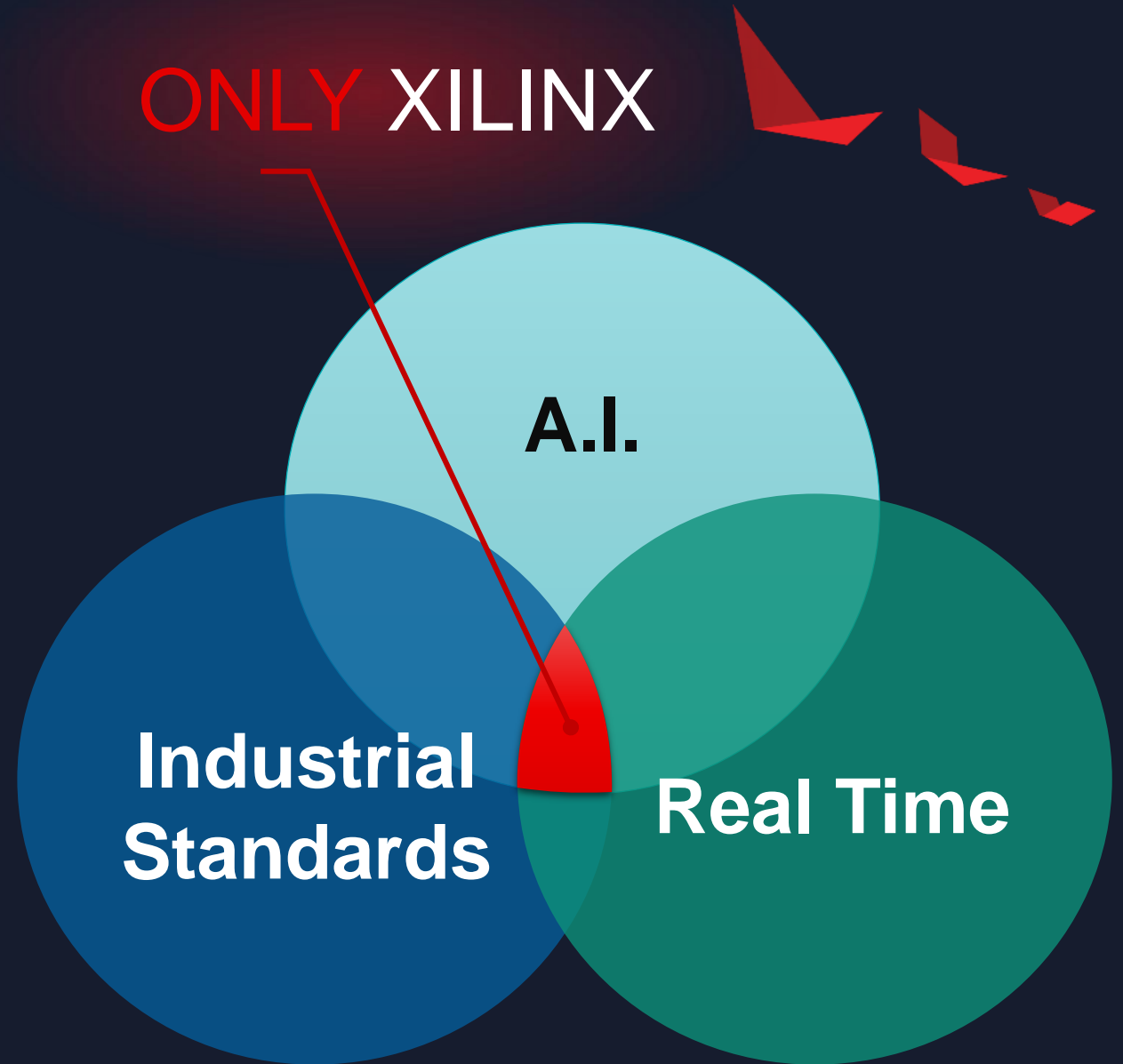# All Aboard with Xilinx:

