ARTEMIS 2013 AIPP5

EMC²

A Platform Project on Embedded Microcontrollers in Applications of Mobility, Industry and the Internet of Things

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… in cooperation with entire Project Management Team

Project Overview
Numbers

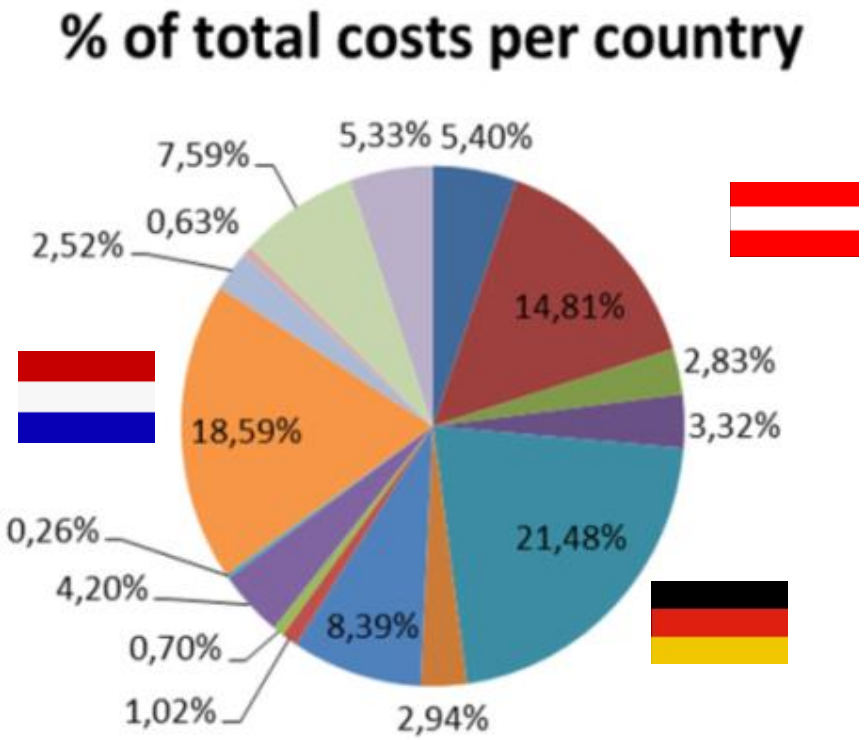
Embedded Multi-core Systems for Mixed-Criticality Applications in Dynamic and Changeable Real-Time Environments – EMC²

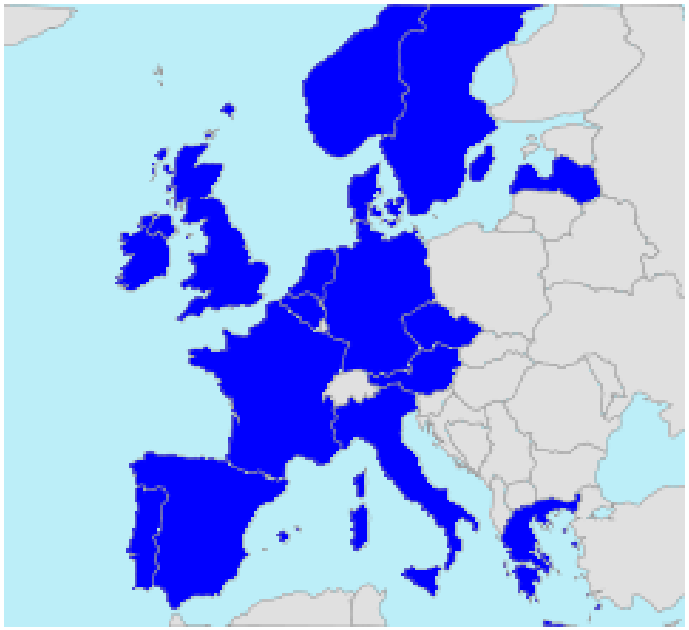
(Artemis Innovation Pilot Project (AIPP)

- AIPP 5: Computing Platforms for Embedded Systems
- Budget: 93.9 M€
- Funding: 15.7 M€ EU funding (Artemis)
  26.7 M€ National funding
- Resources: 9636 person months (803 person years)
- Consortium: 99 Partners, 16 EU Countries + Israel

→ Largest ARTEMIS-JU project ever!

