

ELECTRONICS FOR TRUSTWORTHY COMMUNICATION

6G & BEYOND

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EUCNC, JUNE 8



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But is it trustworthy ???

Agenda

Societal Trends towards 6G

From 5G to 6G

Mobility Use Case for Trustworthy 6G

Trustworthiness @ Different Levels

Trustworthy Computing Platforms

Conclusion

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Societal Trends towards 6G

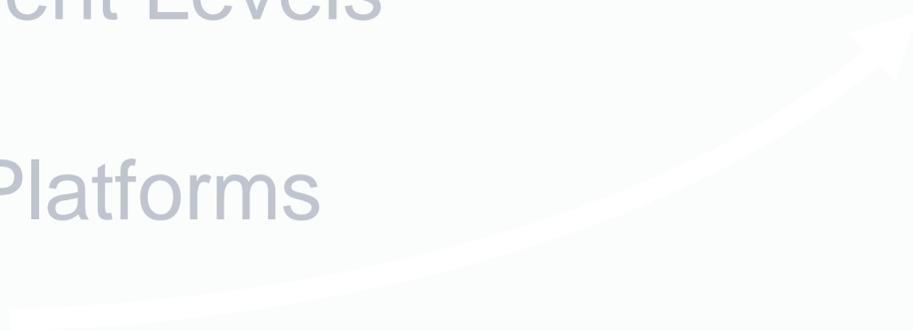
From 5G to 6G

Mobility Use Case for Trustworthy 6G

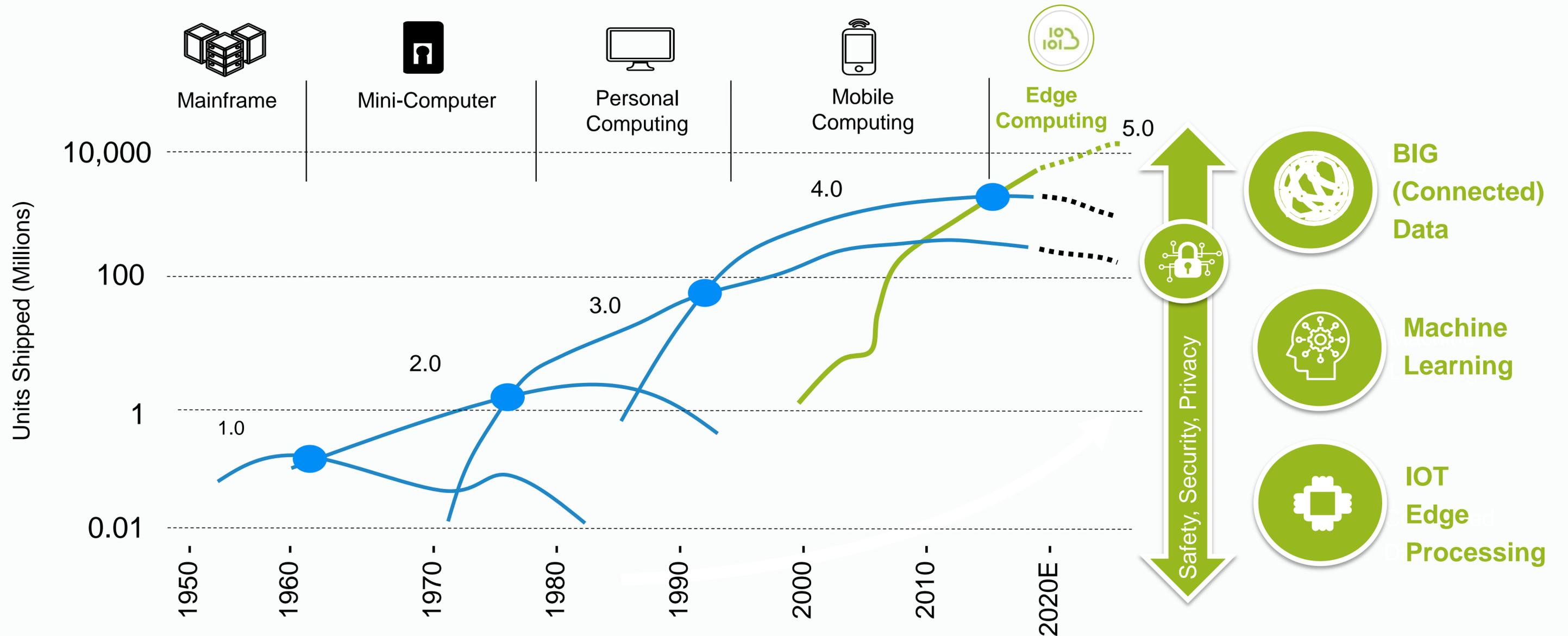
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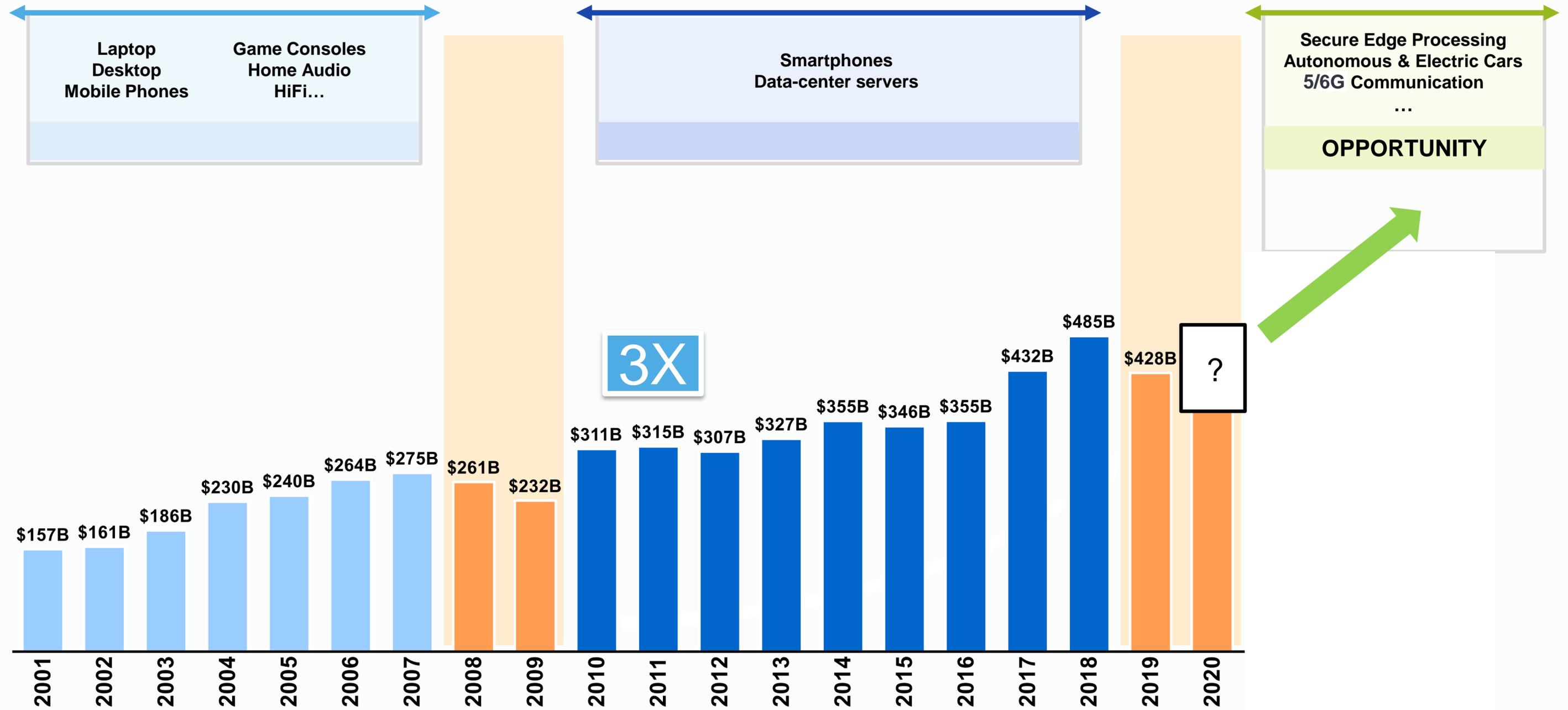
Conclusion



