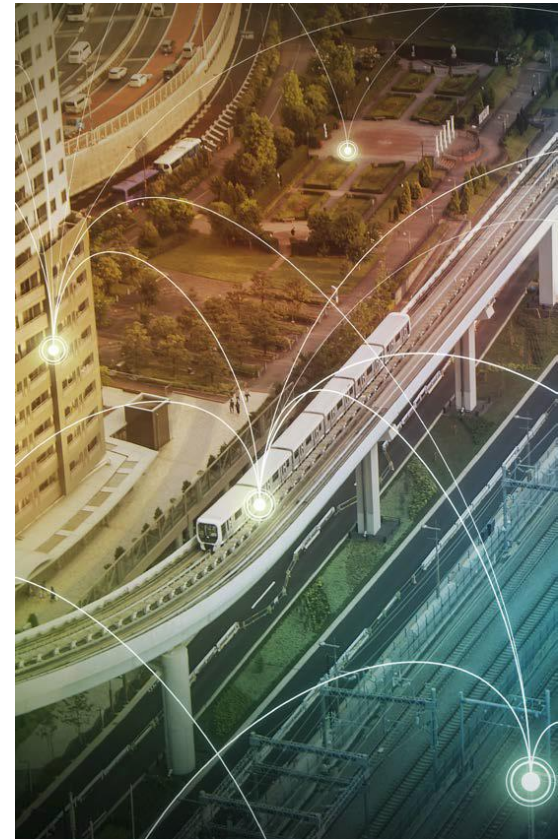
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INNOVATIVE RAIL
SOLUTIONS

IOT GATEWAYS WITH EDGE, FOG AND CENTRAL CLOUD ANALYTICS AND BIG DATA PROCESSING

Embedded Cloud

- Kontron Embedded Server

▶ **Cloud Server**
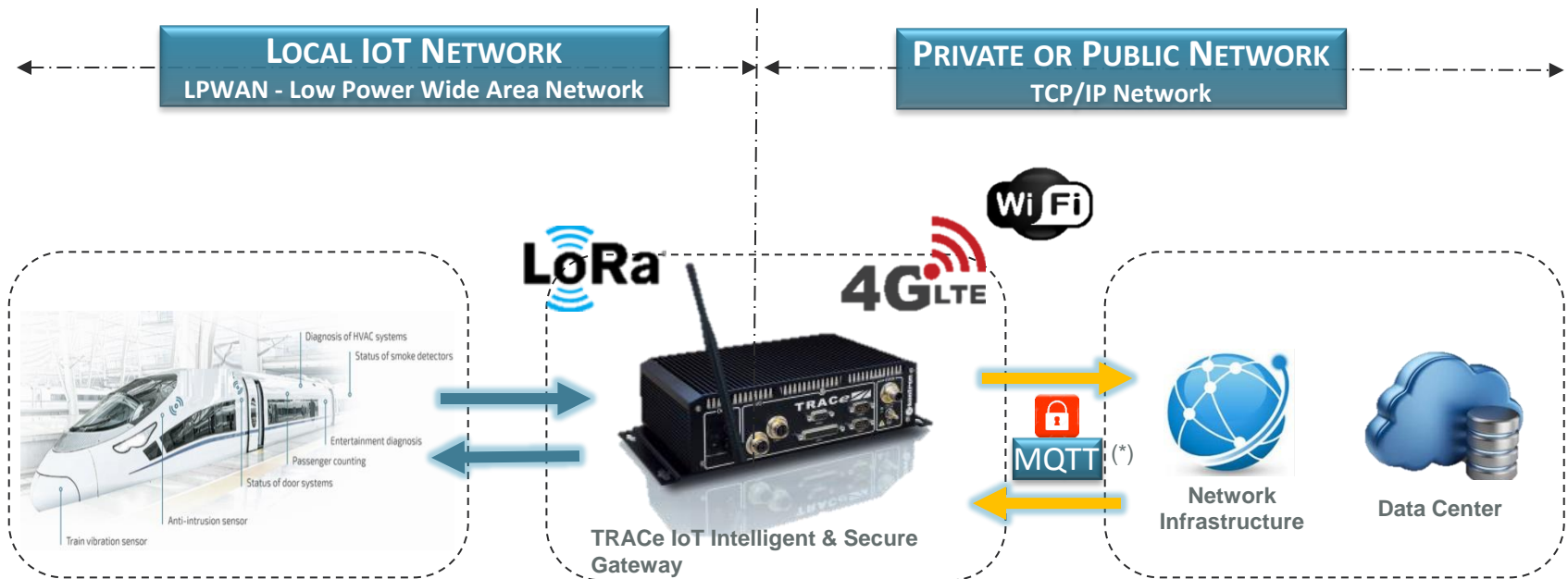
- Kontron high performance Industrial Computer Platforms