Project Overview
European Dimension





EMC² – targets at European level

EMC2 targets
Reduce the cost of the system design by 15%
Reduce the effort and time required for re-validation and recertification of systems after making changes by 15%
Manage a ***complexity increase of 25% with 10% effort reduction***
Achieve ***cross-sectorial reusability*** of Embedded Systems devices and architecture platforms that will be developed using the ARTEMIS JU results.

Economic Impact of EMC²

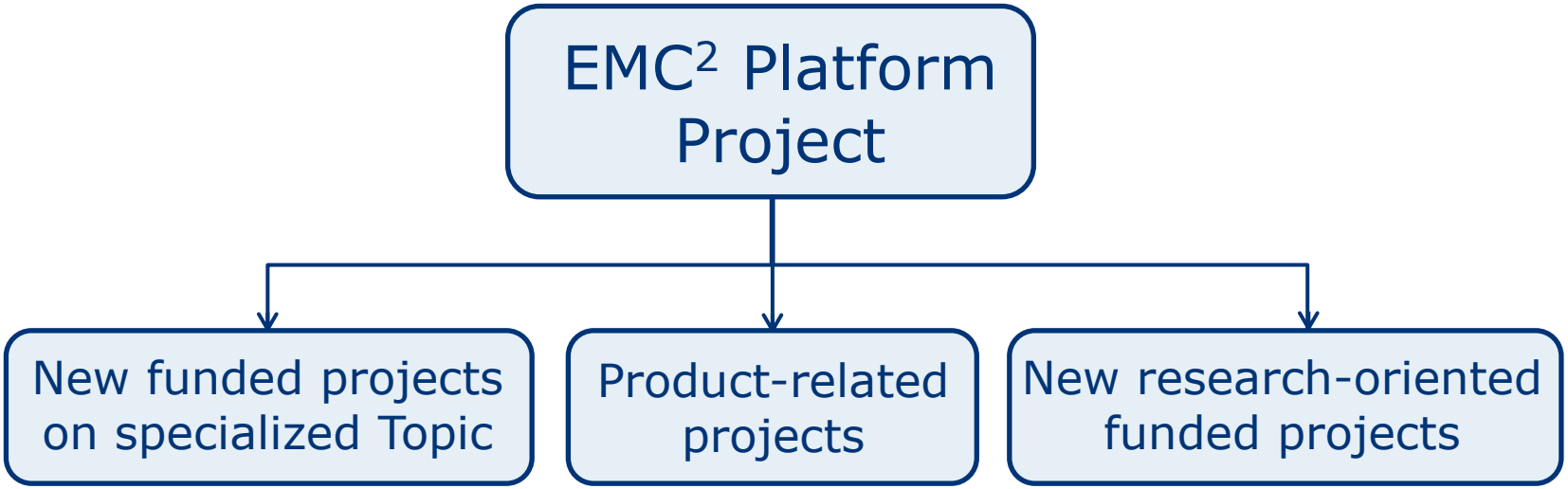
High impact of embedded systems to ***support and drive the innovation*** in many important market sectors:

- **Automotive**: key sector for the European economy, 12 million jobs, 26 billion annual invest in R&D by European car manufacturers; positive contribution to trade balance of € 90 billion p.a.; ***embedded systems enable >90% of innovations***.
- **Industrial control and factory automation**: revenue of 16.5 B€; 30% of energy consumed in the world is used for electric motors. ***Large potential for energy saving***;
- **Healthcare**: represents 25% of the EU economy; Challenges related to ***improving efficiency and effectiveness*** of healthcare

→ Multicore technology as enabler for driving the innovation!

