ARTEMIS 2013 AIPP5

EMC²

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

ARTEMIS TECHNOLOGY CONFERENCE 2016

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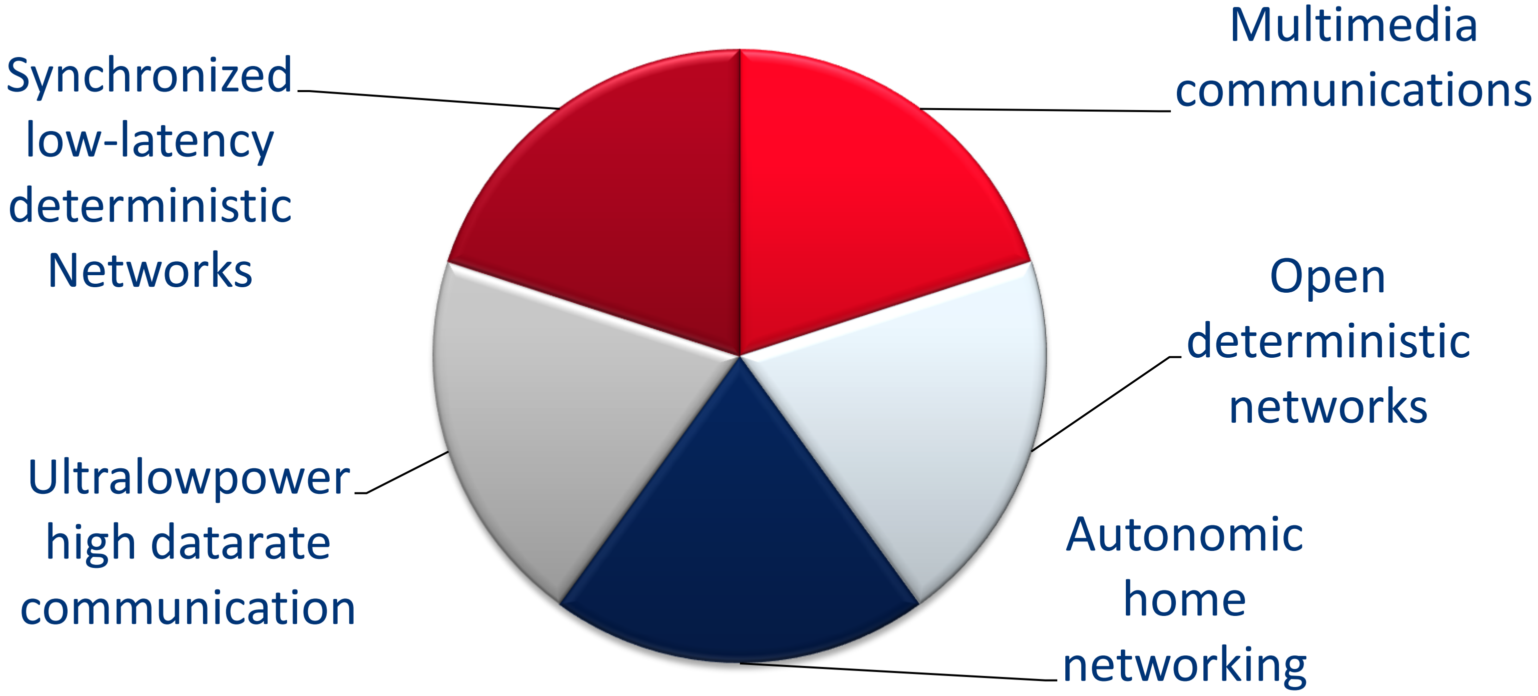
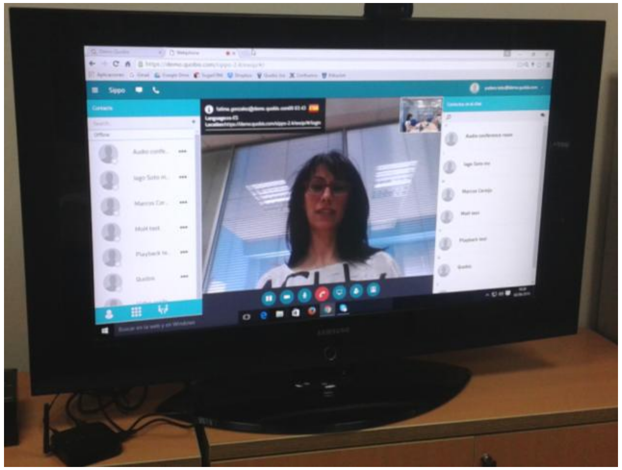
Internet of Things & IT infrastructure Motivation

