The future challenges of the IP train as an adaptable backbone to new equipment and technologies – an open standardized architecture

Peter Eldh & Göran Lindblad
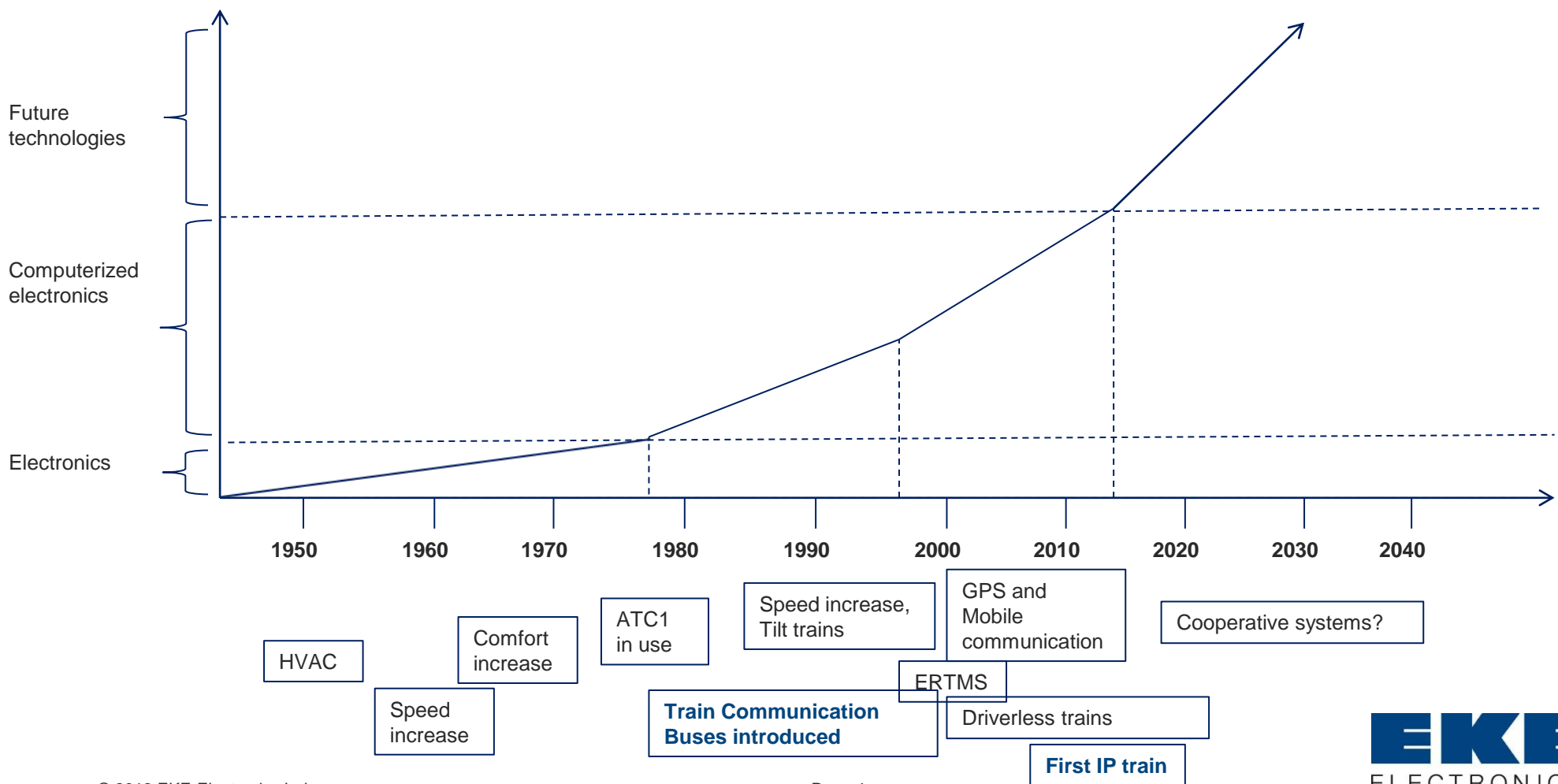EKE-Electronics Ltd.

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Short about EKE-Electronics Ltd.

- Part of the EKE-Group – located in Finland

- Established in 1971

- First business area: Industrial automation

- First railway electronics projects: 1987 with VR (Finnish Railways)

- Today focusing 100% on TCMS (train communication and management systems), train communication, train buses and monitoring

- Train projects all around world

- ISO 9001 & 14001 certified

- IRIS certified

- Full member of the UNIFE organization

Technical development time-line

Future technologies

Computerized electronics

Electronics

1950 1960 1970 1980 1990 2000 2010 2020 2030 2040

HVAC

Comfort increase

Speed increase

ATC1 in use

Train Communication Buses introduced

Speed increase, Tilt trains

ERTMS

GPS and Mobile communication

Driverless trains

First IP train

Cooperative systems?