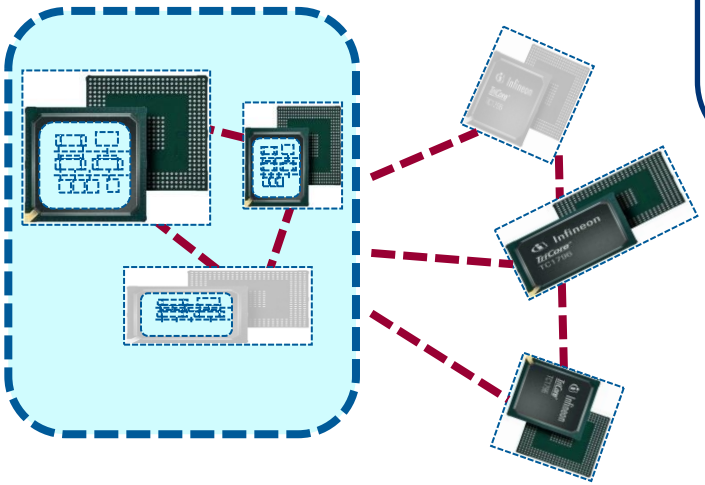
EMC² a large-size project

Large Size **platform project EMC²**
encourages and catalyzes new consortia on EU level
for product-oriented and successive funded projects



Cyberphysical System: Criticality, Complexity and Dynamics in Embedded Systems

State of the art in Criticality:
- Handle different tasks in separate hardware



EMC² Goals:
- Handle mixed critical applications on one single die

State of the art in Complexity and Dynamics:
- known number of control units and applications
- test before runtime
- Static scheduling of tasks, no dynamic changes at runtime

EMC² Goals
- variable number of control units and unknown applications possible
- full range of dynamic changes possible

