Embedded France
L'EMBARQUÉ MADE IN FRANCE

Assises de l'Embarqué

# Digital Transformation
# From Cloud to Field

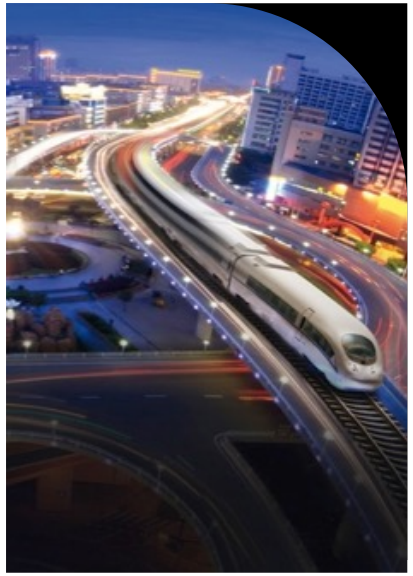
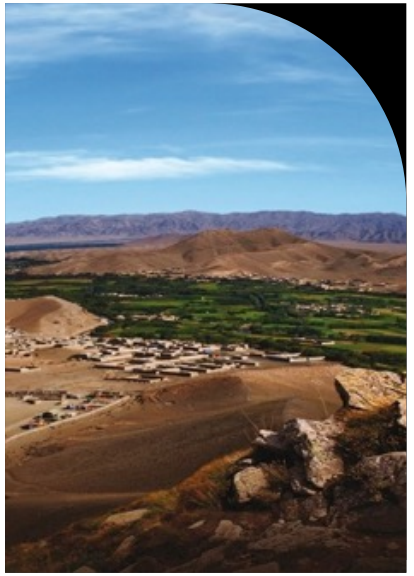
**Bertrand TAVERNIER** | THALES

THALES

#2019embarque

# Thales Mission Statement




**WHEREVER SAFETY AND SECURITY ARE CRITICAL, THALES DELIVERS.**
**TOGETHER, WE INNOVATE WITH OUR CUSTOMERS**
**TO BUILD SMARTER SOLUTIONS. EVERYWHERE.**

# Mastering the critical decision chain

**Critical decision chain**

Sensing and data gathering → Data transmission and storage → Data processing and decision making

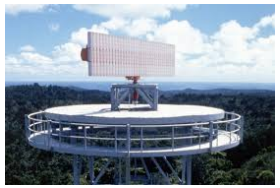
**Critical digital decision chain**

Sensors → Computing / Connectivity → Network & Gateway → Connectivity Platform → Application & Big Data/AI Platform → Application & Analytics / AI

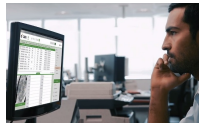
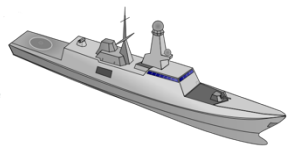
*End-point protection* — *Network* — *Cloud and data protection*

**Very Different real-time and bandwidth constraints**








# OT and IT : are we talking about us ?


**Data Scientists**
*Decision support*

**Engineers**
*Process Analytics*


**Information technology (IT)** : technologies for information management and processing, including software, hardware, communications technologies & services.

**Operational technology (OT) :** hardware and software that detects or causes a change through the direct monitoring and/or control of physical environment.

# Critial Decision Chain, from field to cloud

**Safety Critical**
Real Time
Deterministic
Power (SWaP)
Domain specific interfaces
NoOps / NRC optim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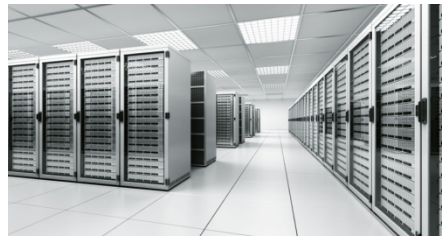
Gateway / C2