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Train communication buses

- TCN (Train Communication Network) is a combination of two fieldbuses, WTB (Wire Train Bus) and MVB (Multifunction Vehicle Bus)

- ECN (Ethernet Consist Network) used as vehicle train bus or ETB (Ethernet Train Backbone) as a train bus

- The early use of train buses were for onboard remote control and monitoring of subsystems

- One advantage of Ethernet especially in combination with fiber is the great bandwidth and data capacity

- The train communication and management system (TCMS) manage the on-board buses
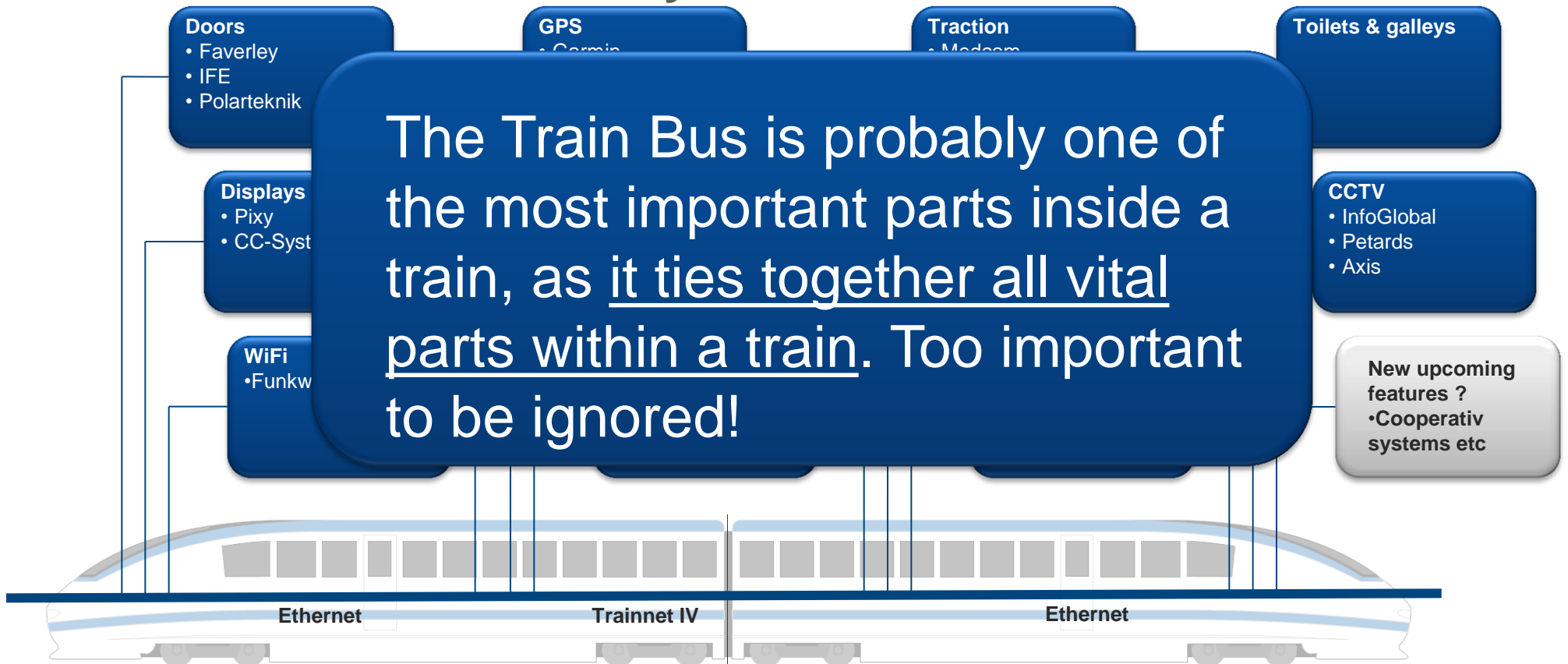
Open architecture?