- The number of physical objects connected to the Internet will increase dramatically
- Real time safety requirements
- To showcase the results of EMC^2 project



Internet of Things & IT infrastructure
Multimedia communication

- Address large-scale application of UC Services web-based on Embedded Systems.
- Main goal is to enable audio or video communication, images, files and data transfer through web-based applications on any type of small embedded systems, to have the possibility to adapt these systems to the new paradigm where the web browser is going to be the player.
- **Multimedia processes** distribution over multicore



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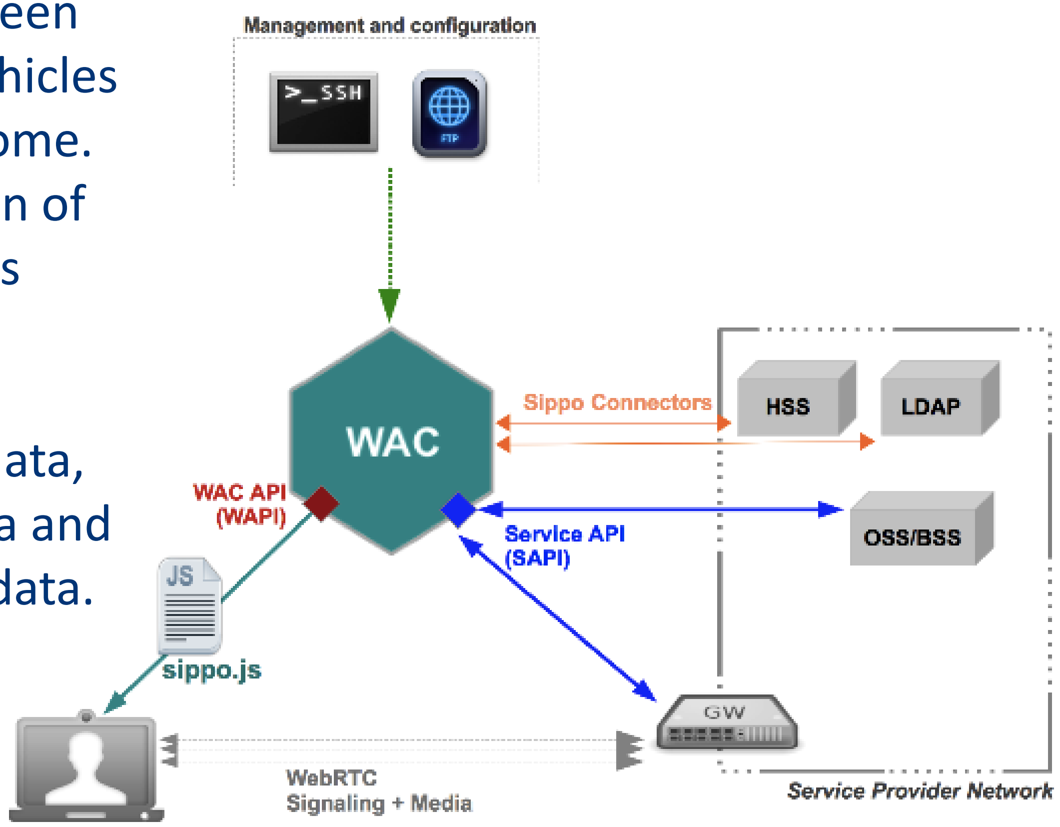
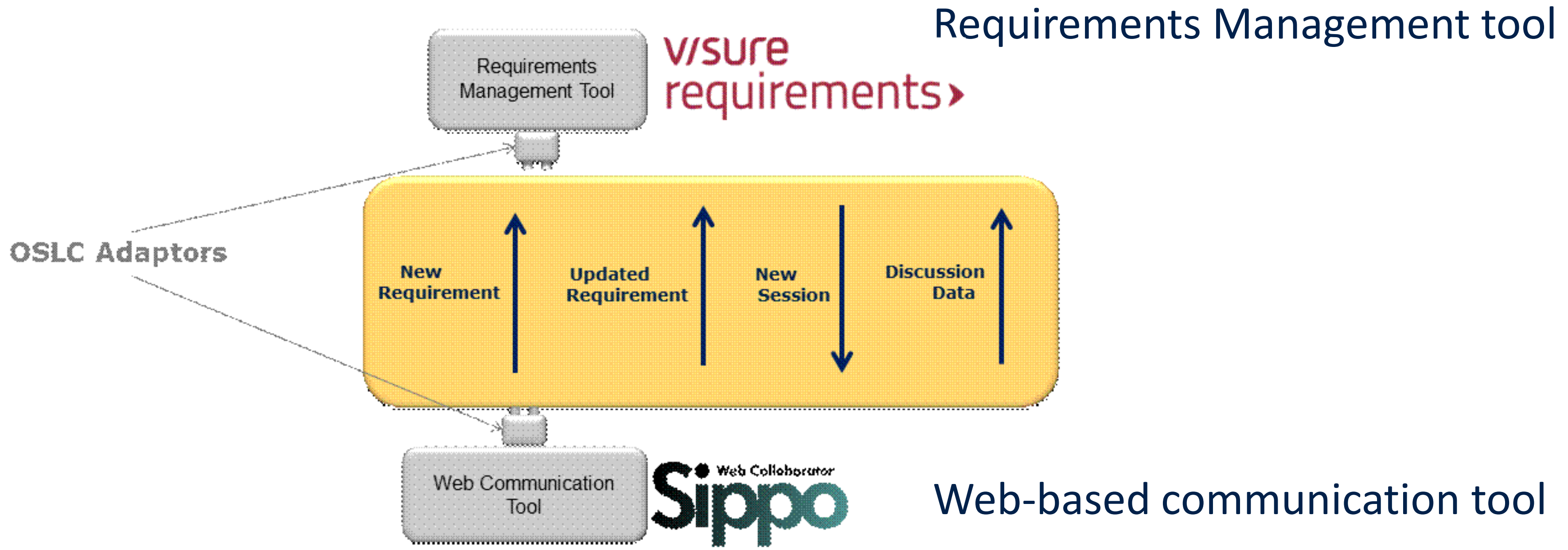
Internet of Things & IT infrastructure
Multimedia communication