Exploring the Future of Trains and Railways

Webinar

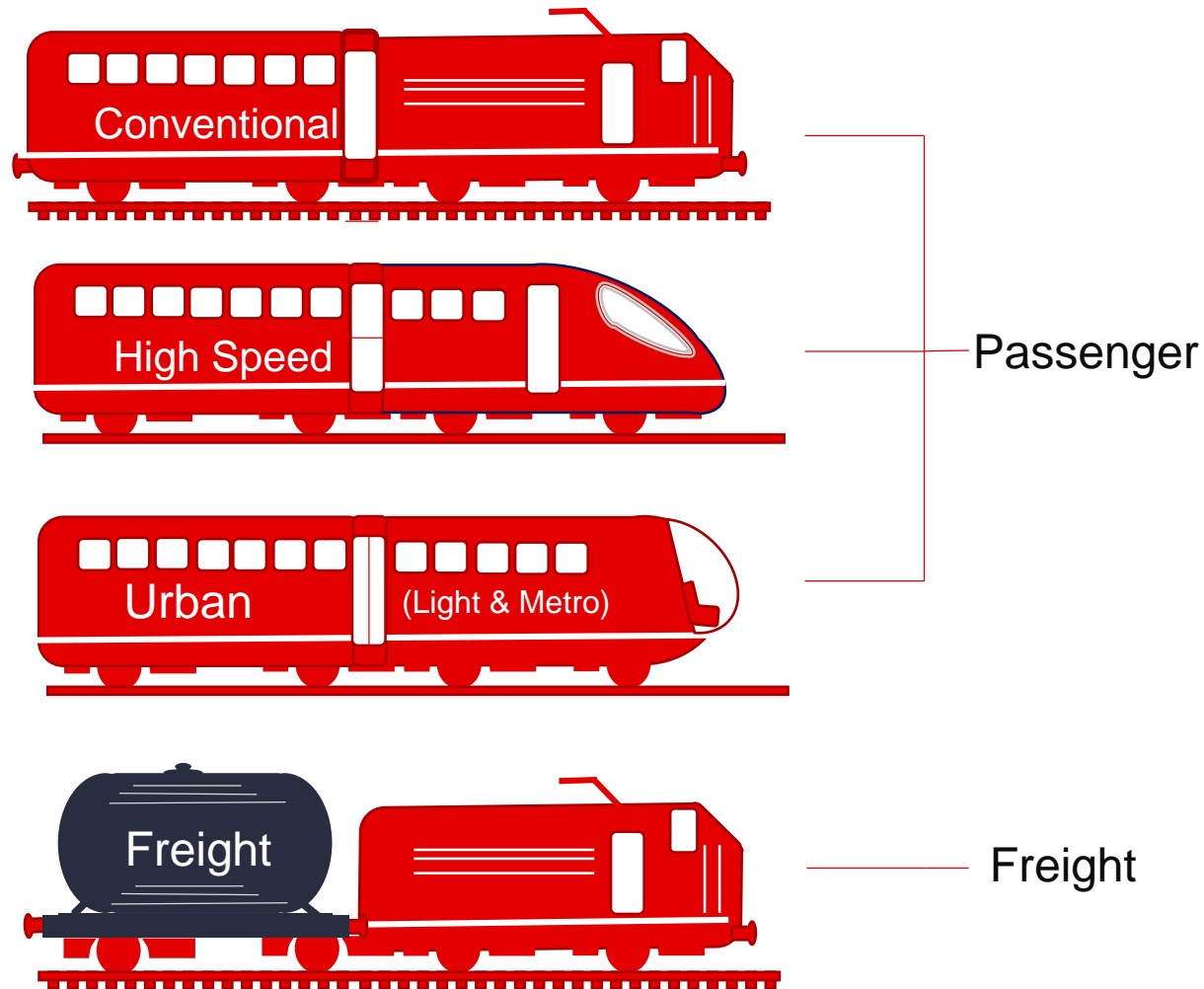23-Jun-2020

Value add with Xilinx SoCs for Trains&Railways

Giulio Corradi, Xilinx
Principal Architect
Industrial, Vision, Healthcare & Sciences

ONLY XILINX

A.I.

Industrial Standards

Real Time

Rail challenges and requirements

Conventional

High Speed

Urban (Light & Metro)
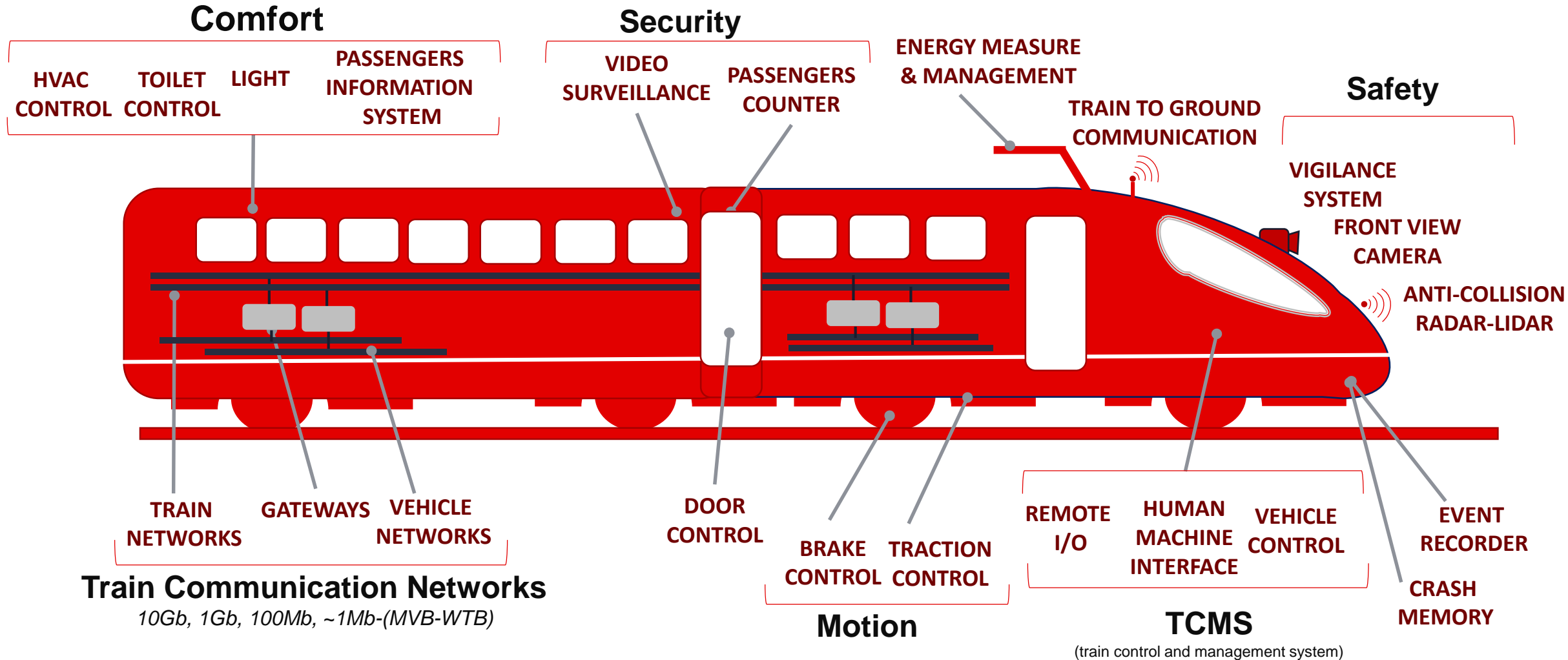
Freight

Passenger

Freight

Infrastructure
(Signalling and Tracks and Stations)