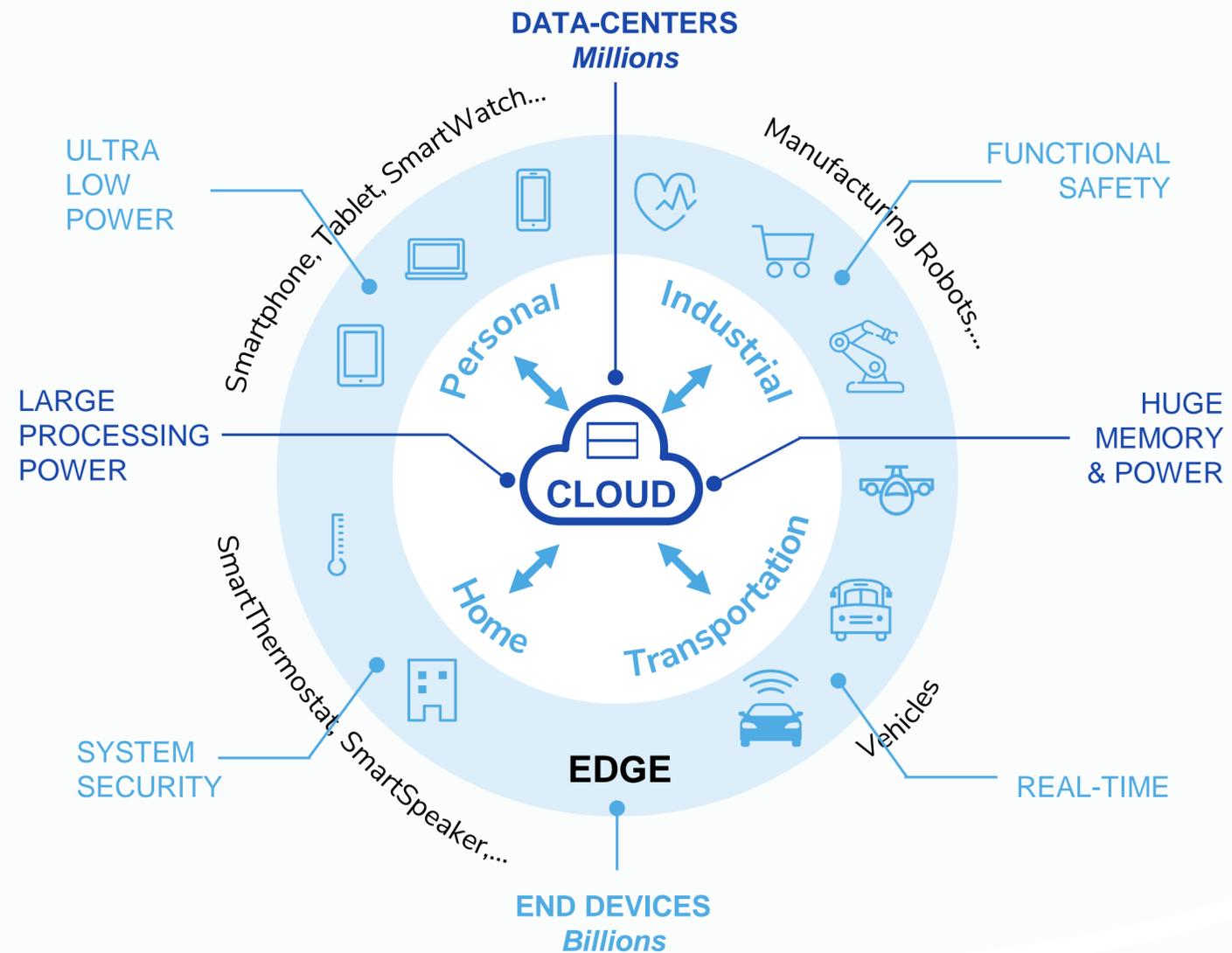
5th Wave of Computing



Semiconductor market growth



Rise of Secure Edge Processing



**DATA COLLECTION, PROCESSING AND DECISIONS TAKEN AT THE EDGE,
EDGE DEVICES SECURELY CONNECTED TO THE CLOUD**

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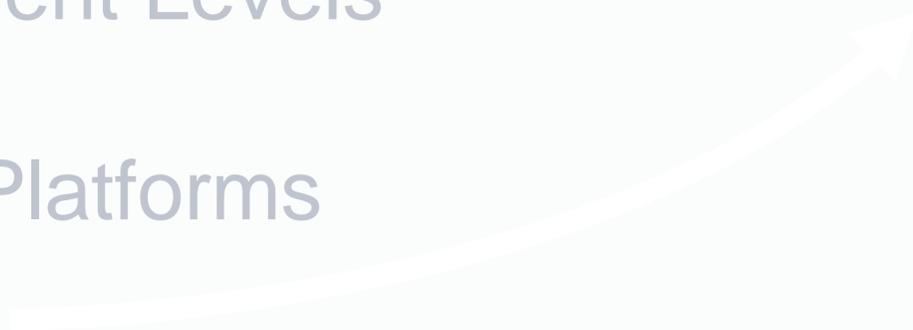
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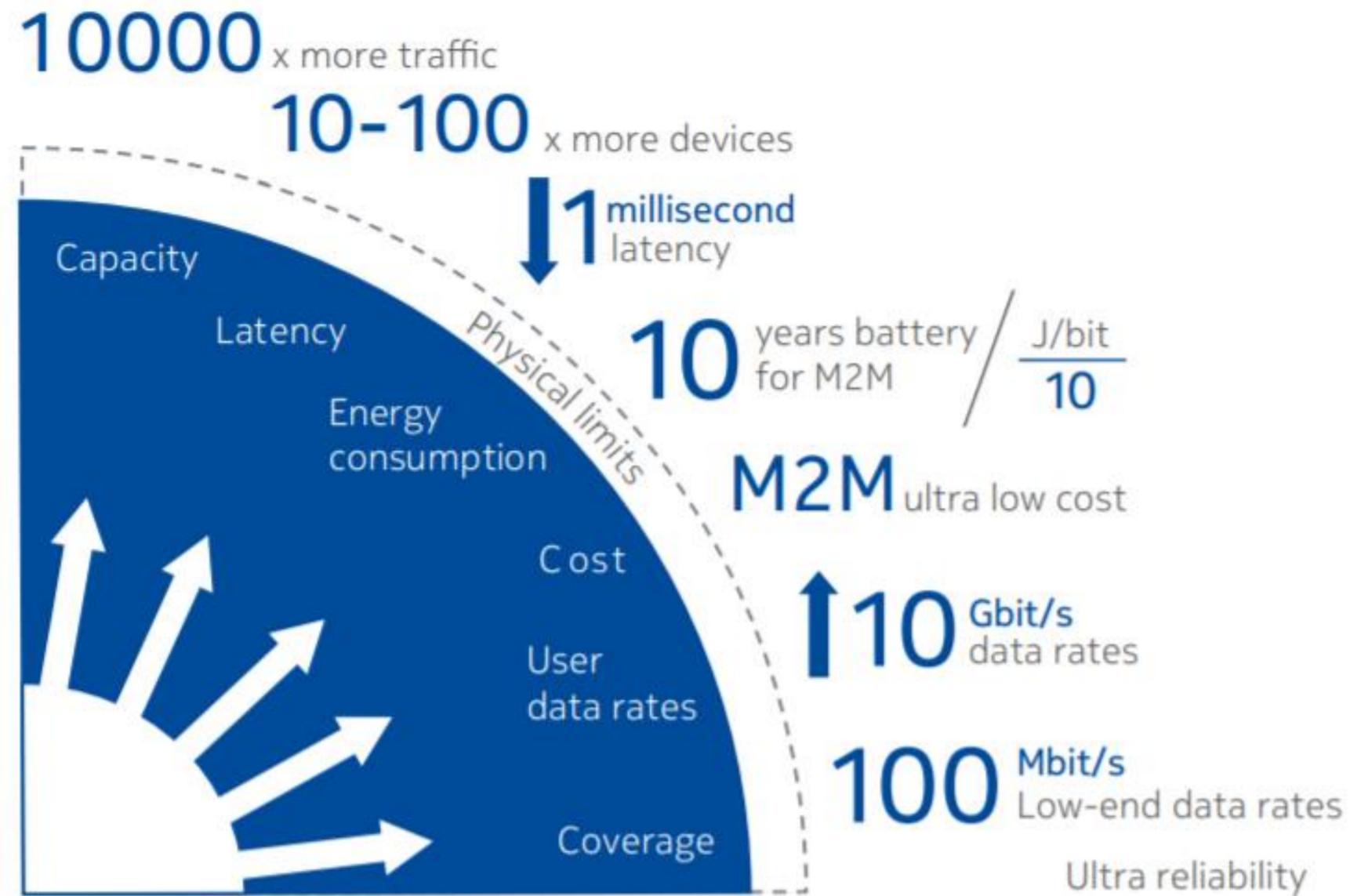
Trustworthy Computing Platforms

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Nokia's 2018 view on 5G requirements