- Media processing is separated in parallel sources -> **WebWorkers**
- eHealth application:
  - Communications between hospitals, emergency vehicles and patient portals at home.
  - Interoperable collection of information from devices
  - Wireless 3G/4G communication
  - Sources: audio-video data, point-of-care device data and patient medical history data.



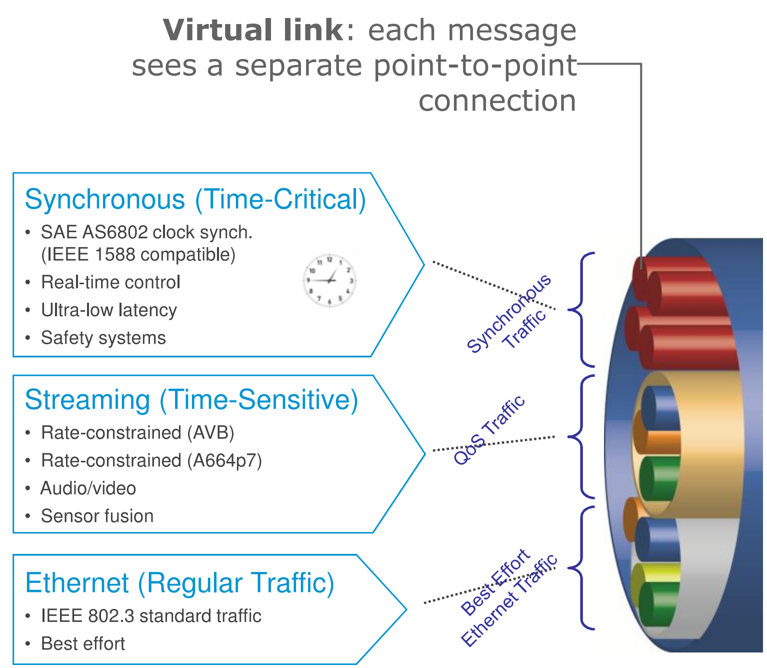
Internet of Things & IT infrastructure Multimedia communication

- WebRTC-based web collaboration tool with audio, video and chat support can work as a **requirements elicitation tool**.
- OSLC integration



Internet of Things & IT infrastructure
Open deterministic networks

- Showcase the potential of open deterministic networking by connecting a variety of local embedded systems to other embedded systems in the area of transportation industrial domains.
- **Video surveillance application** – passenger tracking - executed in a mixed-criticality system.
- Application anticipates the advantages of open deterministic networks by **streaming important meta data via rate-constrained traffic**
- Increase performance and traffic utilization of Deterministic Ethernet Network