The 3 M of Rail

▶ Minimising costs per
- Passenger-kilometer
- Tonne-kilometer
- Better energy efficiency

▶ Maximising usage
- More passengers
- More goods
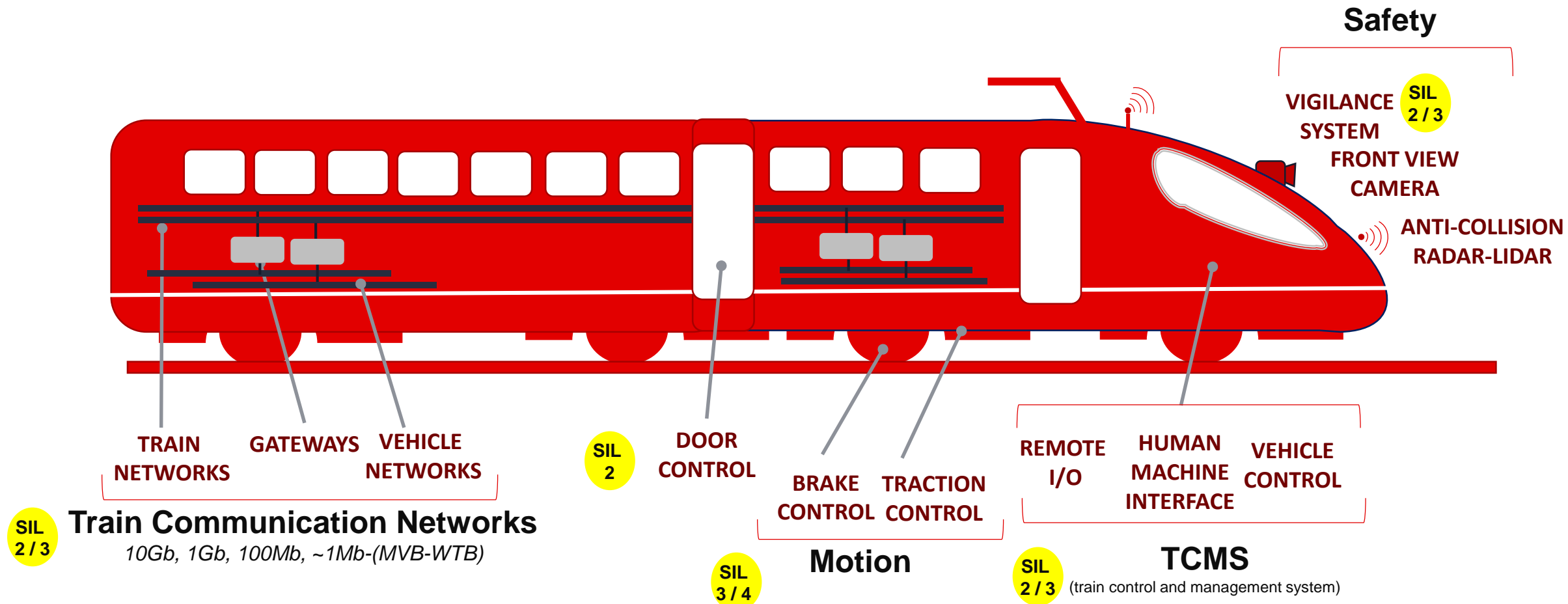- Higher throughput