- The IP (intellectual property) of the TCMS system has so far almost always been owned by the manufacturer (closed)
- Today the need and demand from operators are moving towards more flexible systems. This require open TCMS systems where application software can belong to the System Integrator or the customer
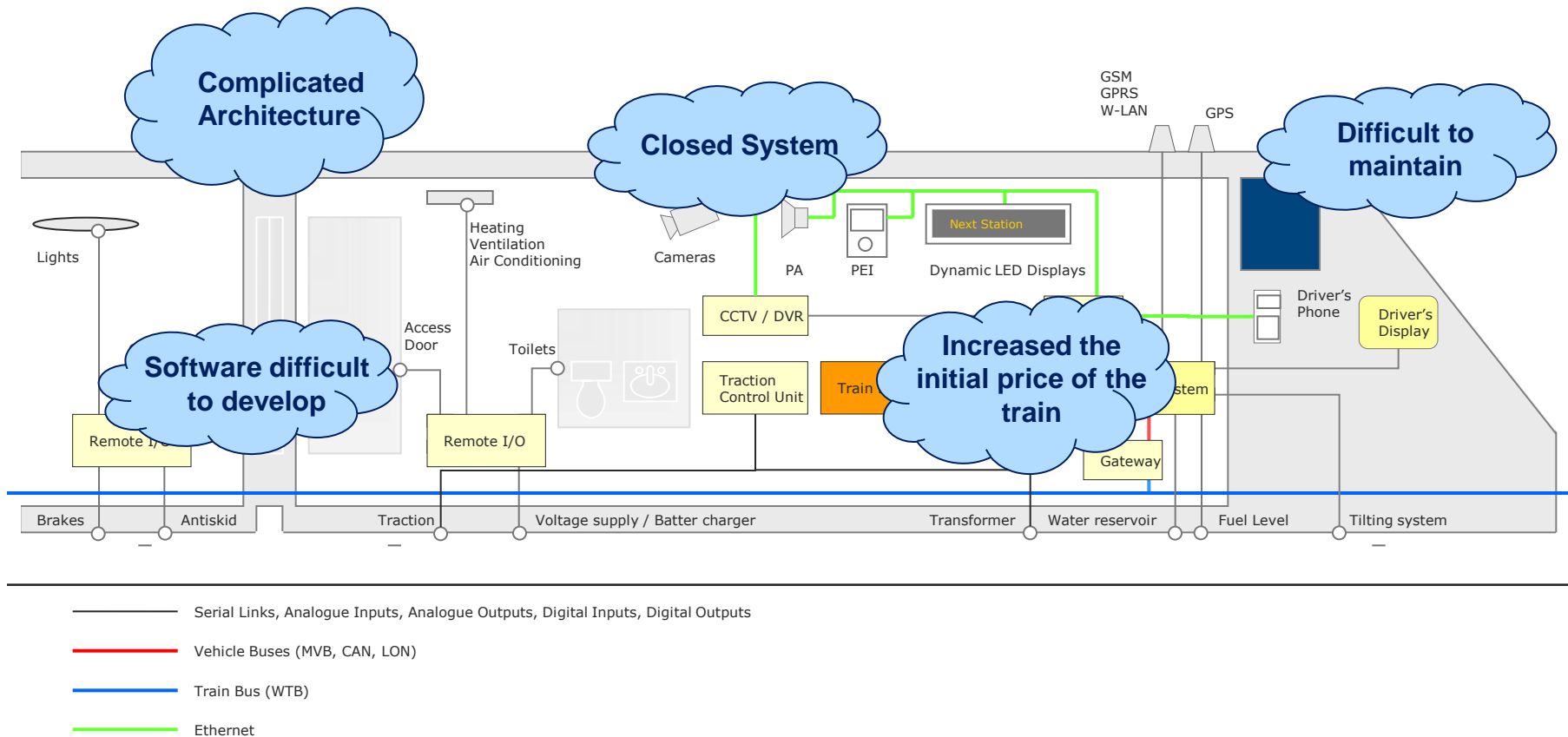- Use of components from different manufacturers are possible