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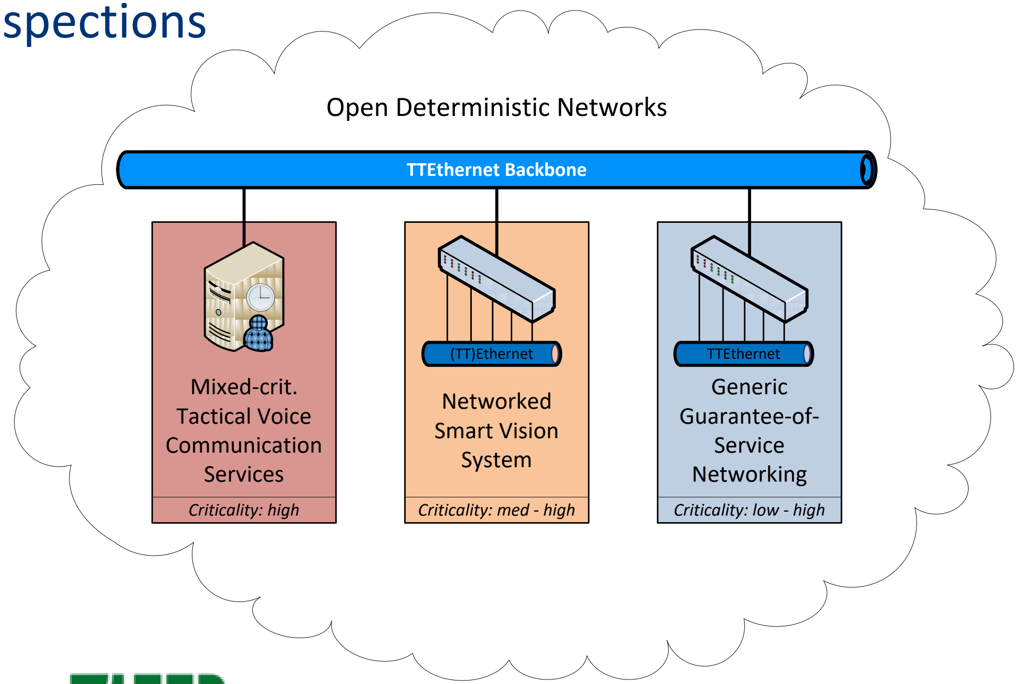
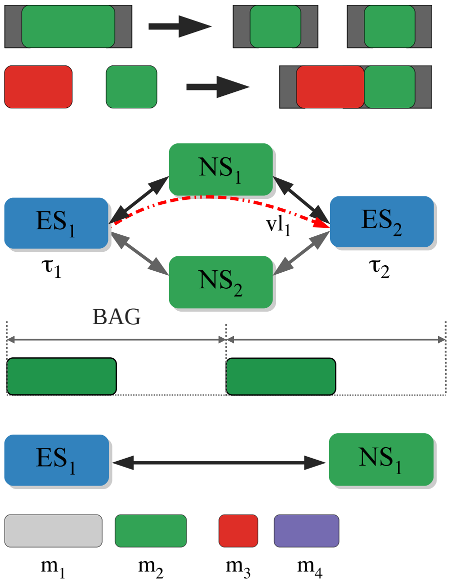
Internet of Things & IT infrastructure
Open deterministic networks