**Data Critical**
Transactionnal
High throughput
Scalable
Standard IT interfaces
FinOps / RC optim



Edge

Cloud

Safety Critical

Security Critical

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# Critial Decision Chain, from field to cloud

**Why OT needs IT ?**

- **Data analytics** (HUMS, Autonomy…)
- SW Talents **attractiveness**.
- Source of inspiration for **agility**
- Integration and openness

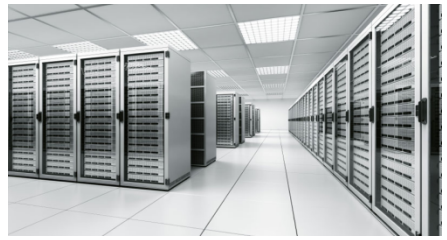

**Why IT needs OT ?**

- Capture **real data**
- Act in **physical world** with safety
- **Power consumption** with HW/SW integration !

Embedded

Gateway / C2

Edge



Cloud

A continuum mixing the constraints

**End to end cybersecurity is required !**

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# Safety and Security Side by Side

**SAFETY** | **SECURITY**

«Always » and « Never » demonstration
- Analysis of intended functions
- Absence of unintended or malicious functions
- Determinism / partitioning

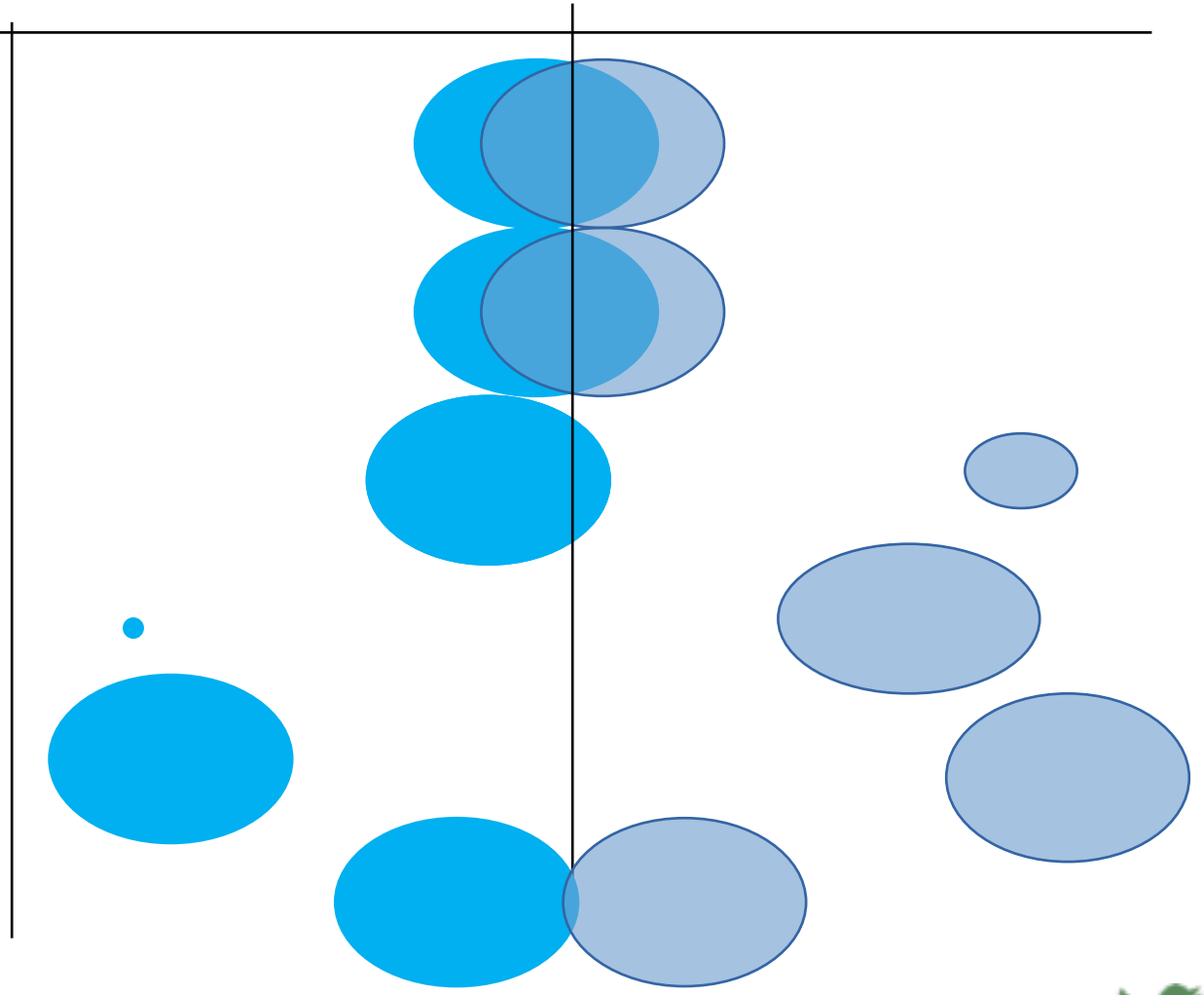
Traceability and compliance
Analysis of derived requirements