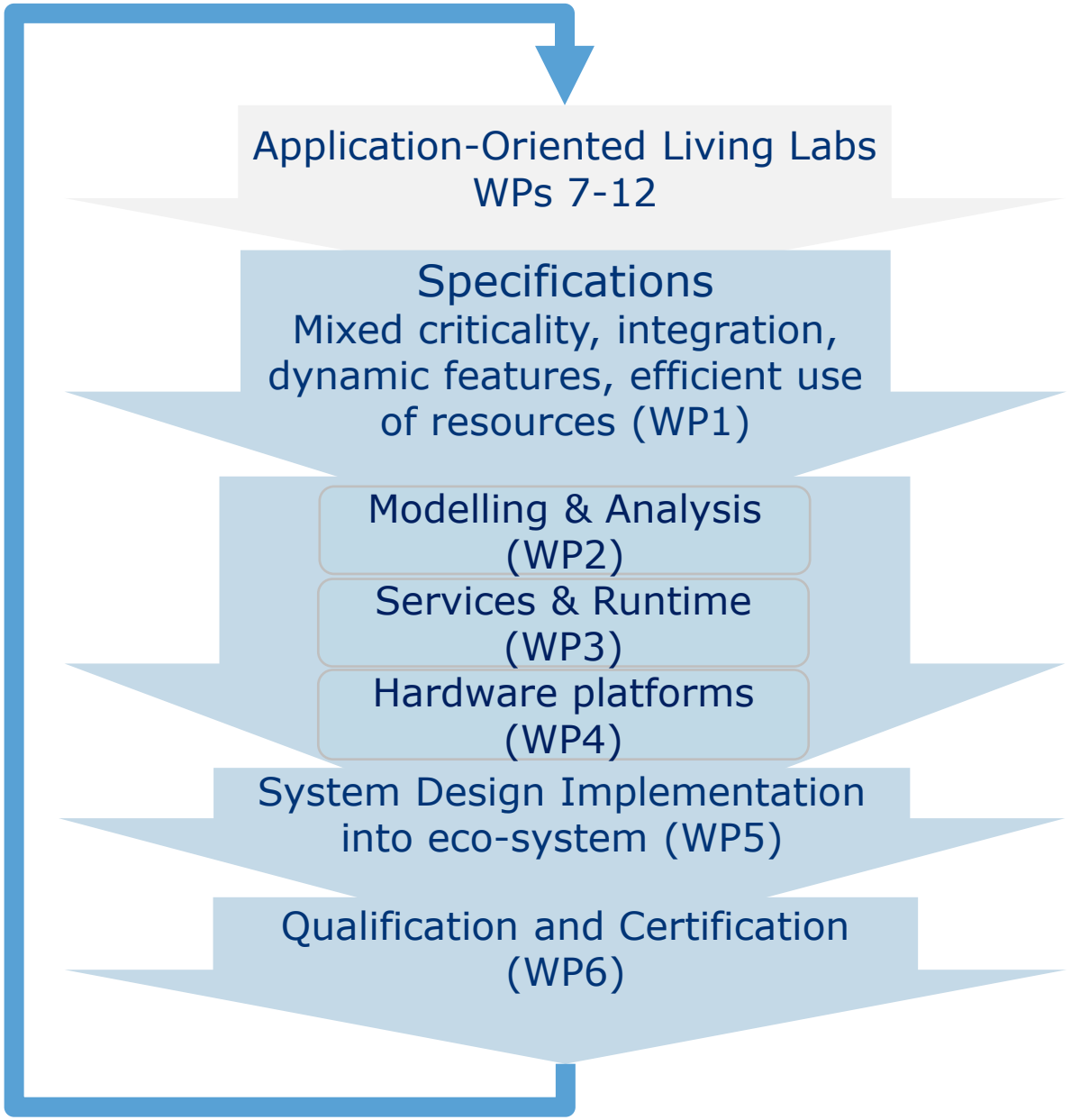
EMC² Project Architecture

What is unique about EMC²?

- All domains: Home Automation through Automatic Driving
- All areas: Sea, Land, Air and Space
- All driven by Embedded Computing
- All running a mix of applications
- All using Multi-Core ...

… but so far nobody knows how.

EMC² Project Architecture



Application Topics in EMC²

- Automotive
- Avionics
- Space
- Industrial manufacturing
- Logistics
- IT-infrastructure (‘Internet of Things’)
- Healthcare
- Railway
- Seismic surveying