“Limits will be reached. Current systems do not scale to requirements beyond 2020” (*)



(*) Source : <https://tweet4technology.blogspot.com/2018/09/nokia-5g-looking-ahead-to-5g.html>

From 5G to 6G...

Enhanced Mobile Broadband



Massive Machine Type Communication



Safety Critical Communication



100 Gbps



network plus ultra reliability

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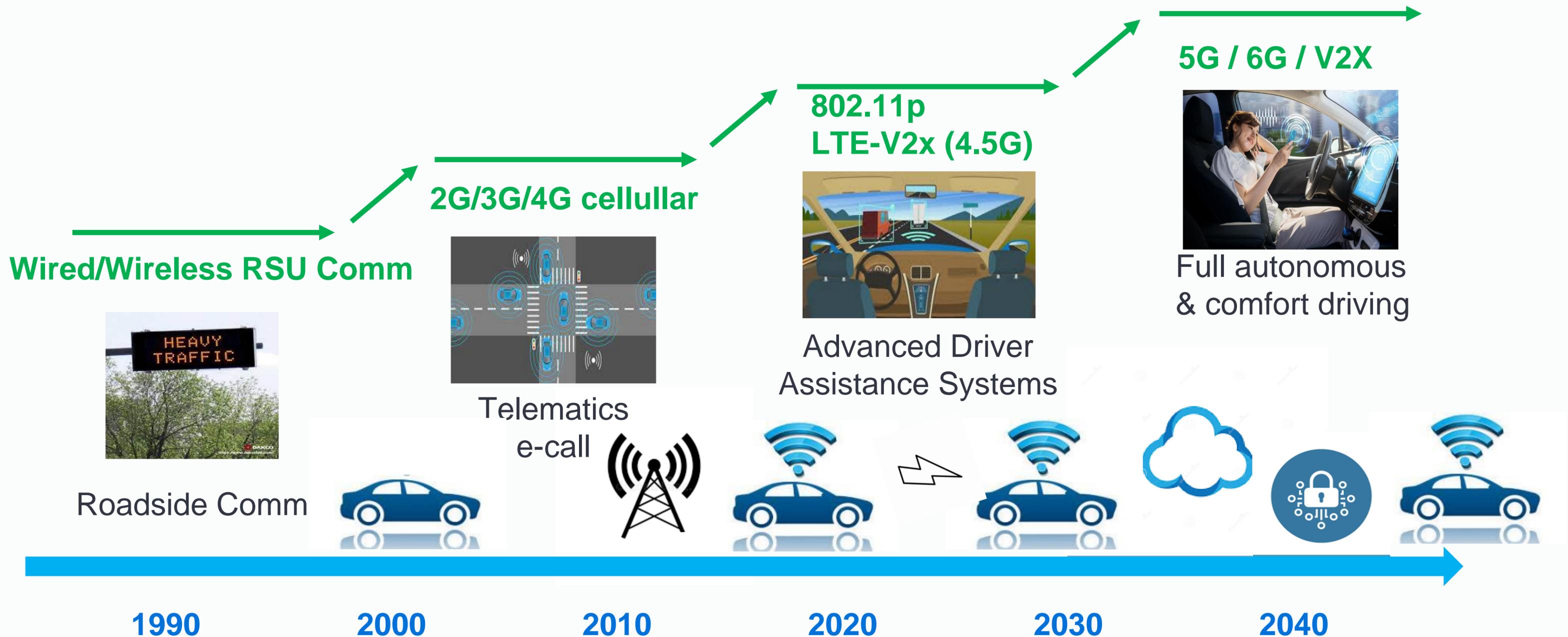
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The Road to Autonomous Driving