History of service

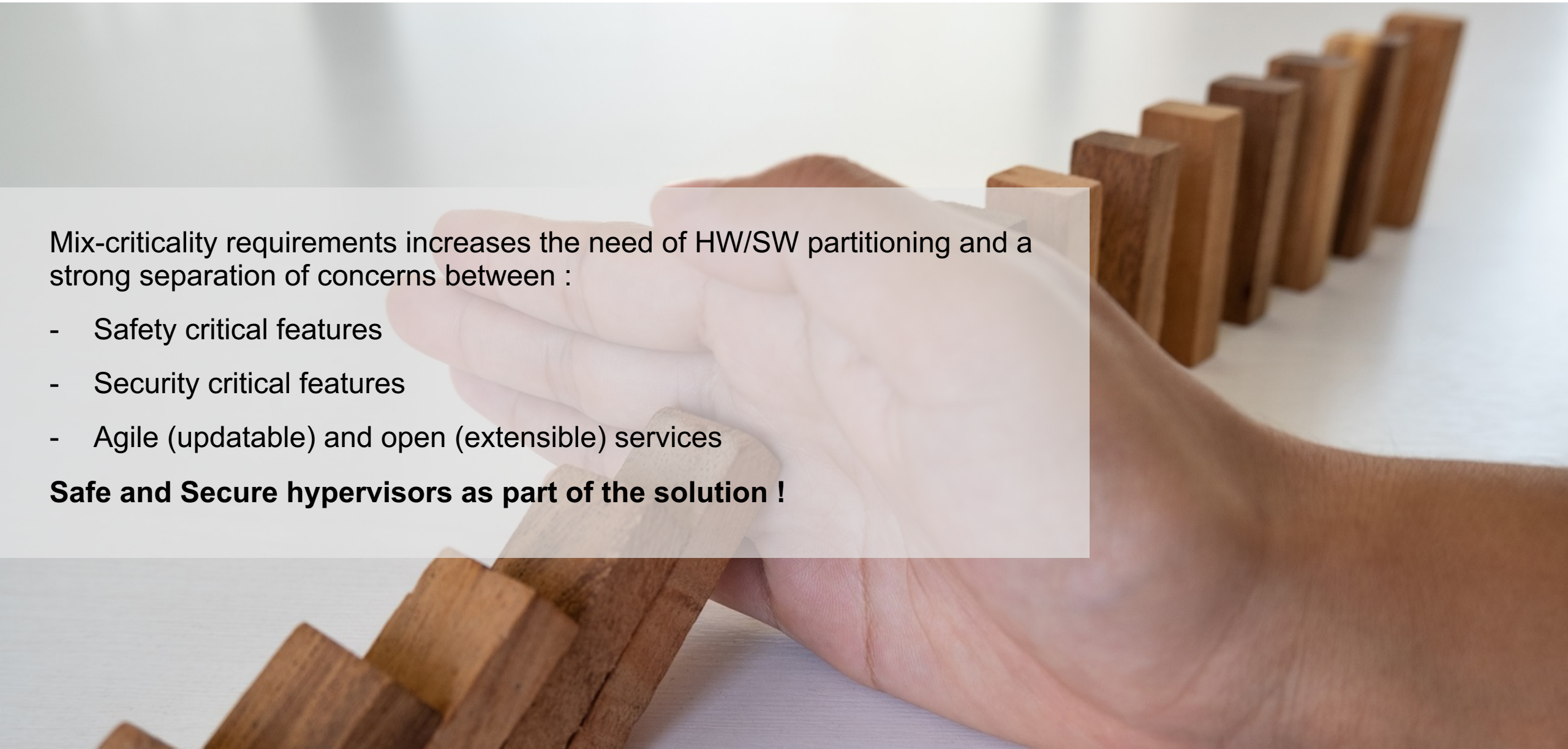
Randomness

Responsible disclosure of problems

Impact of residual problems (low-risk)