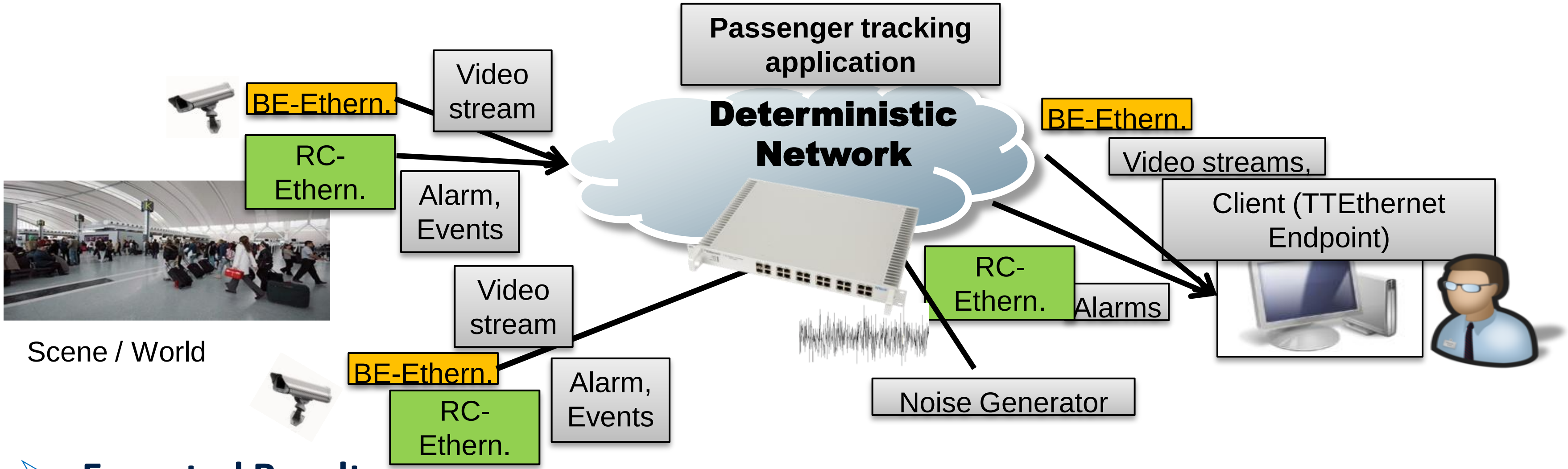
- Potential applications:
  - Passenger tracking at airports
  - Arbitrary video surveillance applications
  - Other distributed mixed-criticality vision systems such as driver assistance applications or industrial inspections





Internet of Things & IT infrastructure
Open deterministic networks

- **Prototype**
  - Alarms and events are extracted from the video stream. Data is transmitted over a network to the client.
  - Video data is transmitted via **best effort**, while alarms (meta data) are transmitted via **rate constrained** Ethernet.
  - In real-world scenario hundreds of cameras stream their data to clients, so that the system may behave highly dynamic.



- **Expected Results**
  - In case of overload, the important alarms (Meta data) are still received by the client while video data is lost.

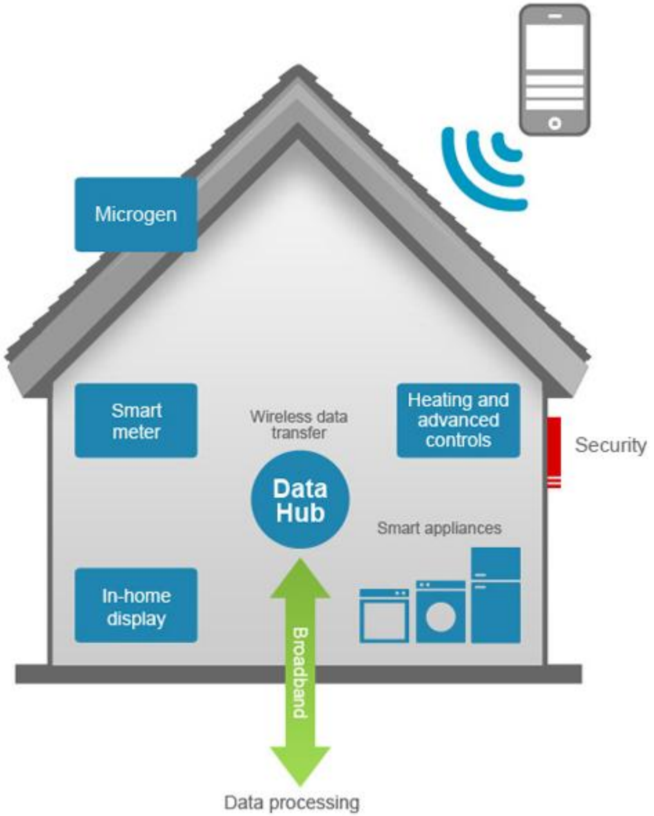
Internet of Things & IT infrastructure
Autonomic home networking

- Design, develop and implement technologies that are relevant to management of home networks in accordance with the autonomic computing paradigm.

- Test a data aggregator to be applied in home environment to process sensors' and identification data of things

- Innovations:
  - Smart homes innovations with emphasis on management systems
  - Autonomic algorithms and autonomic computing
  - Smart home metering and smart home energy management

- Prototype: highly scalable **Smart Grid** application
  - Smart energy metering
  - Smart access (to the technology by the end user)
  - Smart control