The Ultimate Edge Node

High Bandwidth Connectivity

Gateway Capability

Local Compute Capacity

Connected Services

Advanced Sensor Hub

Machine Learning

Ingrained Security

Remote Access

Advanced Displays

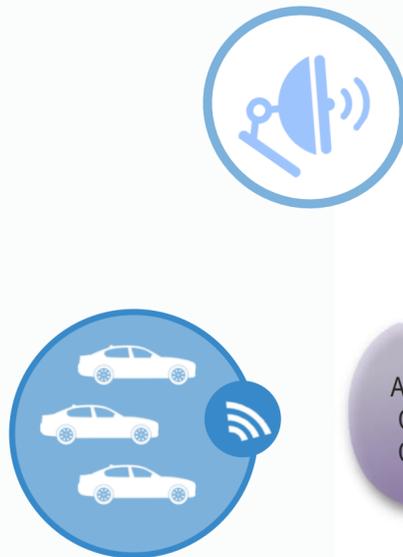
Advanced HMI



Sensing & Processing coming together

RADAR WITH COMM TECHNIQUES

Resolution and robustness



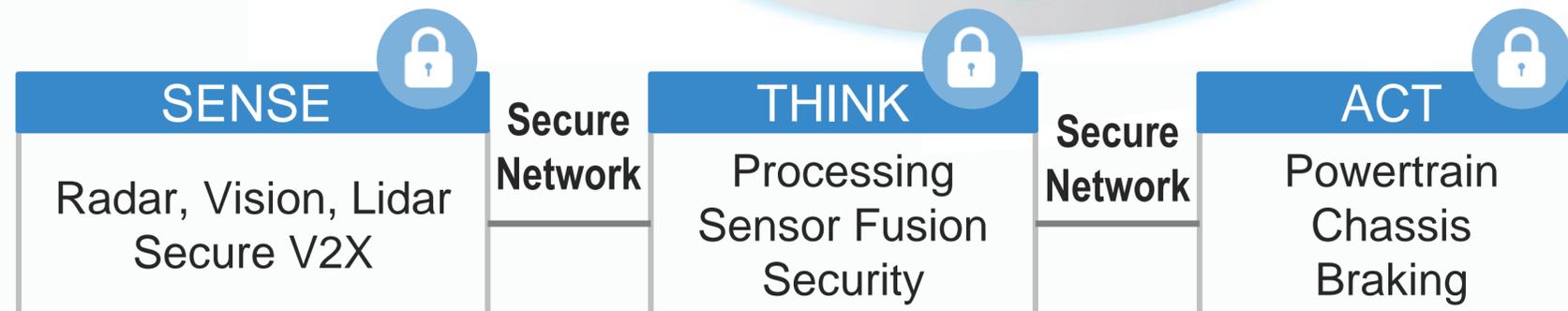
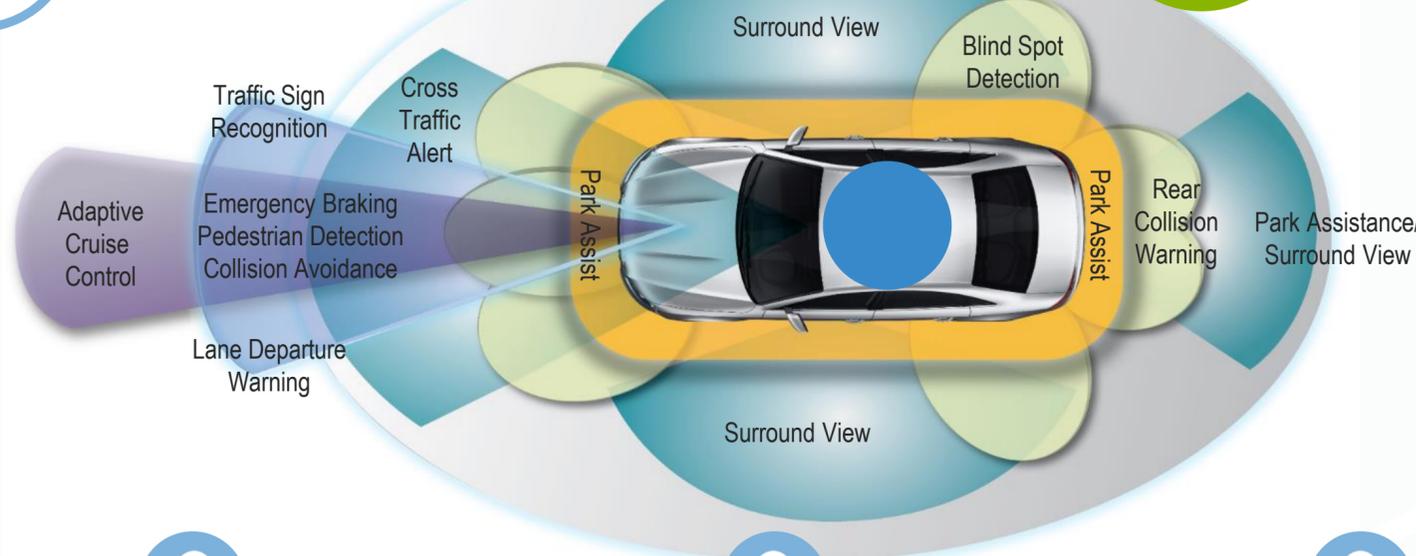
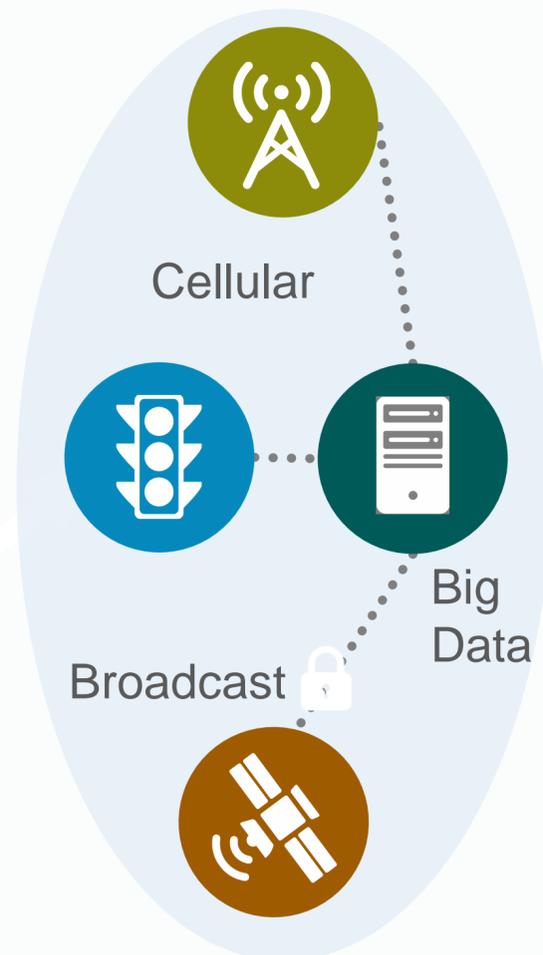
RADAR AND V2X COMM

Combined Perception



RADAR-ENHANCED DATACOMM

Higher rates, efficiency



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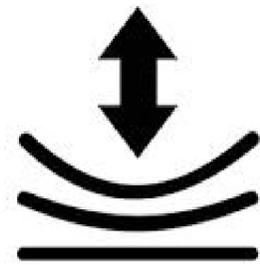
Trustworthiness @ Different Levels

Effective Supply Chains	➔	Trade relationships, Sovereignty,...
Seamless Design2Manufacturing	➔	Avoid unauthorized elements in the process And smooth integration of different steps
Stable Process Technologies	➔	Split manufacturing or vertical separation of Functionality among multiple chiplets
Reliable Electronic Components	➔	Self-healing and failure-safe components
Open HW / SW	➔	Standardization & certification
End2End Communication	➔	Encrypted, resilient to hacking & secured platform upgradability

Trustworthiness of Electronic Components & Systems



PRIVACY



RESILIENCE



SECURITY



INTELLIGENCE

Resilience

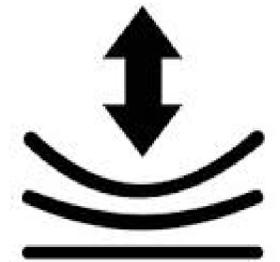
Goal :

Continuously deliver the intended functionality despite adverse events, adapt to changing environmental conditions, and withstand disruptive events, due to 3 reasons :