▶ **Edge/Fog Computing**

- Kontron TRACe™ LoRa-MQTT Rail COTS Gateway

▶ **Gateway Systems**

LoRa

GPS

4G LTE

LoRa-MQTT TRACe™ GATEWAY WITH EDGE COMPUTING FOR MOBILITY

LOCAL IoT NETWORK
LPWAN - Low Power Wide Area Network

PRIVATE OR PUBLIC NETWORK
TCP/IP Network

LoRa

Wi Fi

4G LTE

MQTT (*)

TRACe IoT Intelligent & Secure Gateway

Network Infrastructure

Data Center

▶ Vibration sensors
▶ Door diagnostic sensors
▶ Passenger counting
▶ Energy consumption sensor
▶ Smoke/ Fire detection
▶ Emotions button
▶ Tank levels
▶ …

IoT Core Library
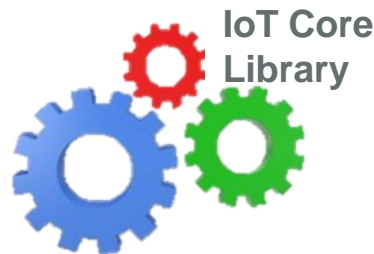
Edge Analytics

▶ Stream Analytics
▶ Fleet/Asset management
▶ Preventive maintenance
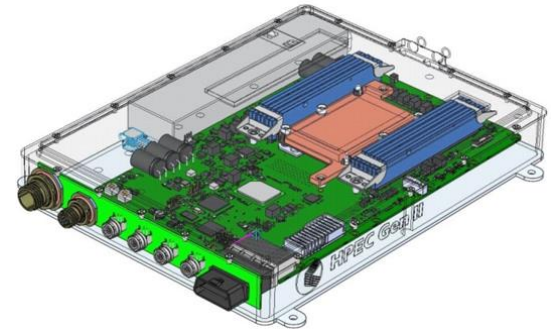▶ Remote rolling stock devices management
▶ Real-time traffic information
▶ …

MQTT: standard publish-subscribe-based lightweight protocol on top of TCP/IP

HPEC ONBOARD HW PLATFORMS WITH AI / DEEP LEARNING / DATA FUSION SW ENGINES

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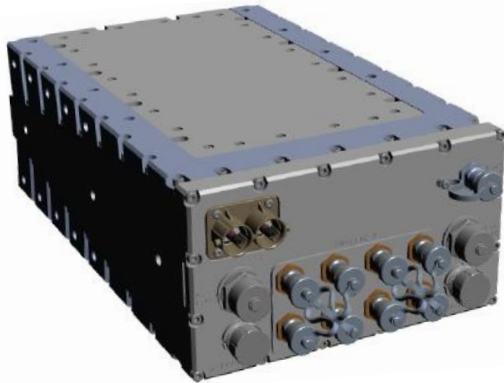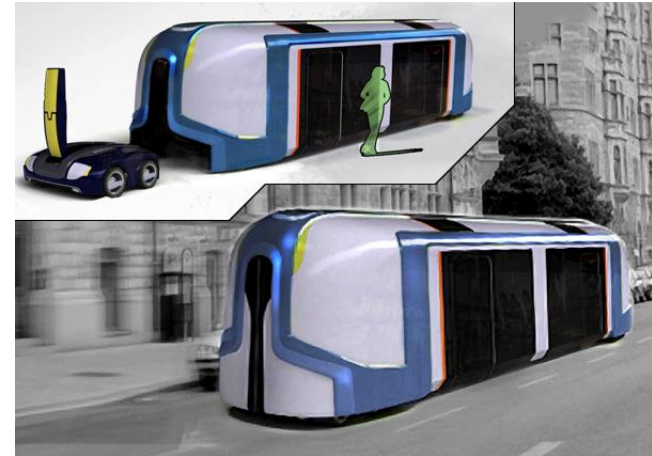
AV HPEC ➡ **Autonomous "Anywhere" Solutions**