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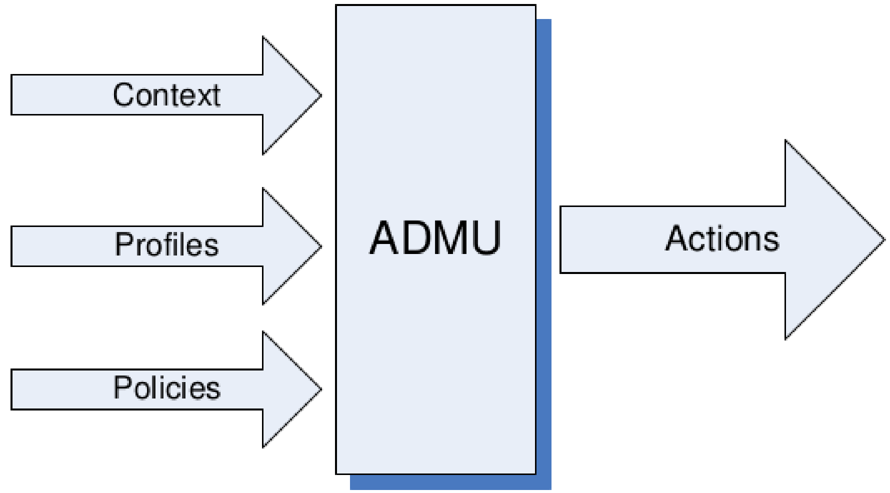
Internet of Things & IT infrastructure
Autonomic home networking

The Automatic Decision Making Unit

- ADMU takes into consideration the **context** from the available information as well as user profiles and policies
- Employing a prolog interpreter it makes decisions and acts over the TCP/IP protocol and using JSON messages over simple HTTP or HTTPS if we can make it on time



- Distinguish between **criticality levels** according to user profiles and policies

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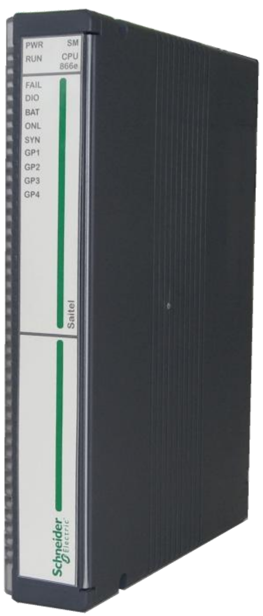
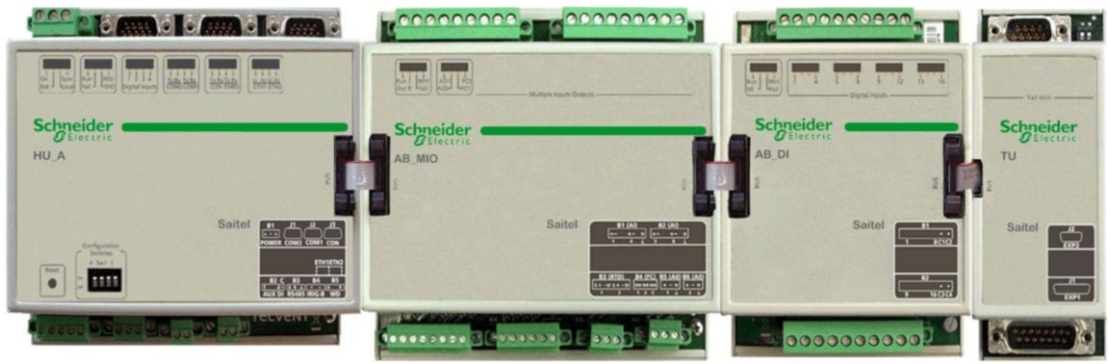
Internet of Things & IT infrastructure
Synchronized low-latency deterministic Networks

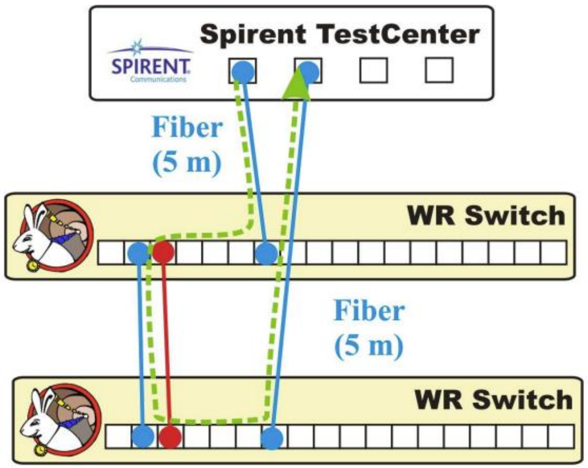
- Provide **synchronization** capabilities of distributed multicore systems with an **accuracy** of few hundred of picoseconds.
- Applicable to high accuracy positioning systems, Smart-Grid technology and high accurate Internet quality of service measurement.