▶ Monetize
- Infrastructure
- Services

+
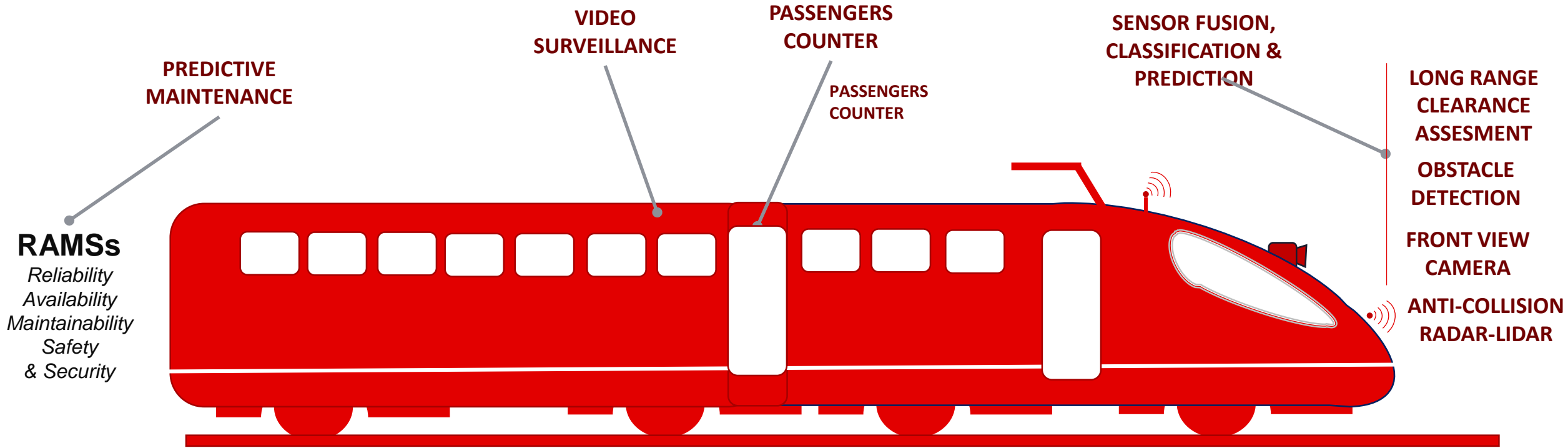**Automation
Digital Technologies**

XILINX

Train automation & functions

Comfort
- HVAC CONTROL
- TOILET CONTROL
- LIGHT
- PASSENGERS INFORMATION SYSTEM

Security
- VIDEO SURVEILLANCE
- PASSENGERS COUNTER

ENERGY MEASURE & MANAGEMENT

TRAIN TO GROUND COMMUNICATION

Safety
- VIGILANCE SYSTEM
- FRONT VIEW CAMERA
- ANTI-COLLISION RADAR-LIDAR

TRAIN NETWORKS

GATEWAYS

VEHICLE NETWORKS

Train Communication Networks
10Gb, 1Gb, 100Mb, ~1Mb-(MVB-WTB)

DOOR CONTROL

BRAKE CONTROL

TRACTION CONTROL

Motion

REMOTE I/O

HUMAN MACHINE INTERFACE

VEHICLE CONTROL

EVENT RECORDER

CRASH MEMORY

TCMS
(train control and management system)

XILINX.

RAMS Requirements
Reliability Availability Maintainability Safety & Security

Safety

VIGILANCE SYSTEM
FRONT VIEW CAMERA

SIL 2 / 3

ANTI-COLLISION RADAR-LIDAR

TRAIN NETWORKS

GATEWAYS

VEHICLE NETWORKS

SIL 2

DOOR CONTROL

REMOTE I/O

HUMAN MACHINE INTERFACE

VEHICLE CONTROL

SIL 2 / 3

Train Communication Networks
10Gb, 1Gb, 100Mb, ~1Mb-(MVB-WTB)

BRAKE CONTROL

TRACTION CONTROL

SIL 3 / 4

Motion

SIL 2 / 3

TCMS
(train control and management system)

XILINX

A.I. and Machine Learning for Rolling Stock

PREDICTIVE MAINTENANCE

VIDEO SURVEILLANCE

PASSENGERS COUNTER

PASSENGERS COUNTER

SENSOR FUSION, CLASSIFICATION & PREDICTION

LONG RANGE CLEARANCE ASSESMENT

OBSTACLE DETECTION

FRONT VIEW CAMERA

ANTI-COLLISION RADAR-LIDAR

RAMSs
Reliability
Availability
Maintainability
Safety
& Security

XILINX

Rail Electronic Equipment Challenges

Traditional Challenges

▸ Small or medium equipment quantity
- No mass market like automotive and strong cost pressure on manufacturers "*give me 3% discount / year…*"

▸ High variability and customization for end user
- No standard products (depend on rolling stock builder & railway undertaker)

▸ Extreme long life 15…30 years

▸ Many Functional Safety equipment

▸ Regulated market & specific standards (EN50155, EN50657, EN 50126.. UIC,...)

New Challenges

▸ More automation
- Old processors are insufficient for new tasks

▸ Digitalization and A.I.
- Higher computing performances

▸ More connectivity and networking
- Wired, Wireless, 10G, Edge-Cloud

▸ Long term Cybersecurity

PLATFORM AS SOLUTION

A product is something you sell. A platform is common infrastructure that you build products on.