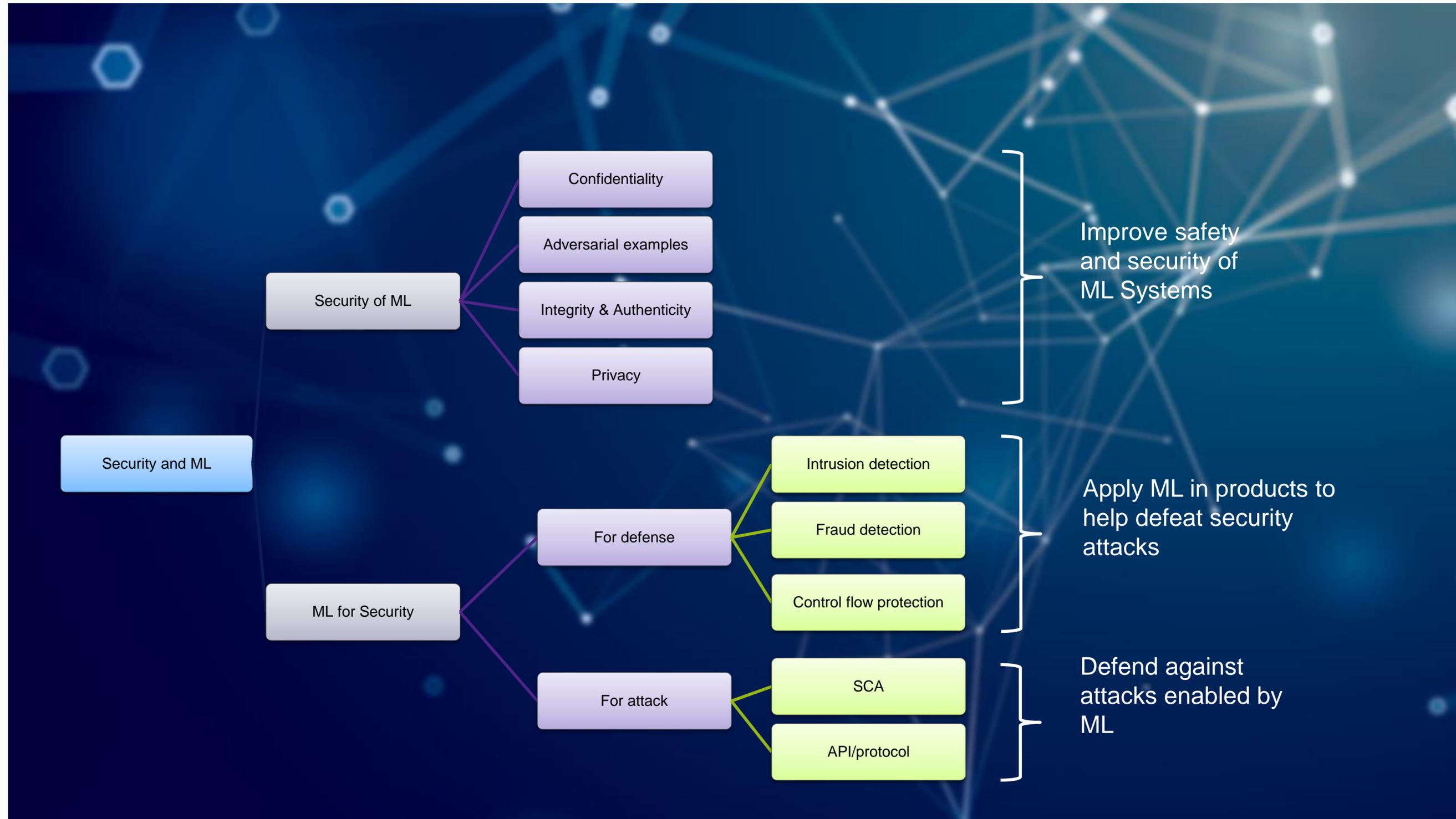
- Failures of HW or SW due to bugs, ageing or misconfiguration
- Maliciously induced failures or security attacks from outside the system
- Unexpected inputs