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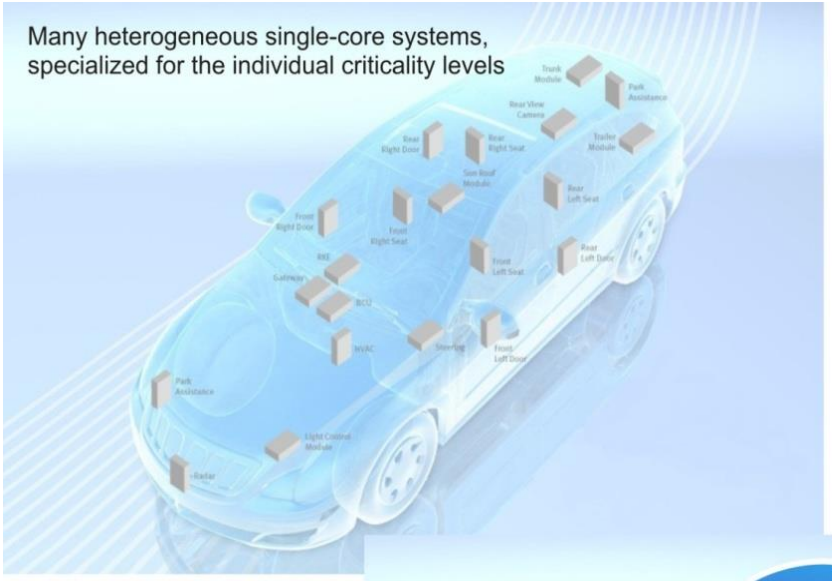
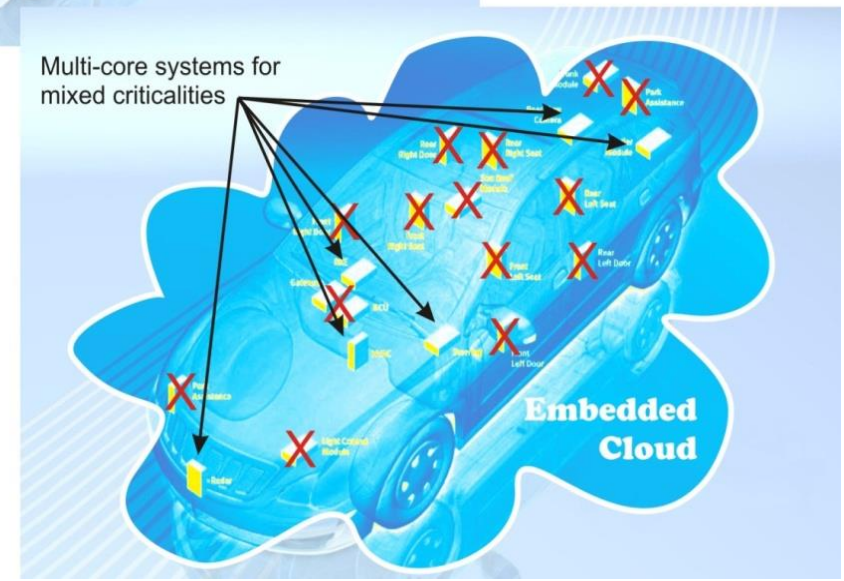
Reduce Number of Control Units
Save cost and increase performance





Vision

Aggregate resources
In multi/many cores,
ECU networks

Offer system properties as services and not as independent systems

EMC² - Medical Imaging (Philips, TNO, Vector Fabrics, TUDelft)

Objective / Scope

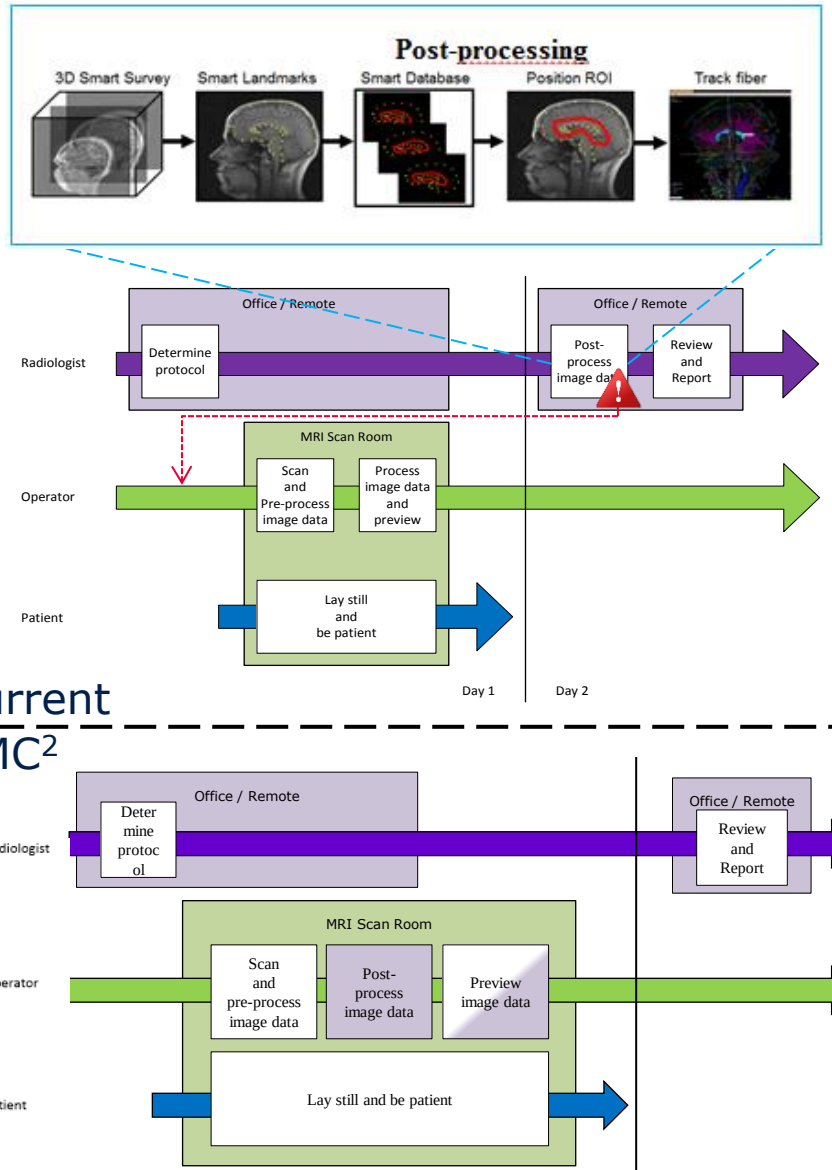
- Today: problems in data acquisition not visible to the operator in examination room → often rescan needed.
- Prevented when multiple mixed-critical systems are combined on hardware level.
- Challenges to manage mixed-criticality