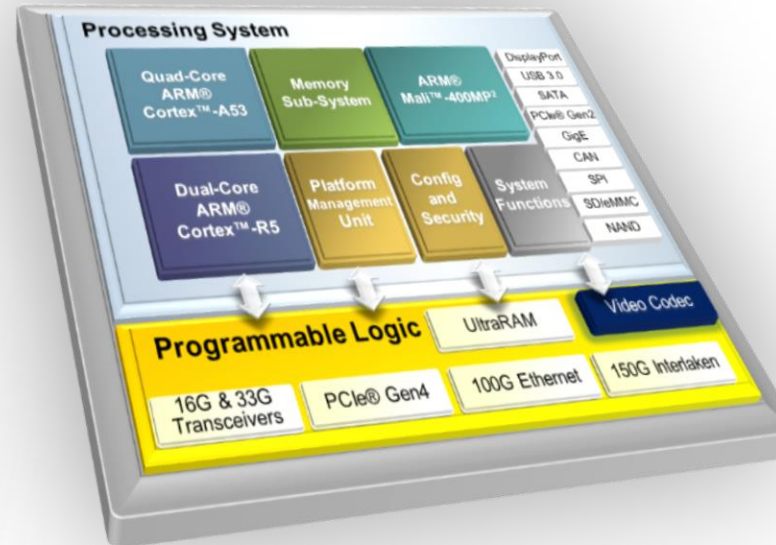 XILINX.
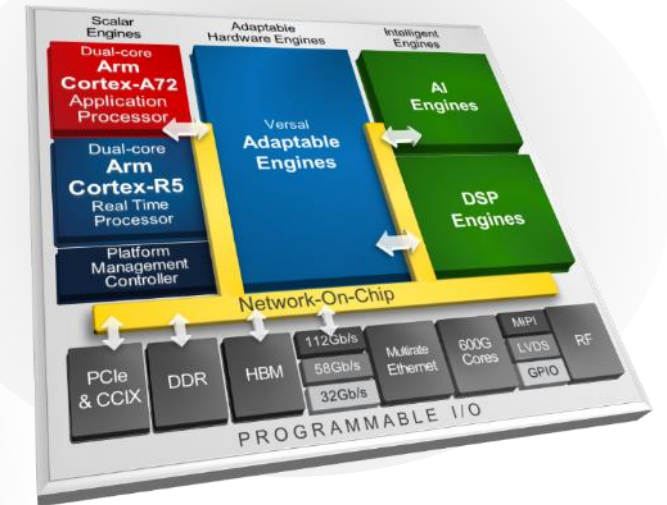
Silicon Architecture:
Xilinx Platform Devices
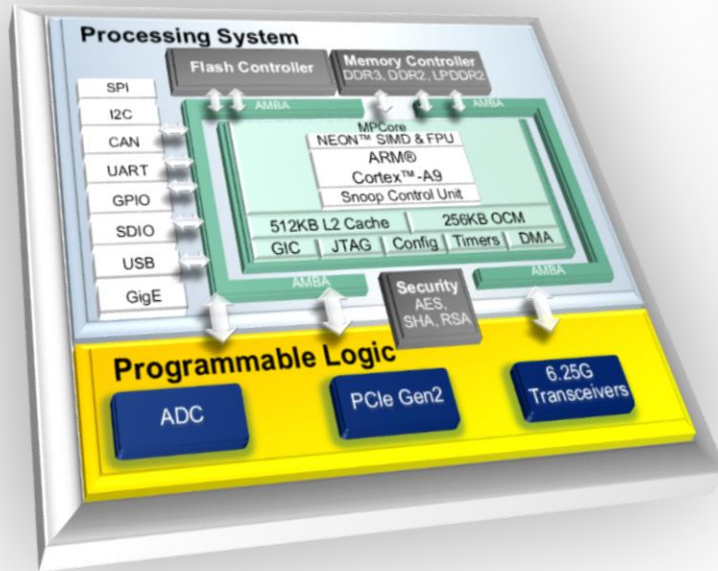
2012

2016

2020

Xilinx Platforms for Rail

A platform is common infrastructure that you build products on.

© Copyright 2020 Xilinx
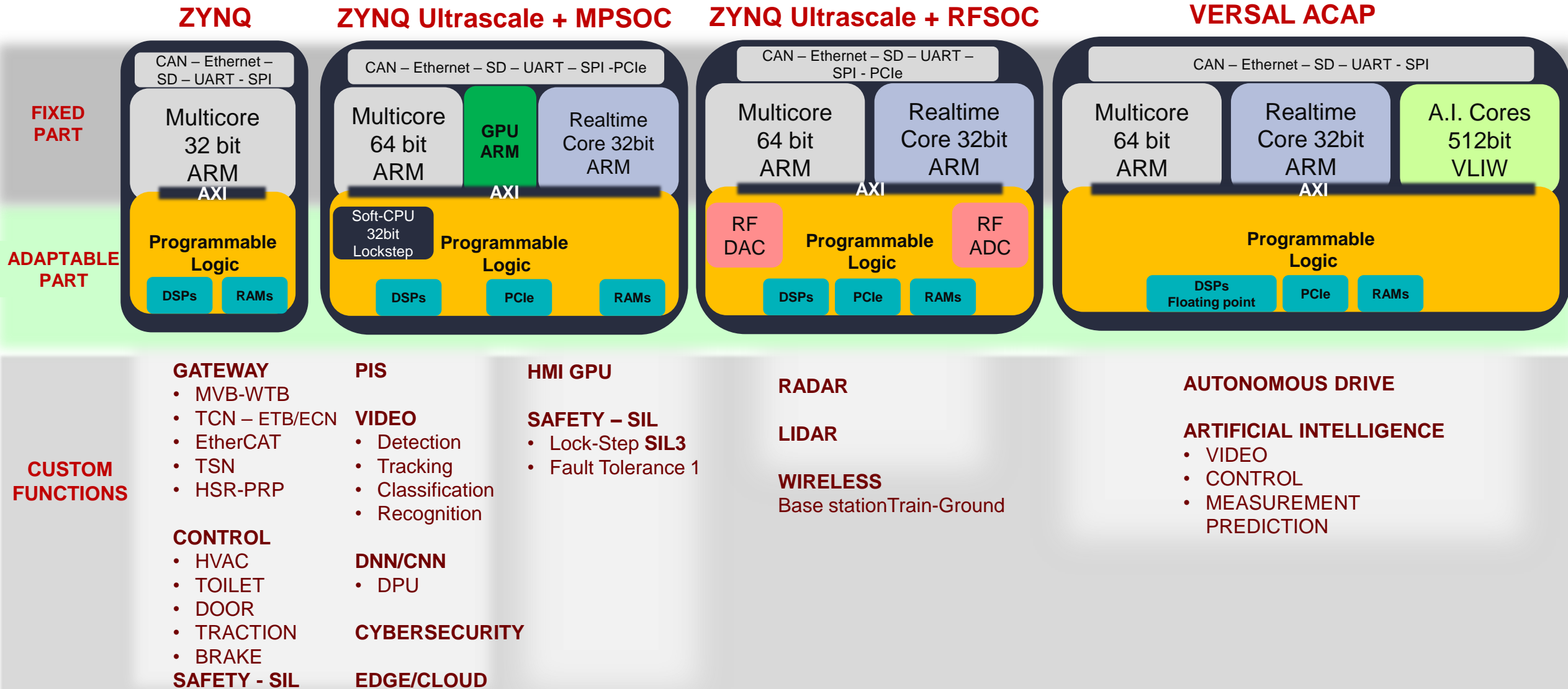
Vitis Unified Software Platform