THE DEVELOPMENT OF AUTONOMOUS VEHICLE (AV) TECHNOLOGY IN RAIL IS ALREADY BEING PLANNED ON LINES AROUND THE WORLD AS THE NEXT GENERATION OF DRIVERLESS TRAINS

VIRTUALIZATION THROUGH SDN/NFV

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- **NFV:**

  - Network Functions Virtualization (NFV) is an architecture concept that virtualizes different resources (e.g. CPU, Memory, Storage) to connect and/or chain, to support communication services
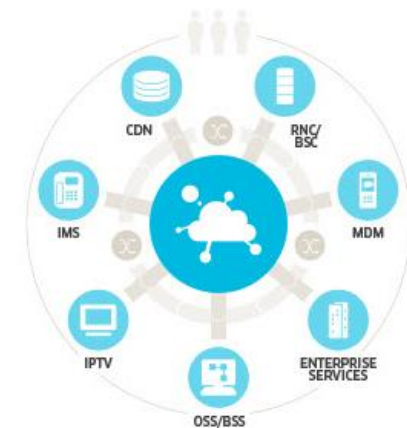
- **SDN:**

  - Software Defined Networking (SDN) is an approach to networking in which control is decoupled from hardware and given to a software application.

  - The goal of SDN is to allow the network to be configure and reconfigured dynamically without having to touch individual switches.