Project Goals

- Reduce number of systems
- Bring reconstruction and post-processing into examination room

Exploitation

- Prevent patient recall
- Reduce hardware and maintenance cost



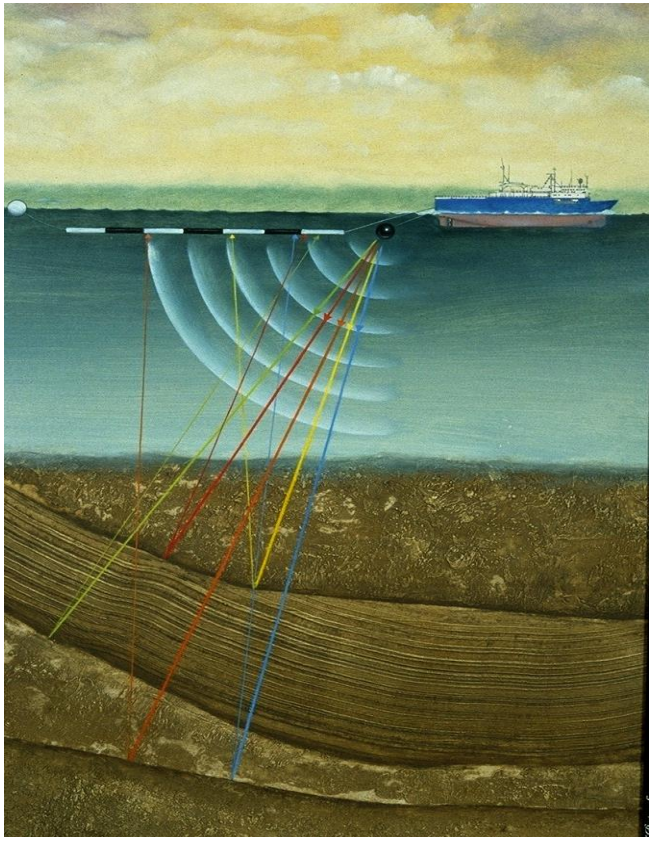
EMC² Seismic processing

(WesternGeco, Simula, U. Oslo, Fornebu, KTH)

Purpose: Produce images of geological features and their structure below the surface of the earth

On sea:

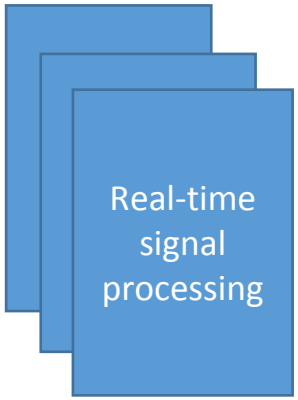
- Networked computers
  - In the streamers > 2 000 computers
  - Onboard the ship > 200 computers
- Compute power > 2 Tflops
- Number of sensors > 200 000
- Huge Data rate 1-3 Gbit/s
- Disk capacity > 100 Tbytes



EMC² Seismic processing
(WesternGeco, Simula, U. Oslo, Fornebu, KTH)

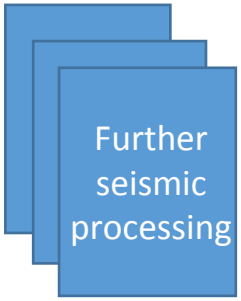
Real-time processing on sea:

300 Mbit/sec per streamer

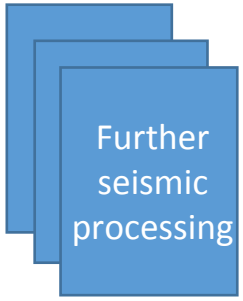


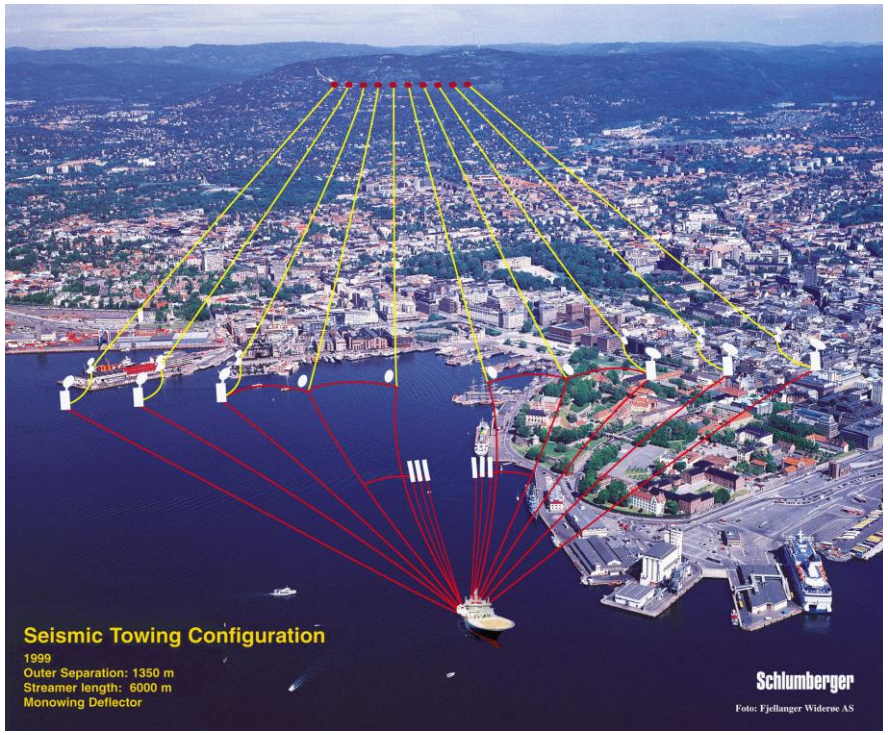
300 Mbit/sec per streamer

On ship:



On land:





200 computers with 4 000 cores

8-14 streamers behind ship
Streamer length 10km - 14 km
100 - 200 computers per streamer
200 000 sensors per streamer

Question to you...

"Would you feel o.k. driving a car where one chip controls both critical and non-critical applications? "

Critical: ESP, Brakes

Non-critical: Window lift, Infotainment

If you don't like it, it will either become expensive or low-performance