# Impact on architecture

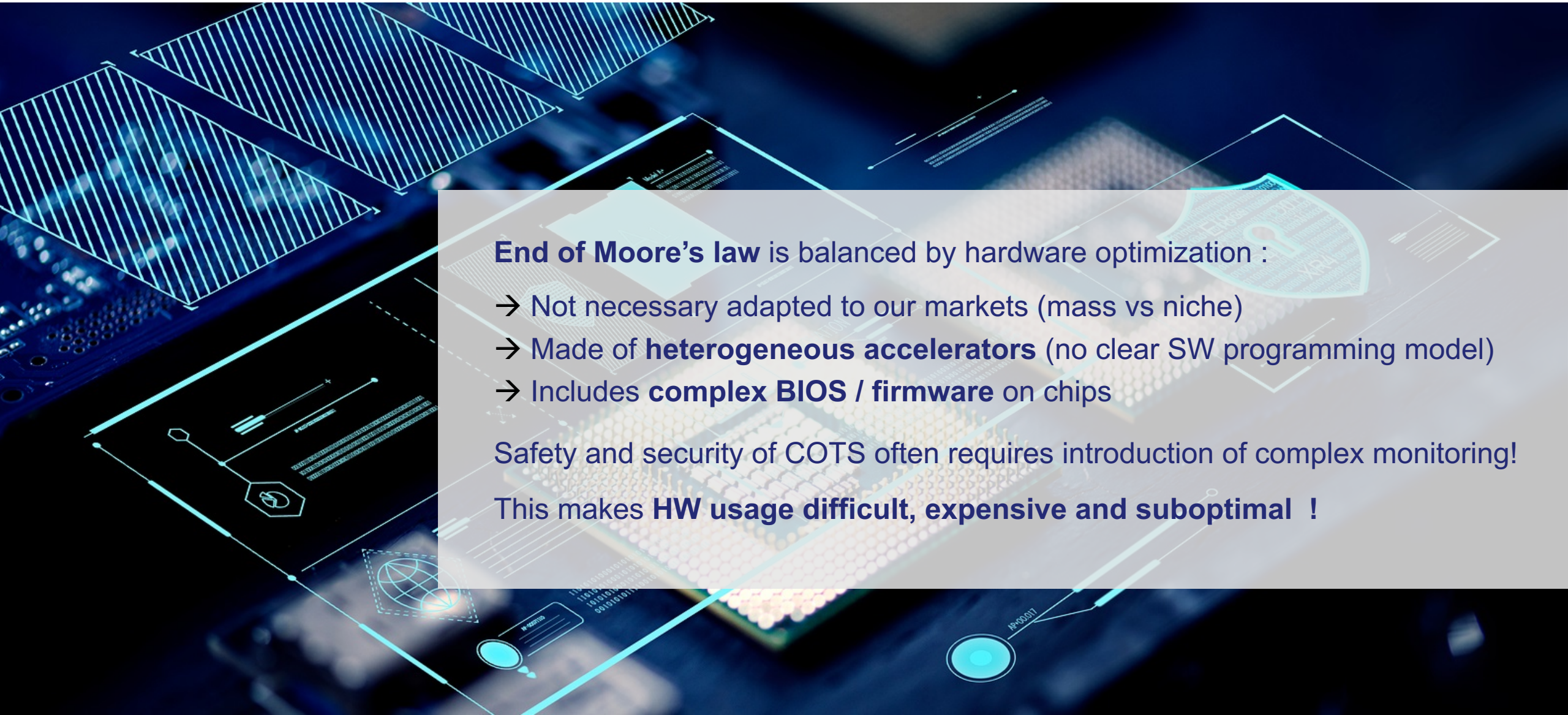


Mix-criticality requirements increases the need of HW/SW partitioning and a strong separation of concerns between :

- Safety critical features
- Security critical features
- Agile (updatable) and open (extensible) services

**Safe and Secure hypervisors as part of the solution !**

# What about computing ?



**End of Moore's law** is balanced by hardware optimization :

→ Not necessary adapted to our markets (mass vs niche)

→ Made of **heterogeneous accelerators** (no clear SW programming model)

→ Includes **complex BIOS / firmware** on chips

Safety and security of COTS often requires introduction of complex monitoring!