Train buses are important, and are used to control and monitor the functionality

Doors
• Faverley
• IFE
• Polarteknik

GPS
• Garmin

Traction
• Medcom

Toilets & galleys

Displays
• Pixy
• CC-Syst

CCTV
• InfoGlobal
• Petards
• Axis

WiFi
•Funkw

New upcoming features ?
•Cooperativ systems etc

The Train Bus is probably one of the most important parts inside a train, as <u>it ties together all vital parts within a train</u>. Too important to be ignored!
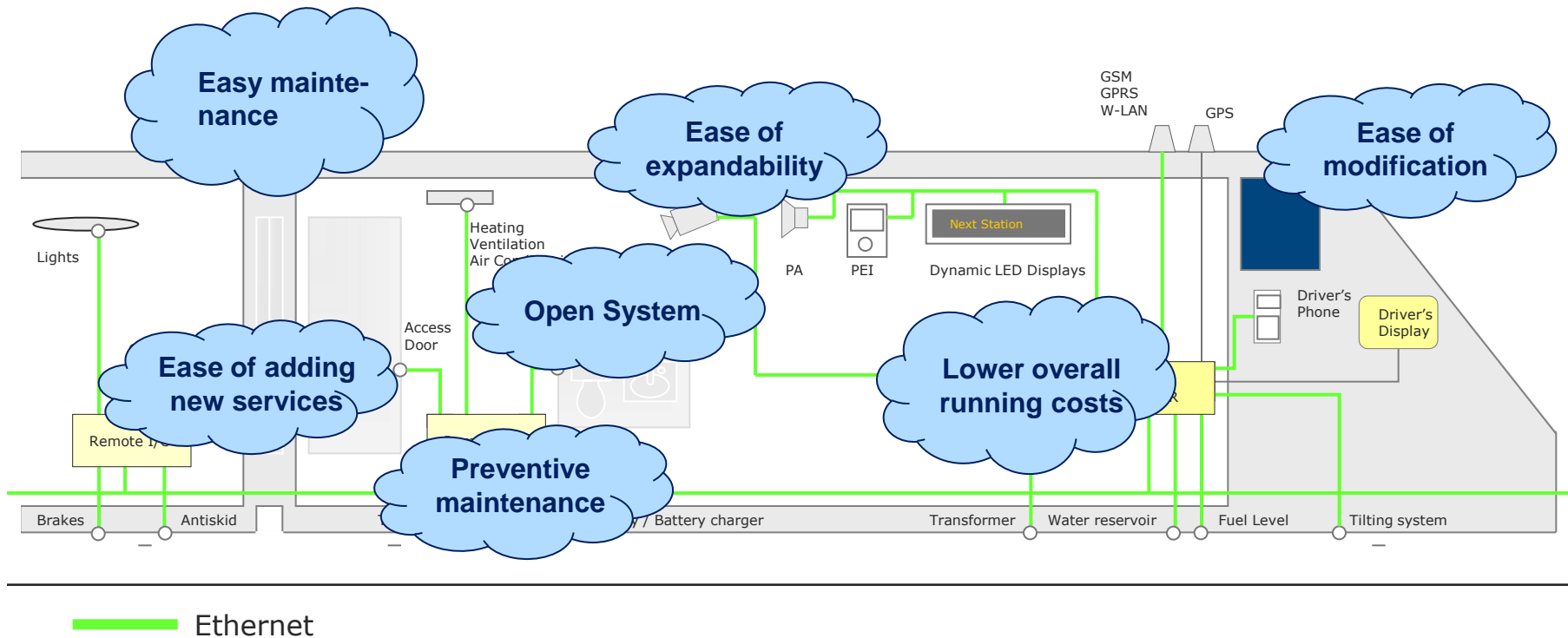
Ethernet   Trainnet IV   Ethernet

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Classic Train Bus Architecture 1980 - 2010

Complicated Architecture

Closed System

Difficult to maintain

GSM
GPRS
W-LAN

GPS

Lights

Heating
Ventilation
Air Conditioning

Cameras

PA

PEI

Next Station

Dynamic LED Displays

Driver's
Phone

Driver's
Display

Access
Door

CCTV / DVR

Software difficult to develop

Toilets

Traction
Control Unit

Train

Increased the initial price of the train

stem

Remote I/

Remote I/O

Gateway

Brakes

Antiskid

Traction

Voltage supply / Batter charger

Transformer

Water reservoir

Fuel Level

Tilting system

—————— Serial Links, Analogue Inputs, Analogue Outputs, Digital Inputs, Digital Outputs

—————— Vehicle Buses (MVB, CAN, LON)

—————— Train Bus (WTB)

—————— Ethernet

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What is an IP-train meant to be?

Reality today?

- Today many operators/train builders still add layers on top of each bus to get additional functionality! Result?
  - a lot of complexity and unnecessary costs are added
  - serviceability difficult
  - further software development difficult
- IP standardization is still not finished (but close…)
- Many operators require open systems but don't know what it is all about
- Necessary technology benefitting operators and owners are not implemented due to the costs and complexity, even for new trains

> But using the Train Bus in a clever way, we can change many things ….

Some clever applications are for example…

- Real-time Diagnostics and Fault Management Application

- Decision Support System for Control Room & Depots

- Reducing Energy & Fuel consumption

- Preventative Fault Management

- Optimizing time tables

- Smart infotainment

- And there will be a lot more applications making things better and saving money…many of them are based upon optimization, communication and real-time monitoring

Not in order of importance

Different players, different needs and concerns

Operator/Owner	Train manufacturers	Passengers
Low Cost of Ownership	Standardization	Comfort
Monitoring and diagnostics • preventive maintenance • real-time fault/status monitoring	Openess • intellectual property (IP) rights • ease of change	New services • Infotainment • Mobile serveices
Good passenger comfort	Price competitiveness	Punctuality
Easy to adapt changes due to new regulations or demands	Easy servicability	Information • Timetable changes
Regulatory changes	High reliability	Safety
Passenger safety	Security	Security

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How to prepare and meet the challenges with IP technology

- Secure the use of standardized communication for IP train
- Increase the awareness of this technology among the industry
- Make operators and buyers aware of the importance of internal buses
- Increase research related to TCMS systems and IP buses

Thank You