Build

Embedded Developers   Enterprise Application Developers   Enterprise Infrastructure Developers   Data & AI Scientists

Deploy

Zynq-7000   Zynq UltraScale+ MPSoC   Alveo   Versal ACAPs

IEC 61508 Defines Functional Safety on SoC Level
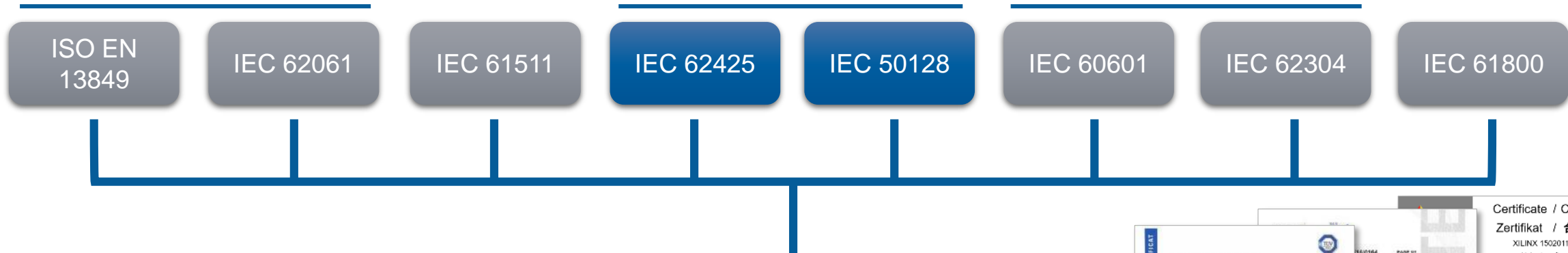

MACHINERY   PROCESS INDUSTRY   RAILWAY   MEDICAL   POWER DRIVE SYSTEMS
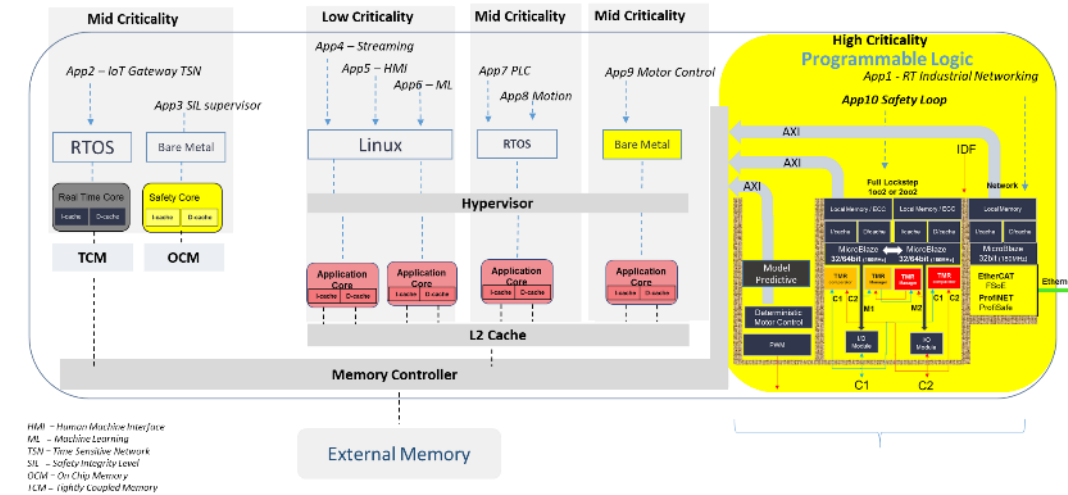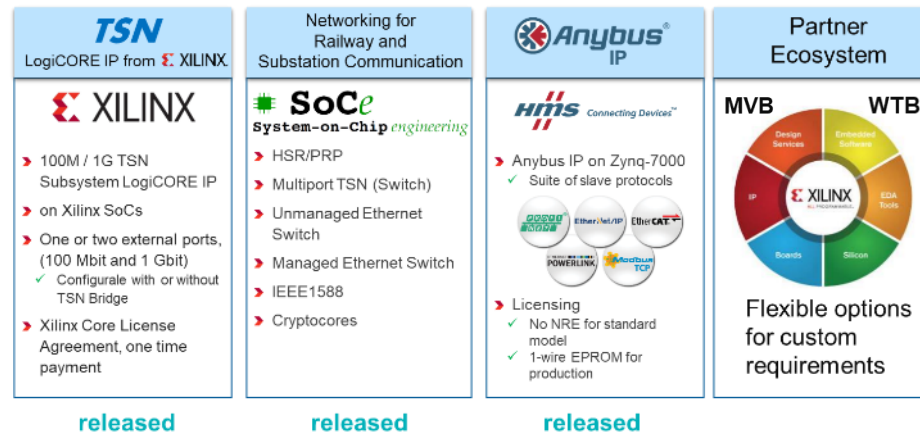
| ISO EN 13849 | IEC 62061 | IEC 61511 | IEC 62425 | IEC 50128 | IEC 60601 | IEC 62304 | IEC 61800 |