This makes **HW usage difficult, expensive and suboptimal !**

# Why Thales pays attention to OSHW ?

**SAFETY**

*No black-box*

**PERFORMANCE**

*State-of-the-art processor*


**SOFTWARE**

*large ecosystem compatible across implementations*

**SWaP**

*Exact fit between features and application needs*

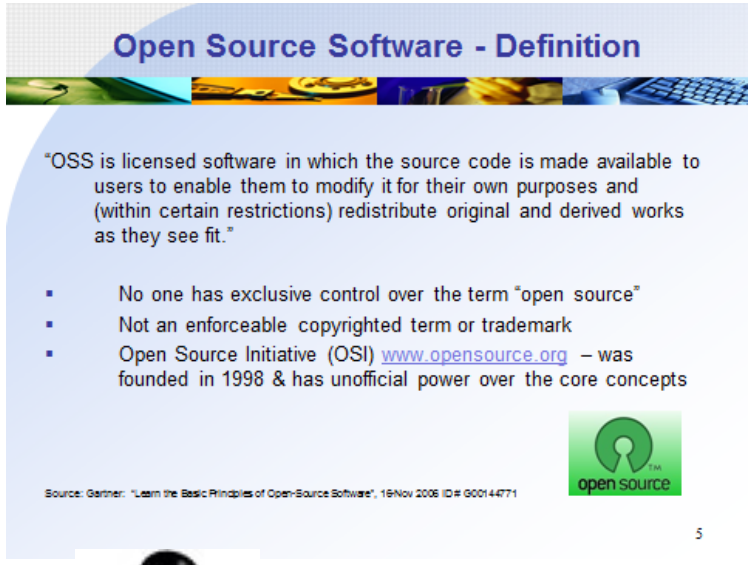
**TRUST**

*a fully auditable processor*

**NO VENDOR-LOCKING**

**a** *SME business to develop custom version is being established*

# Open Source Hardware ?



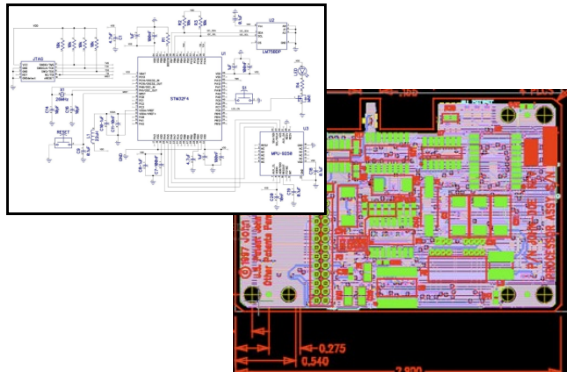

APACHE

Mozilla Firefox

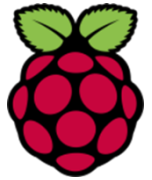
From Open Source Software …

Hardware design files are Open Sourced

- Schematics, topographies
- BOM, Drill, Pick and Place, …
- HDL sources
- Mechanical drawing
- Firmware (sources & bitstreams)