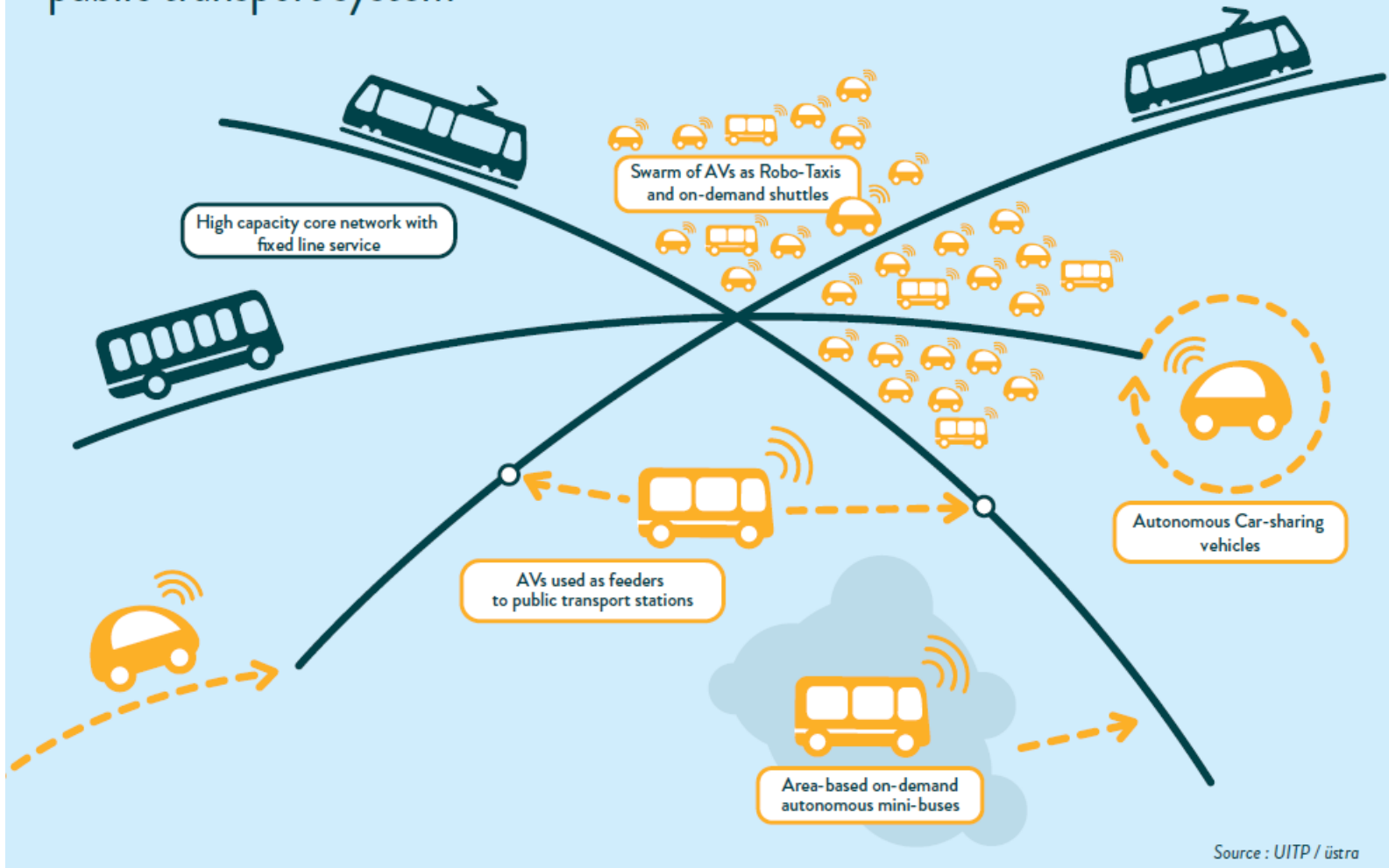FROM CONVENTIONAL INFRASTRUCTURE...
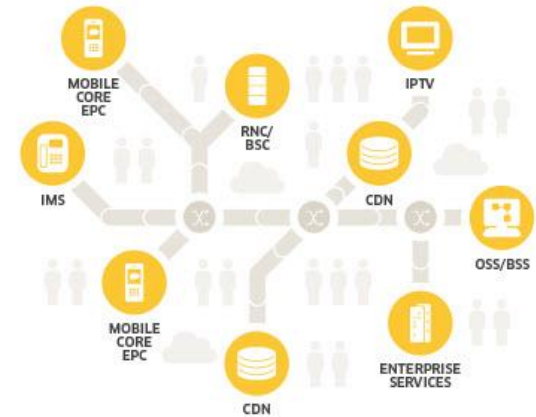
...TO A SOFTWARE-DEFINED ENVIRONMENT

"SOFTWARE DEFINED TRAINS (SDT)" AND "TRAIN FUNCTION VIRTUALIZATION (TFV)" THAT RUN ON HPEC PLATFORMS WITH BUILT-IN REDUNDANCY

MOBILITY AS A SERVICE (MAAS)

Possible applications of autonomous vehicles (AVs) as part of a diversified public transport system

High capacity core network with fixed line service

Swarm of AVs as Robo-Taxis and on-demand shuttles

Autonomous Car-sharing vehicles

AVs used as feeders to public transport stations

Area-based on-demand autonomous mini-buses

Source : UITP / üstra

WHAT CAN WE EXPECT IN THE NEXT DECADE IN TRANSPORTATION?

▼

- ⊕ IoT fixed and mobile meshed Gateways connected to wireless sensors with optimized Edge, Fog and Central Cloud Analytics processing Big Data
- ⊕ Autonomous "Anywhere" Systems running on HPEC HW platforms with AI/ Deep Learning / Data Fusion SW engines
- ⊕ Software Defined Trains (SDT) and Train Function Virtualization (TFV)
- ⊕ MaaS in an integrated multimodal transportation world

Barreto Multimedia

▶ **IT SEEMS TO BE A LAW OF NATURE, INFLEXIBLE AND INEXORABLE, THAT THOSE WHO WILL NOT RISK CANNOT WIN –** *JOHN PAUL JONES, FATHER OF THE AMERICAN NAVY*

POSSIBILITIES START HERE **kontron**

OUR CHANGING WORLD IS FILLED WITH
BOUNDLESS OPPORTUNITIES

▼

▲

WE LOOK FORWARD TO
EXPLORING THEM WITH YOU

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