IEC 61508 — **E**lectric/**E**lectronic/**P**rogrammable **E**lectronic Functional Safety

XILINX

Comprehensive Set of Certificates and Assessments

Vivado /
Vivado HLS
2019.1
SIL3

MicroBlaze
Compiler
2019.1
SIL4

Zynq-7000
Safety Design
(assessment)
SIL3

ISE 14.7
SIL3

Zynq UltraScale+
MPSoC
SIL3 HFT=1

Zynq-7000
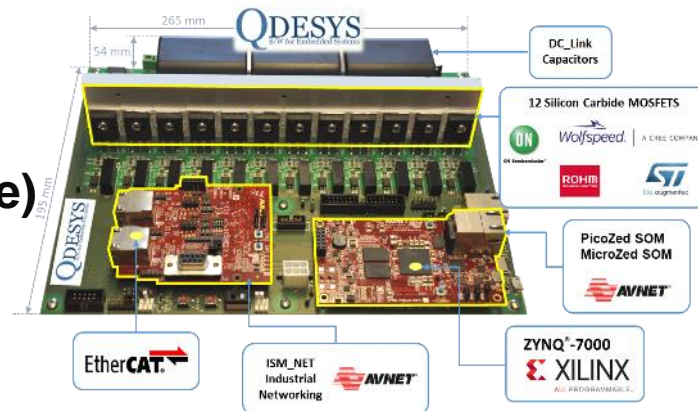Channel Separation
(assessment)
SIL3

XILINX

Snapshot on some ready to use solutions

MIXED CRITICALITY & SAFETY

NETWORKING

TRACTION (Silicon Carbide)

SMART CAMERA

ZYNQ-7000, SoMs, Design Kits & Reference designs

▸ Wide distribution of Zynq®-7000 SoC based boards/kits

- 13,000+ boards/kits shipped between Xilinx and Avnet

▸ 25+ Development Boards and SoM's from Xilinx and its partners

- Application & Market Specific Boards

Zynq® UltraScale+™ MPSoC Development Boards

Starter Kits			Full Evaluation Boards		
Ultra96-V2 Embedded Linux Starter Kit	**UltraZed-EG** Rapid Prototyping Starter Kit	**UltraZed-EV** Video Application Starter Kit	**ZCU104** Embedded Vision Platform	**ZCU106** Multimedia & Connectivity Platform	**ZCU102** General Purpose Development
ZU3EG	ZU3EG	ZU7EV	ZU7EV	ZU7EV	ZU9EG
Available Now	*Available Now*	*Available Now*	*Available Now*	*Available Now*	*Available Now*