Resilience-by-Design

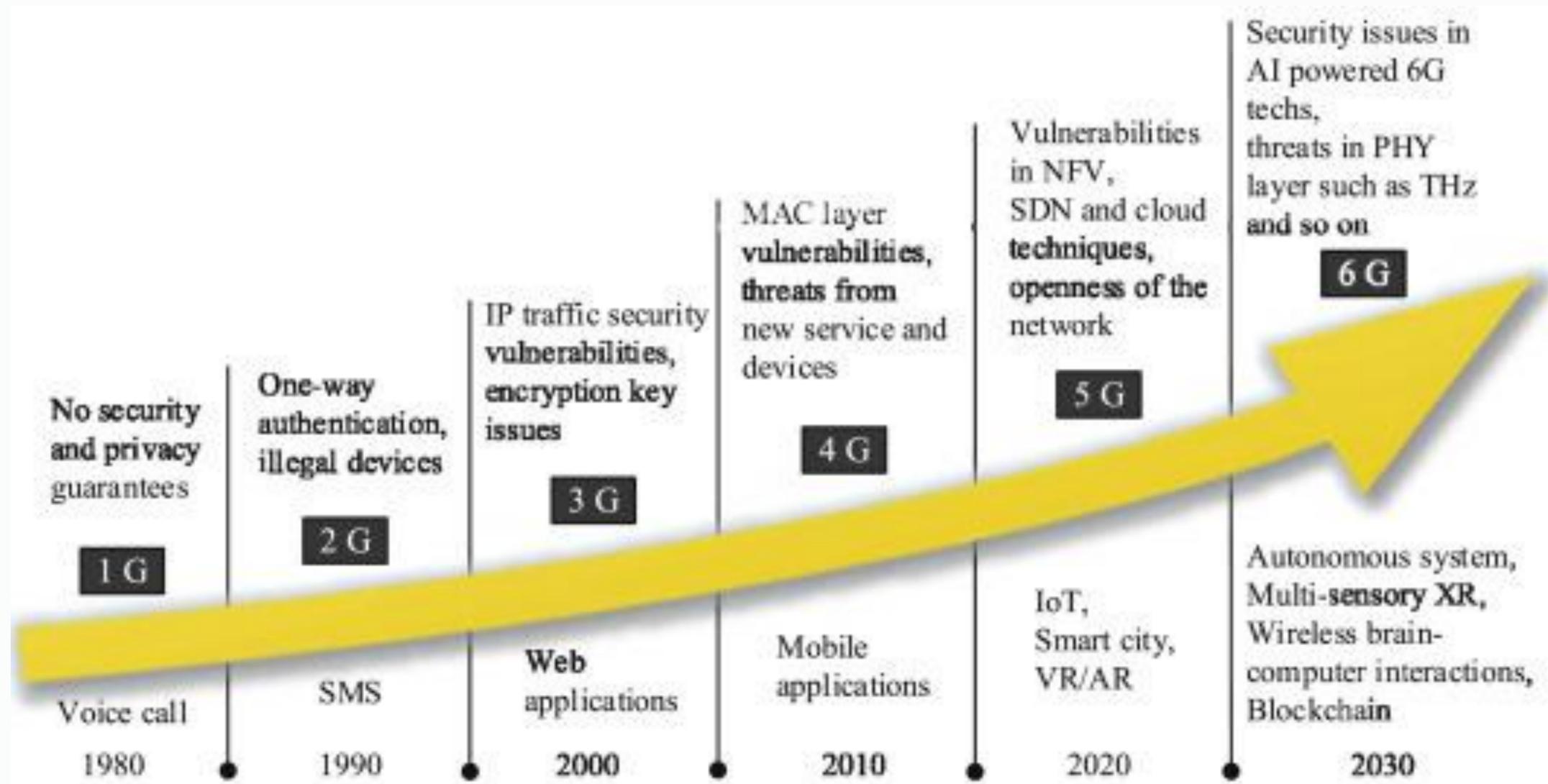
Resilience-by-Reaction



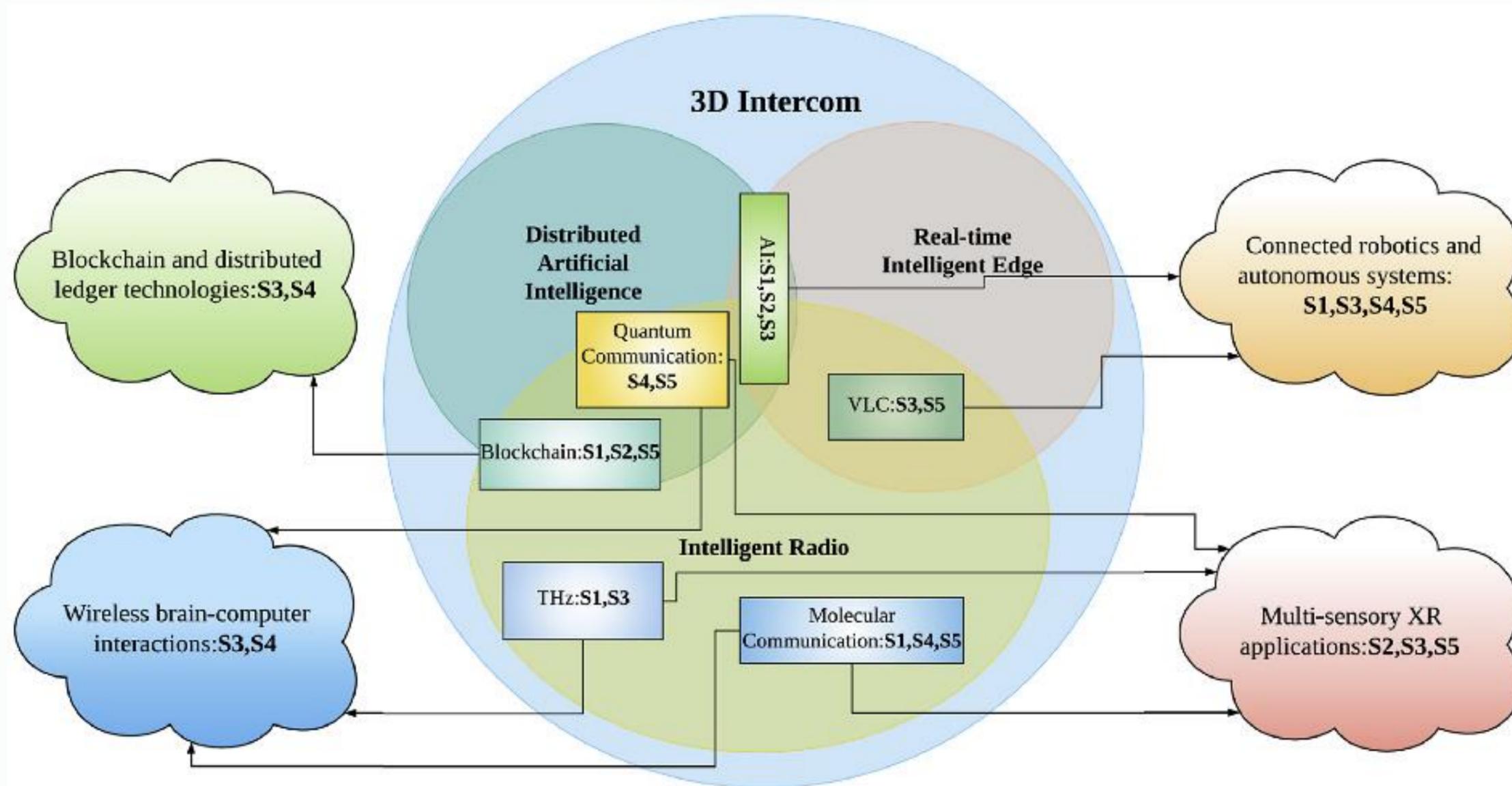
Intelligence... where ML & security meet...



Challenges in security & privacy in 6G



Security & Privacy Issues - Example



Security and Privacy Issues:
S1: Authentication, S2: Access Control, S3: Malicious behaviors, S4: Encryption, S5: Communication

Example Research Challenges on Security & Privacy



	S1 Authentication	S2 Access Control	S3 Malicious behaviour	S4 Encryption	S5 Communication
Multi-sensory XR applications		A new multiple-access method for managing access	A new scheme that could defend against eavesdropping		Treats the dynamics of the network to improve the security of the communication process
Connected robotics and autonomous systems	Self-driving vehicle protocol that could support two-factor authentication		Prevent WiFi-based attacks in autonomous drone networks Attack methods via wireless networks to assault autonomous vehicles	Novel mathematical framework that could enhance the security of autonomous drone networks Post-quantum cryptography	Unique communications method that could prevent eavesdropping attacks