Internet of Things & IT infrastructure
Synchronized low-latency deterministic Networks

- Key achievements:
  - Synchronization with **an accuracy of <1ns** using fiber links.
  - Developement and integration of **different time protocols in the same device** to improve devices interoperability for SmartGrid.
  - Dissemination of **time** in a **deterministic** way, and a best effort approach for normal data.
  - ***Quality of Service*** for the dissemination of data in SmartGrid.

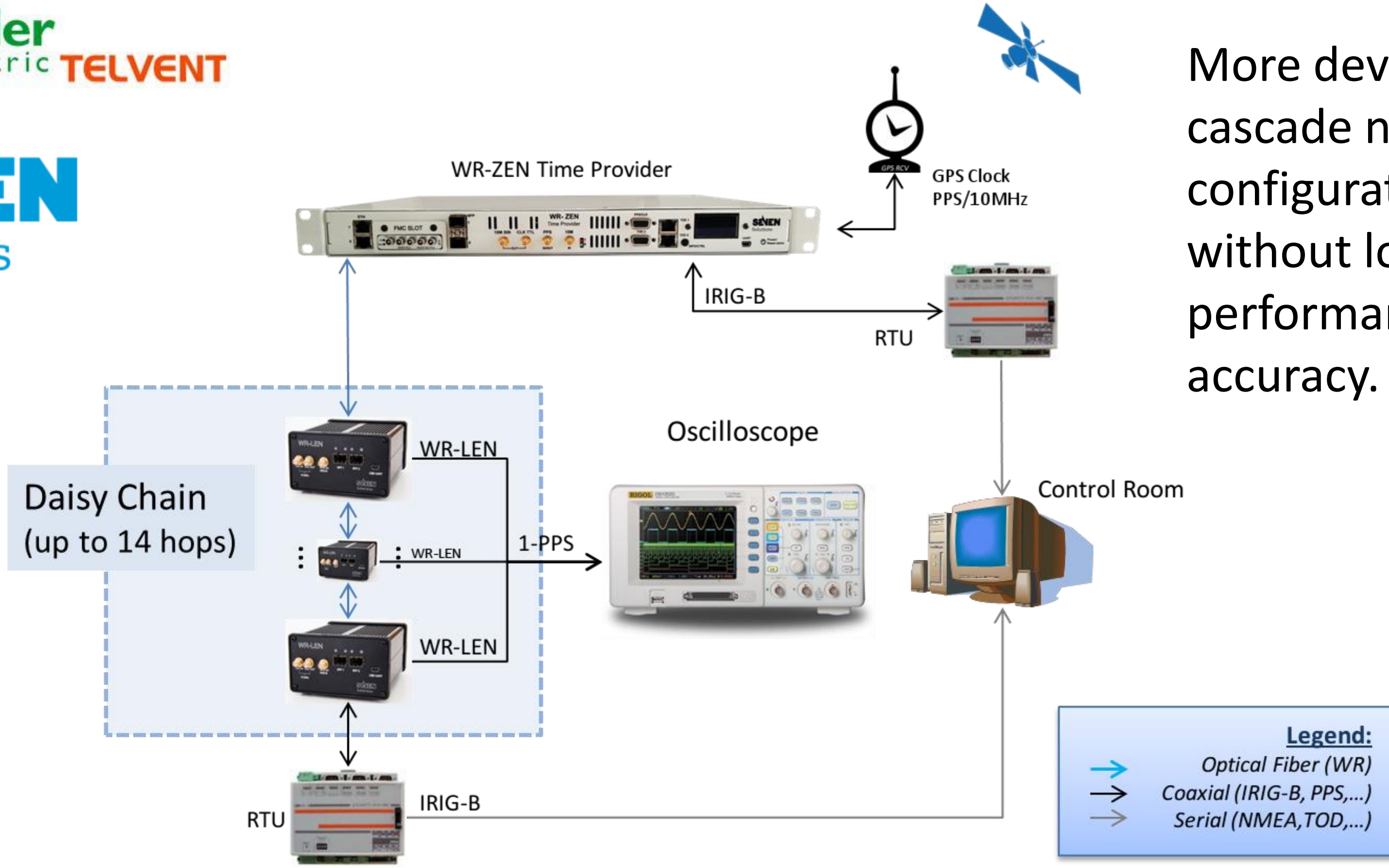


Frame Loss and Latencies

Frame Size (bytes)	Load (%)	Tx Frames	Rx Frames	Frame Loss	Max Latency (uSec)
288	10	1,217,533	1,217,533	0	5.84
288	30	3,652,598	3,652,597	1	5.84
288	50	6,087,663	6,087,663	0	5.84
288	70	8,522,728	8,522,727	1	5.84
288	90	10,957,793	10,957,792	1	6.12