open source hardware



ARDUINO

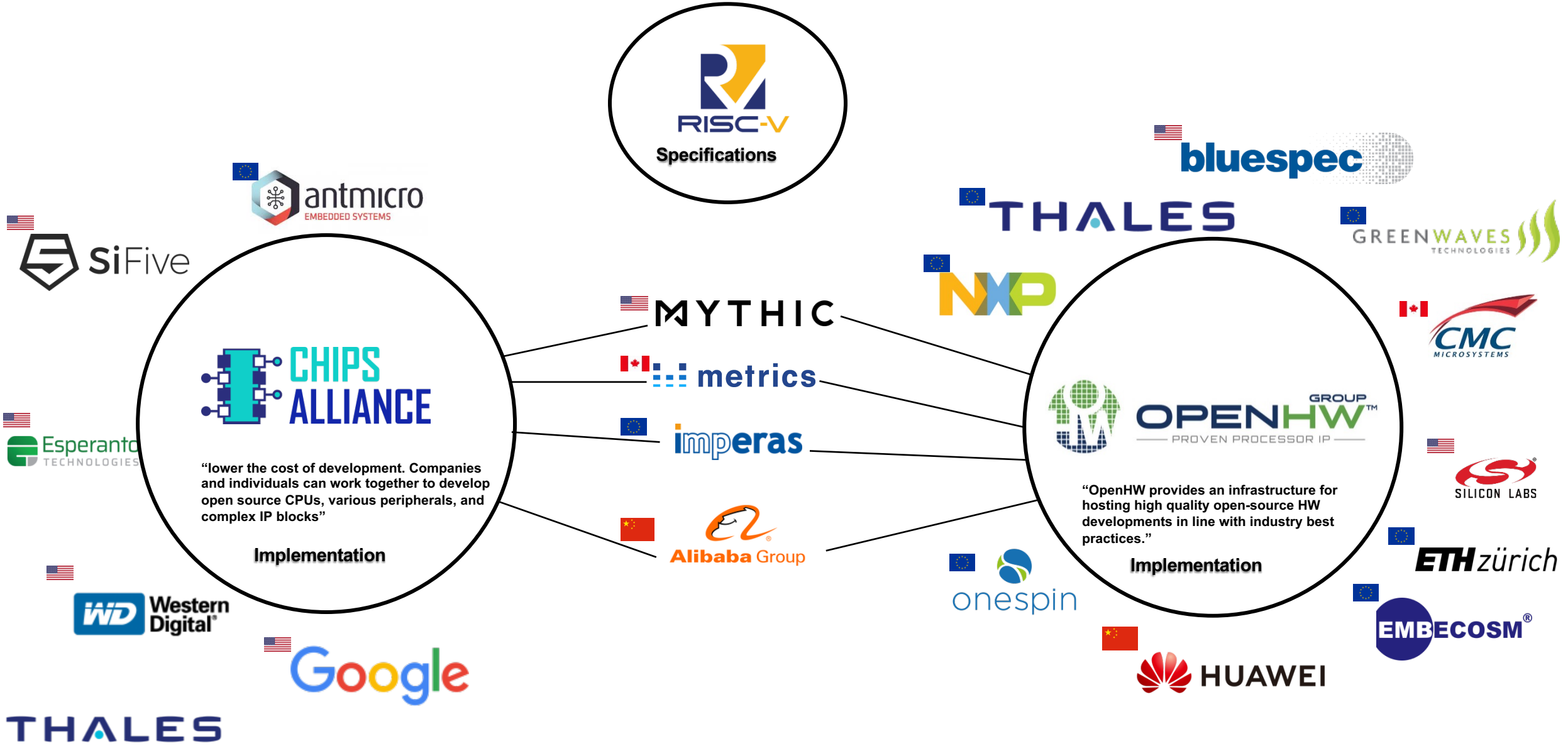
OPEN Compute Project®

RISC-V

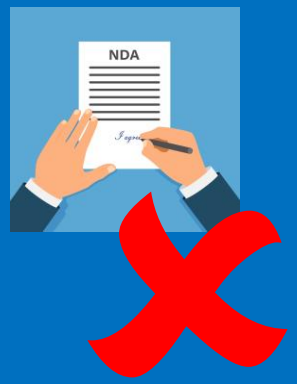
…to Open Source Hardware


The Economist
Topics
Current edition
More
Open season
The rise of open-source computing
It is good for competition—and may offer a way to ease the tech war
BBC NEWS
Technology
Huawei: ARM memo tells staff to stop working with China's tech giant
UK-based chip designer ARM has told staff it must suspend business with Huawei, according to internal documents obtained by the BBC.
ARM instructed employees to halt "all active contracts, support entitlements, and any pending engagements" with Huawei and its subsidiaries to comply with a recent US trade clampdown.
ARM's designs form the basis of most mobile device processors worldwide.
In a company memo, it said its designs contained "US origin technology".
As a consequence, it believes it is affected by the Trump administration's ban.
One analyst described the move, if it became long-term, as an "insurmountable" blow to Huawei's business.
He said it would greatly affect the firm's ability to develop its own chips, many of which are currently built with ARM's underlying technology, for which it pays a
100
75
50
25
0
Q3 2015
Q4 2015
Q1 2016
Q2 2016
Q3 2016
Q4 2016
Q1 2017
Q2 2017
Q3 2017
Q4 2017
Q1 2018
Q2 2018
Q3 2018
Q4 2018
Q1 2019
Q2 2019
Q3 2019
44 Chip (SoC, IP, FPGA)
9 I/O (Memory, network, storage)
31 Services (Fab, design services)
25 Software (Dev tools, firmware, OS)
24 Industry (cloud, mobile, HPC, ML, automotive)
31 Research (Universities, Labs, other alliances)
150+ Individual RISC-V developers and advocates

# RISC-V Alliances & Foundations



# Open Source leading to Open Innovation




REMOVE
UPFRONT BARRIERS
(OPEN STANDARDS)