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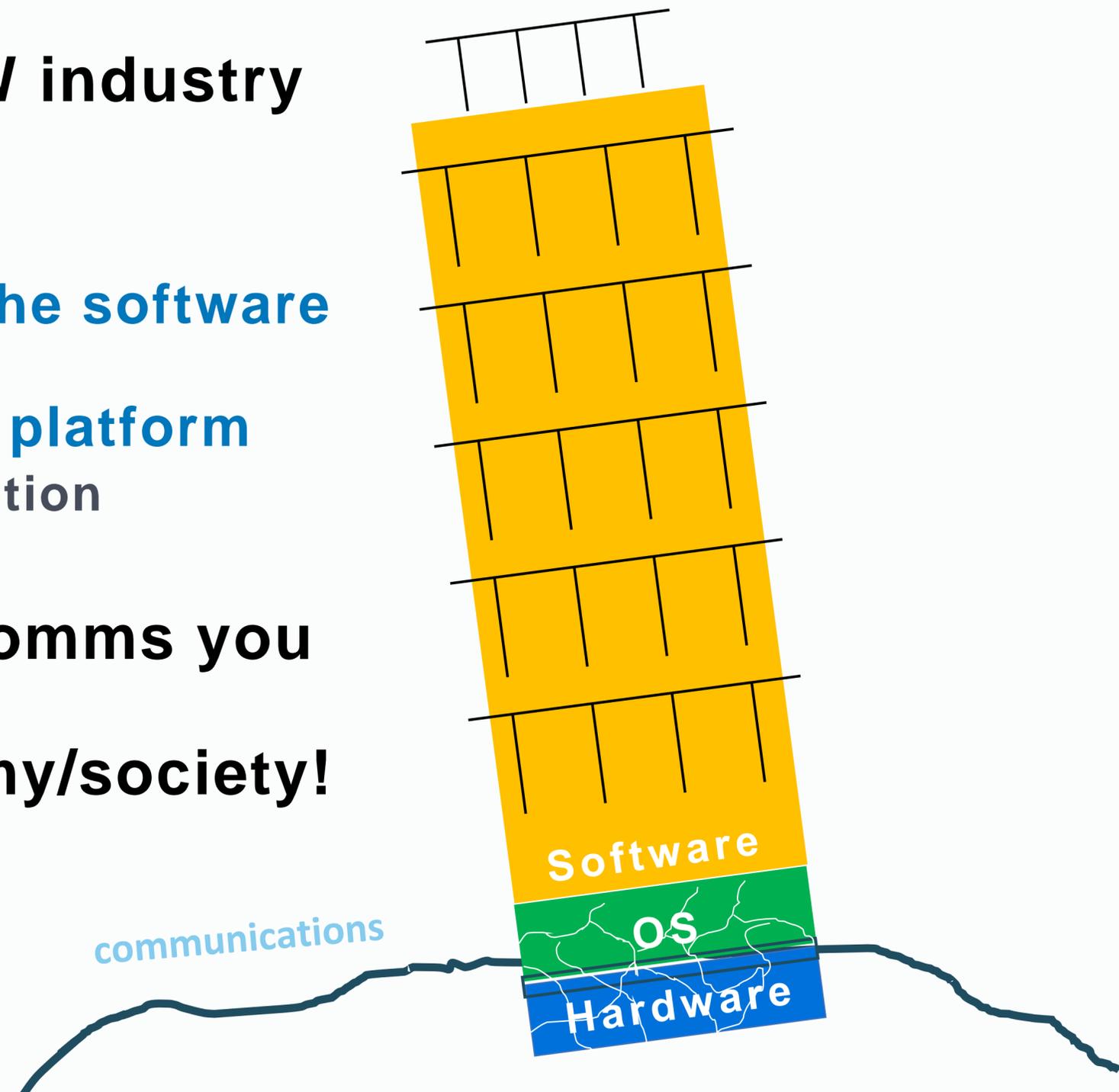
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Trustworthy Computing Platforms

- **SW industry is > 10x larger than HW industry**
- **Software runs on OS/HW platforms**
 - **Who owns the OS/HW also controls the software industry**
 - **Important KPIs dominated by OS/HW platform**
 - E.g. security, privacy, energy consumption

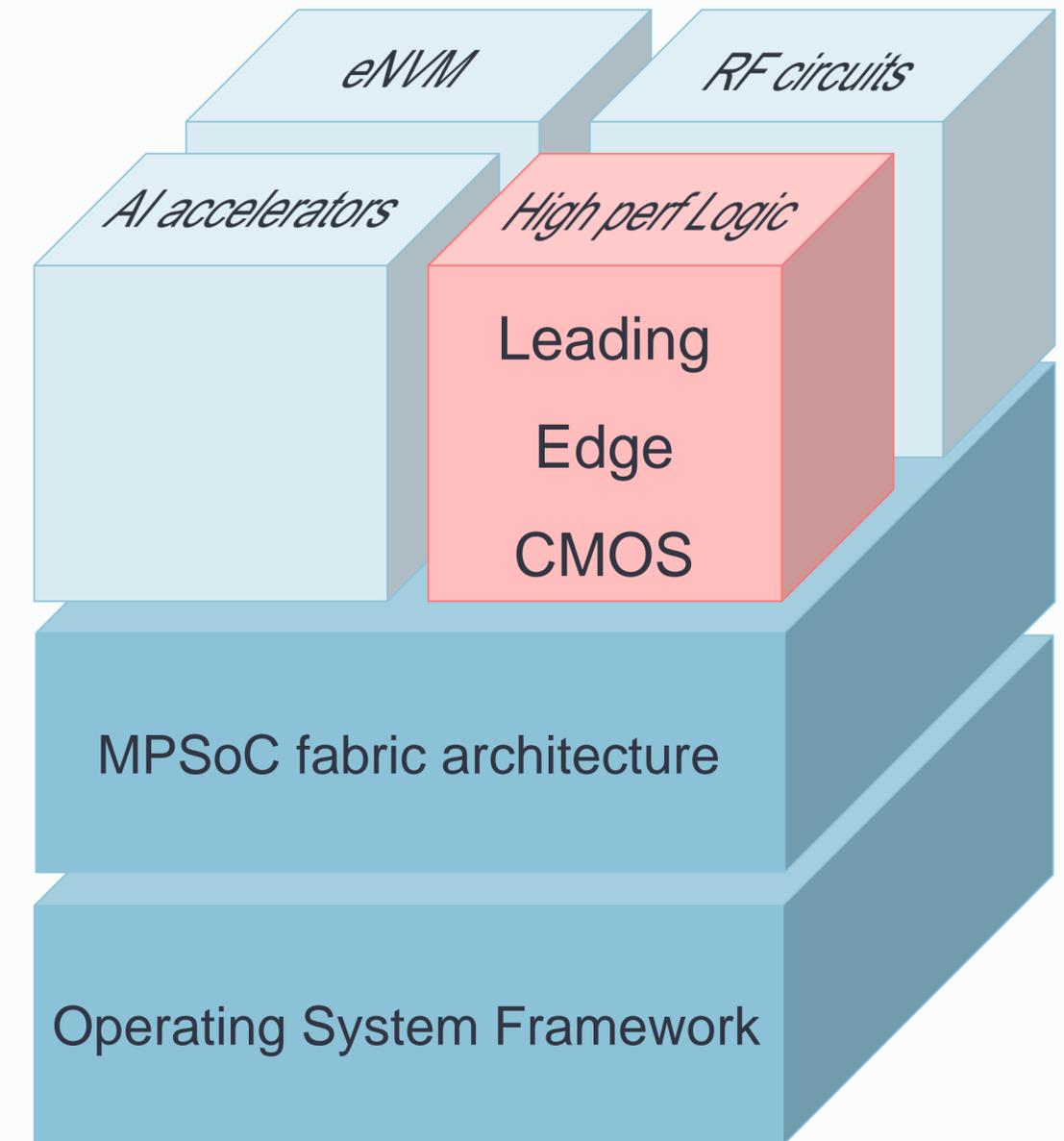
→ **Only by certifying the SW/OS/HW/Comms you can build TRUST**