XILINX

Presentations from
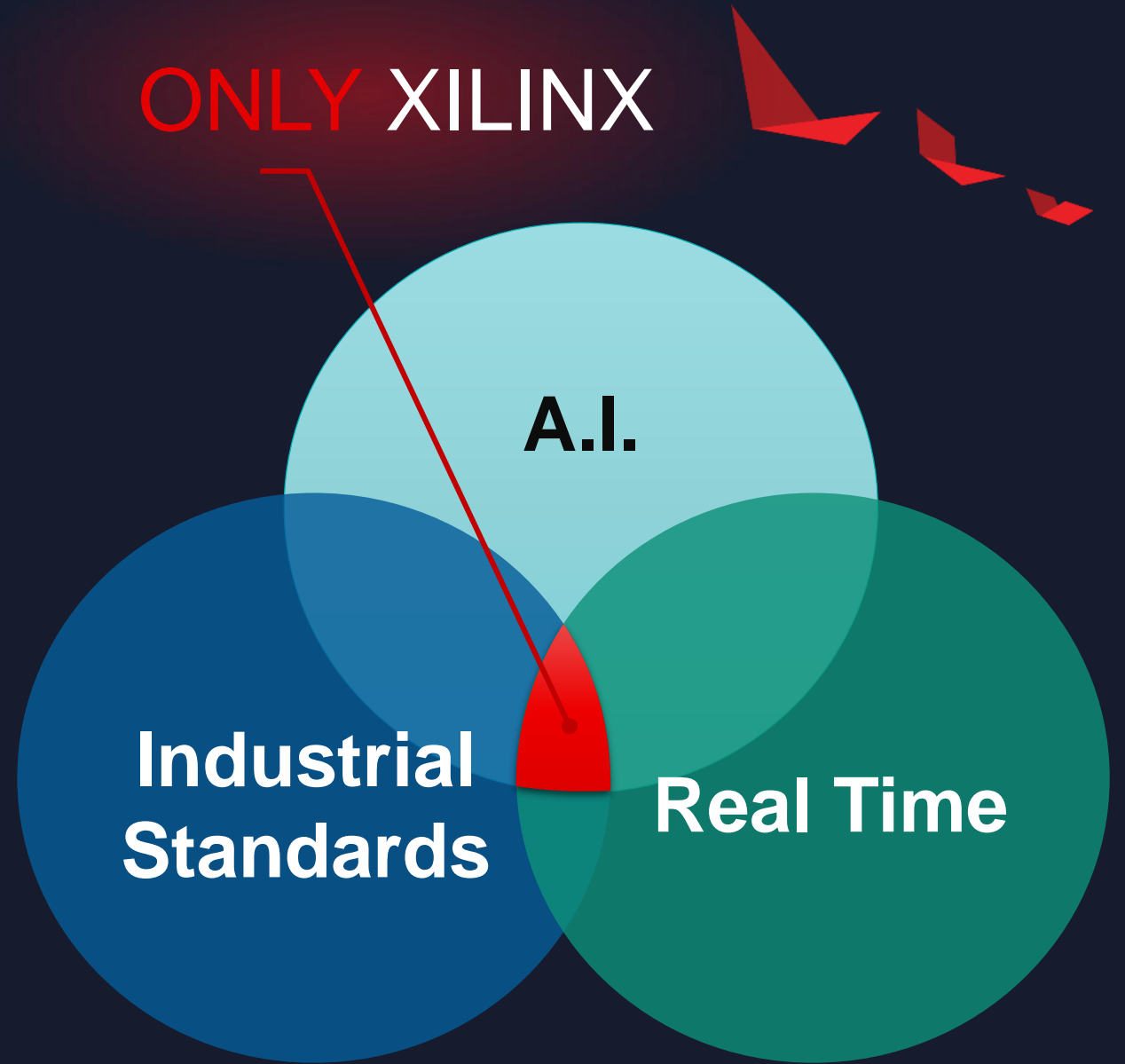
see separate decks

Summary

Xilinx SoCs for Trains & Railways

Giulio Corradi, Xilinx
Principal Architect
Industrial, Vision, Healthcare & Sciences

ONLY XILINX

A.I.

Industrial
Standards

Real Time

XILINX

Xilinx SoCs for Trains & Railways Summary

▸ Differentiate with Xilinx SoCs in Rolling Stock and Wayside applications

- Deploy Scalable Platform with Predictability, Safety, Security, Deterministic Control, Video and Artificial Intelligence

▸ A Zynq-7000 hardware has a proven track record in MIOS Elettronica's product development and service business

- Full set of rugged, affordable, state of the art Railway Gateways, Controllers, Event and Data recorders

▸ Benefit from proven IP cores for reliable and future-proof connectivity and security

- Creating deterministic and customizable Ethernet switch is easy.
- SoCe's IP Cores are ready for TSN, HSR, PRP, MRP, Ethernet Switching and wire-speed cryptography in hardware

▸ Start immediately with Development Boards

▸ Engage with one of the contacts on the next page

Contact us!

MIOS ELETTRONICA
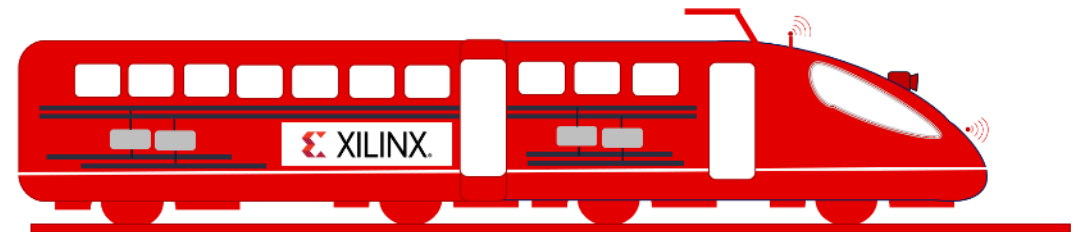
MIOS ELETTRONICA
Via Archimede, 10 - 37036 San Martino Buon Albergo (Verona) - Italy
Phone: + 39 045 5117691 – Telefax: +39 045 5118088

info@mioselettronica.com

www.mioselettronica.com

MIOS CANADA, Inc.
3 Place Ville Marie, suite 400, Montreal – QC H3B 2E3 – Canada
Phone: +1 438-392-2716

info@mioselettronica.com

A COMPANY OF ATIG GROUP

Copyright © 2020– This document is exclusive property of MIOS Elettronica Srl – All Rights Reserved - BRO-2018-00050-14

SoCe
System-on-Chip *engineering*

Contact Information

- soc-e.com
- david.modrono@soc-e.com
- armando.astarloa@soc-e.com

XILINX.
ALLIANCE PROGRAM
CERTIFIED MEMBER – BASE

IIC MEMBER
industrial internet CONSORTIUM
www.iiconsortium.org

XILINX
Industrial, Vision,
Healthcare & Sciences

https://www.xilinx.com/applications/industrial.html

Michael Zapke michael.zapke@xilinx.com
Giulio Corradi giulio.corradi@xilinx.com

XILINX.

To know more see our Solutions Video Library

Edge AI and Edge to Cloud
- Smart Camera development with Vitis & Vitis AI
- AWS Edge - to - Cloud Cooperation

Safety / Cybersecurity
- Industrial Functional Safety with Xilinx SoCs
- IEC 62443 Industrial Cybersecurity

Embedded Vision and AI
- ISP
- xfOpenCV
- Deep Dive into VITIS AI
- Accelerating AI Camera Development with Xilinx Vitis

On - Premises Computing
- Alveo for Industrial PC Acceleration

Mixed Criticality & Soft Processors
- Cache Coloring
- Xilinx MicroBlaze processors are for everyone

Any - to - Any Connectivity
- TSN LogiCORE IP
- Switches for Industrial Ethernet and TSN
- OPC UA and TSN
- DDS and TSN
- Sony SLVS - EC

Smarter Control & Predictive Maintenance
- EDDP and SPYN
- Predictive Maintenance
- SiC and Model Predictive Control
- Operator Panels / HMI

Xilinx Mission

Building the Adaptable, Intelligent World