OPEN SOURCE
BUSINESS
MODELS
ENCOURAGE
INNOVATIONS


SHARE COST
AMONG USERS

DESIGNED AND
OWNED
BY A COMMUNITY

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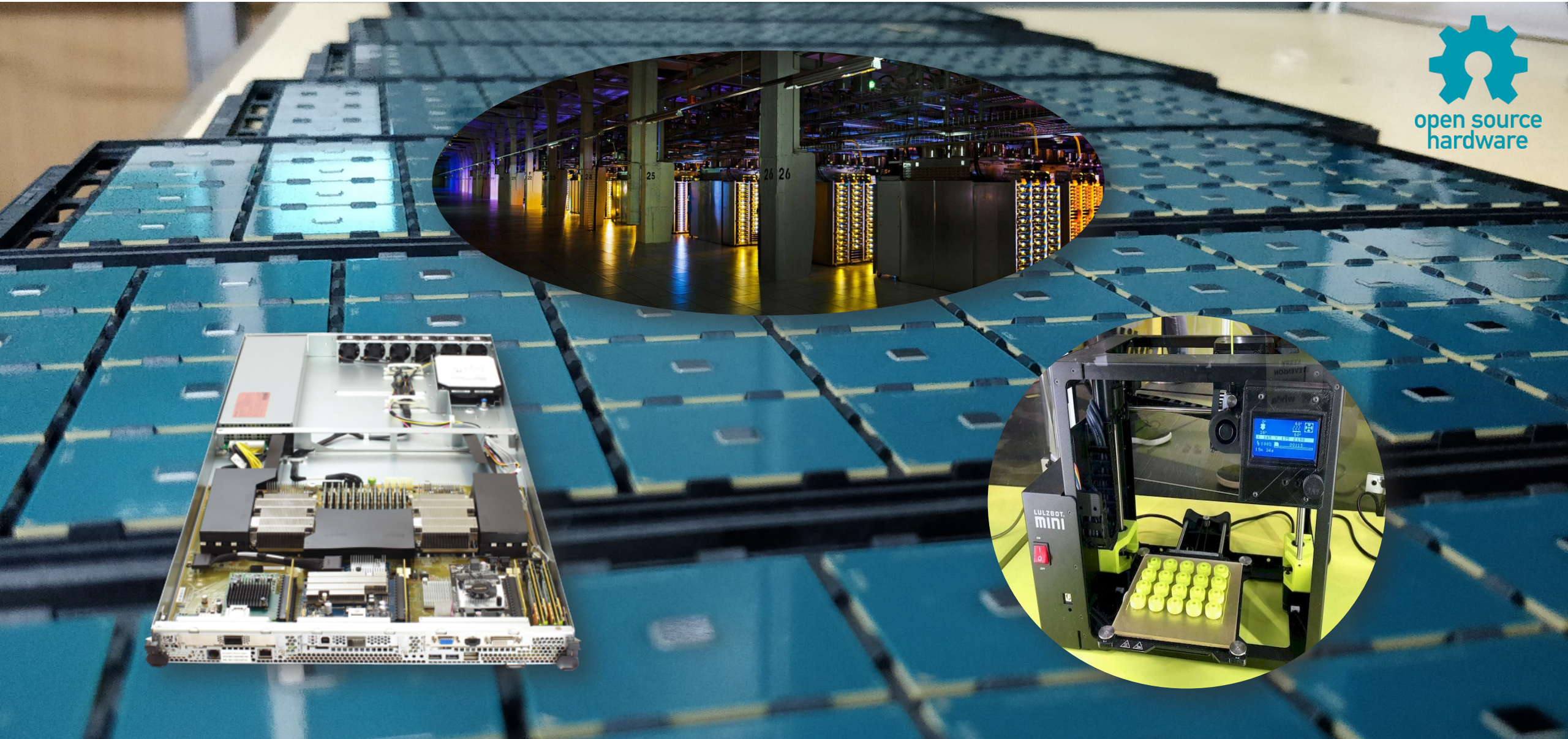
# OSHW - Hype or trend ???

Assises de l'Embarqué



# OSHW - Hype or trend ???

Hello everybody out there using minix –

I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix,

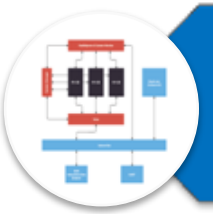
...

Linus ([email protected]) – August 91

PS. Yes – it's free of any minix code, and it has a multi-threaded fs. It is NOT protable (uses 386 task switching etc), and **it probably never will support anything other than AT-harddisks, as that's all I have** :-(.

# Conclusions

**Mission-critical** embedded systems become **more and more complex** (Safety, Security and SWaP) and mass market hardware is **less and less adapted**.



**Open innovation** in hardware is a transformation bringing **digital revolution** to the physical world (from cloud to field)

**Thales decided to leverage RISC-V** initiatives and to provide a safe and secure point of view **in open source hardware communities**.

This **revolution** not only concerns open standard and open source, but the **full ecosystem** (from academia to business and communities, from tools to culture)