Prototype A

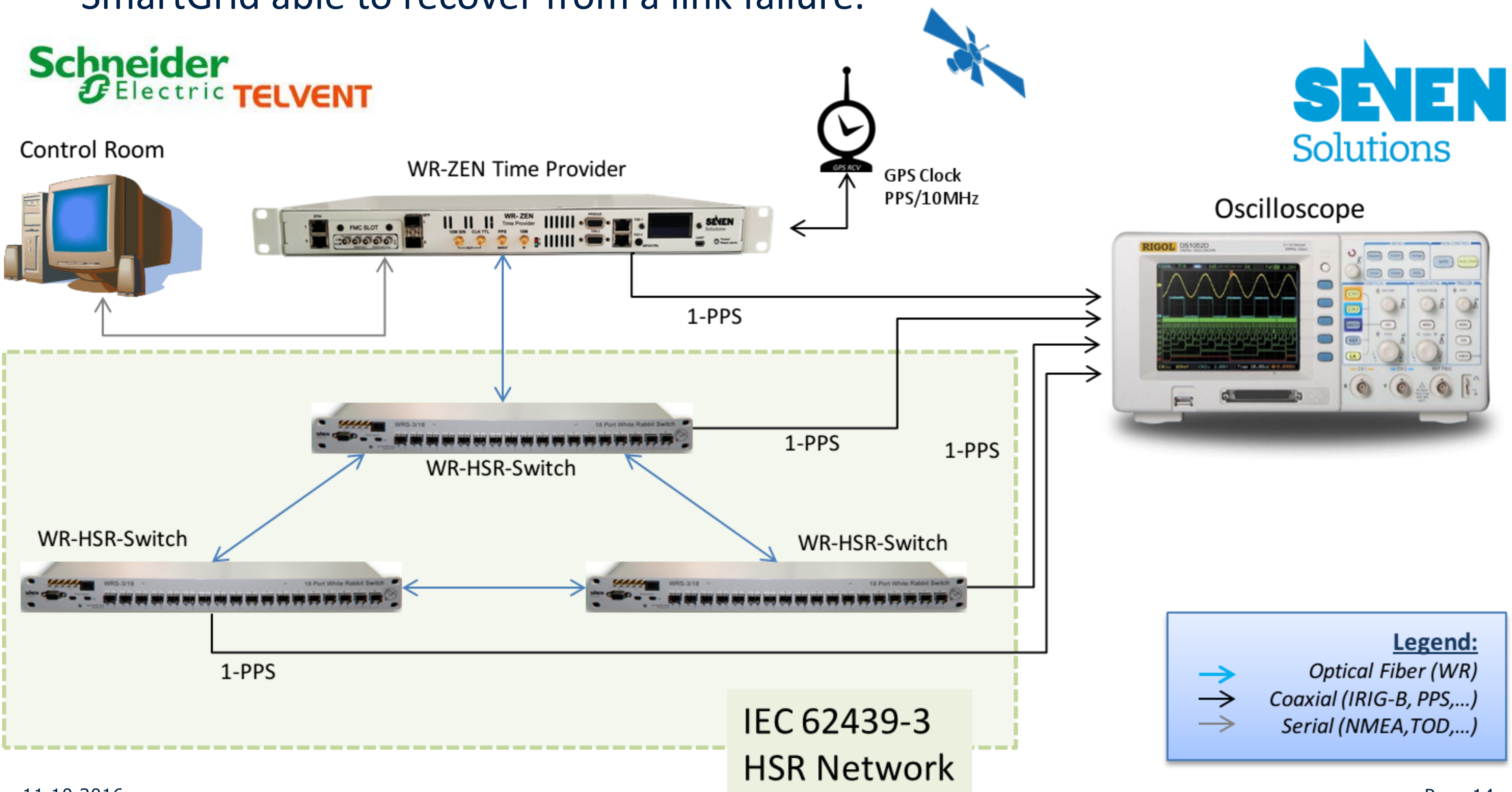
Setup to demonstrate the **scalability** of the **timing solution** and also the utilization of different timing protocols in the same network.



More devices in a cascade network configuration without losing performance and accuracy.

Prototype B

Implementation of the **redundancy protocol** for our Timing solution for SmartGrid able to recover from a link failure.



Many thanks!

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