→ **The basis of our democracy/economy/society!**



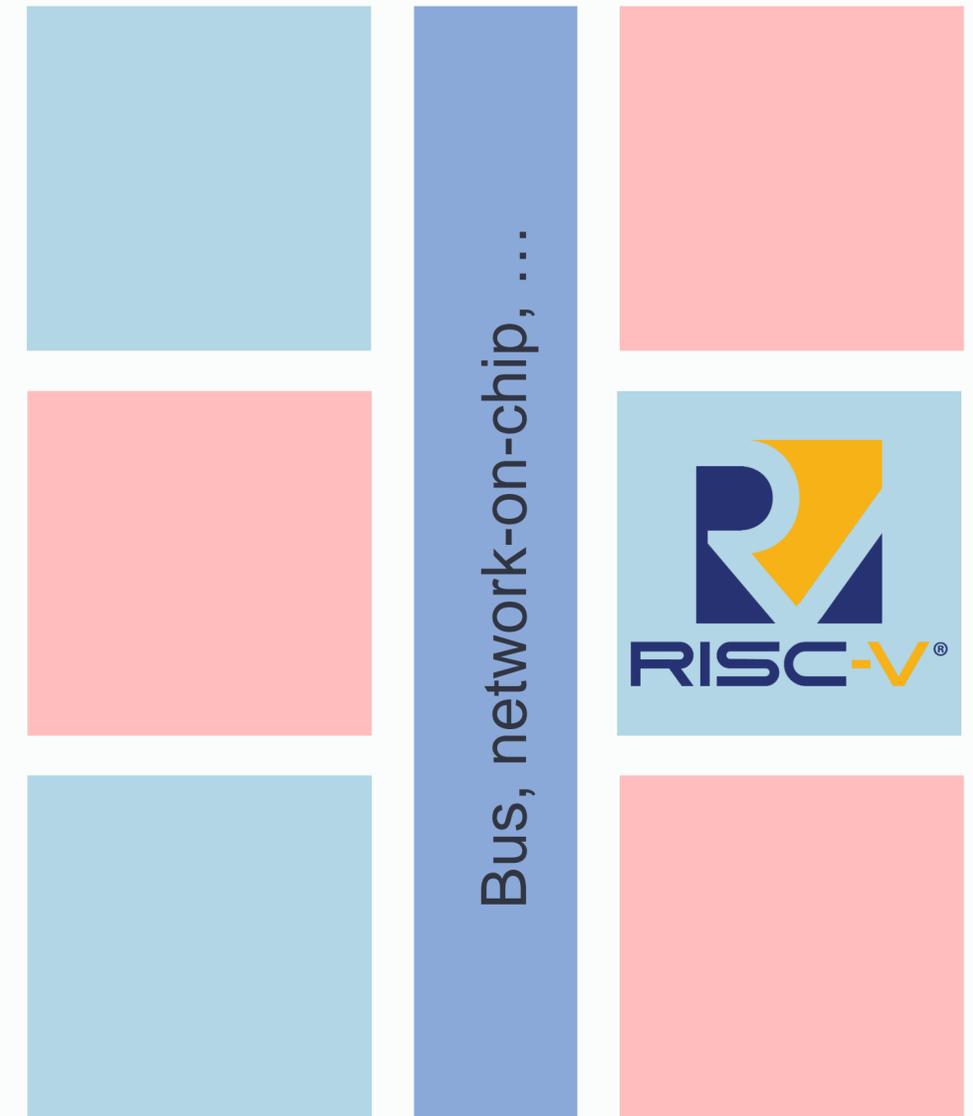
Component Integration

- **2.5D and 3D packaging of trusted and untrusted components**
- **Untrusted components can be “upgraded” to required trust level by**
 - **Open source RISC-V cores**
 - **MPSoC fabric architecture**
 - **Operating System Framework**



MPSoC

- **New MPSoC fabric architecture**
 - **Interface to the OS**
 - **Enable trusted HW units**
 - **Isolate untrusted HW units**
 - **Allow transactions between units**
 - **Independent from chip network, i.e. allow different realizations**



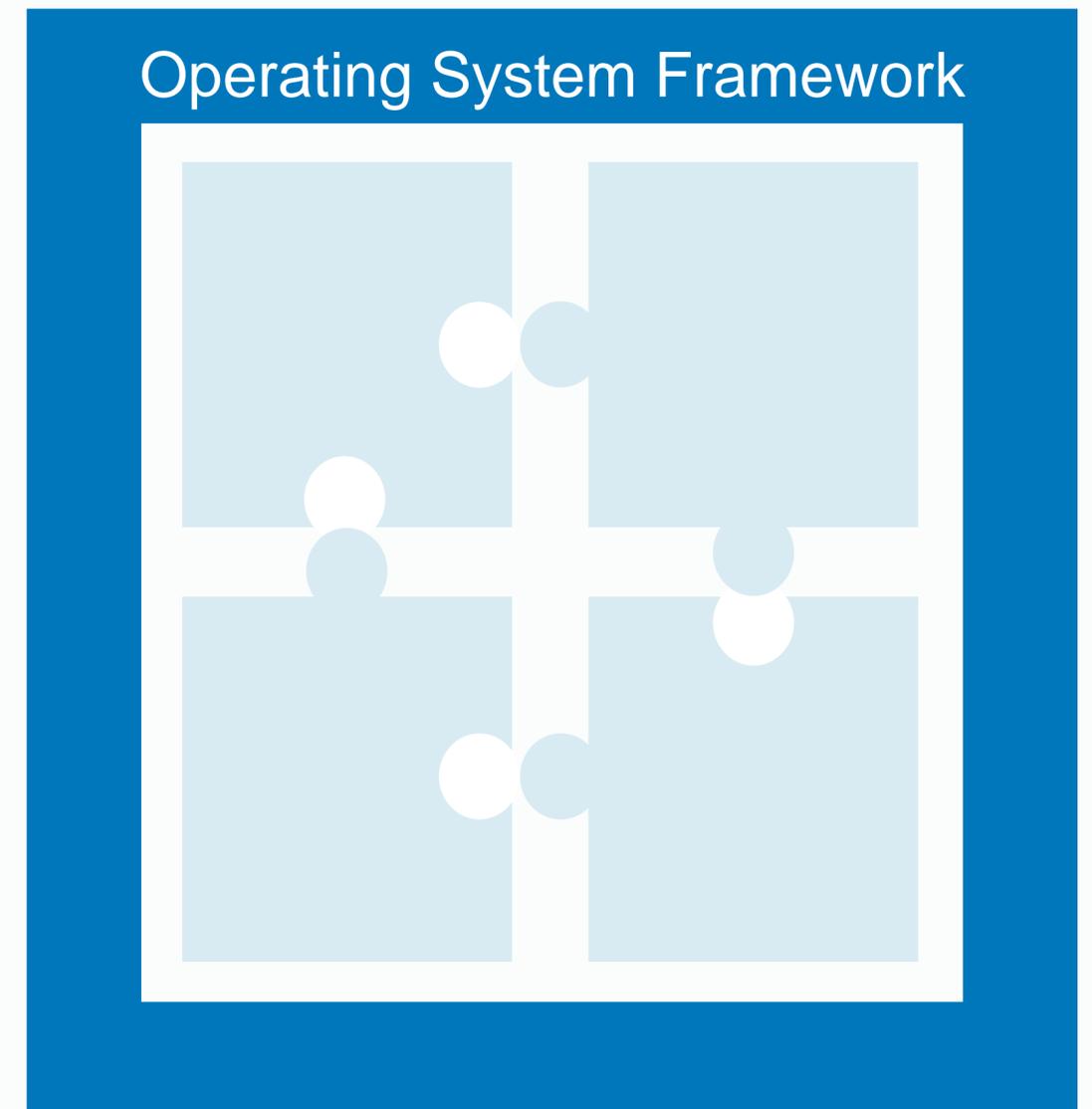
Instruction Set Architecture

- **RISC-V implementations → “root of trust”**
 - **Open-source**
 - **Formally verified**
 - **Certified**
- +**
- **Custom extensions**
 - **Integrate accelerators**
 - **Support MPSoC and OS**
 - **Enhance security**



Operating System Framework

- **Modular, μ -kernel based system**
 - **Trustworthy, secure, flexible**
 - **HW anchors for MPSoC**
- **Open-source**
- **Formally verified**
- **Well documented**
- **Allow for hierarchy and virtualization**



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*Thanks for your
attention !*

