Webinar Logistics

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Course Overview

In this course we will analyze the impact of 5G technology on the industrial automation space. 5G has the ability to replace all of the wireless, and most of the wired, technologies in in the IIoT (Industrial Internet of Things), providing direct connection to the cellular infrastructure. This brings with it a simplified and more robust network architecture. It allows direct connection to remote computing resources including cloud computing. We will look at how this will roll out and what the near future will bring as 5G evolves rapidly.

Class Overview

IIoT devices will evolve in this 5G environment. Impacts will not only include the communication protocols and approaches, but the types of devices which can be implemented. Device architecture and standardization for 5G will be addressed.

Agenda

- Overview
- Market Impact
- Device Architecture
- Application Areas
- Standards

Overview

- 5G is, as we have seen, a communication technology. It's place in the IIoT is as a transport mechanism for the data used in the IIoT. As such, it would not seem to have such a big impact. This is not the case, as the nature of the communication medium is a major factor in how and where IIoT devices can be deployed.
- The good news is that IIoT devices are modular and already support multiple communication devices and media.

Overview

- In developing devices we can leverage the 5G infrastructure to implement new system architectures. These will greatly increase the range of applications and the number of devices deployed.
- Device to device communications will become more common, as will smart devices.
- 5G provides a more secure environment as a part of the standard, thus taking this burden off the device designer.

Market Impact

- The market for 5G IoT smart machines is truly massive.
  - By 2025 it is estimated at $1.7B
  - Edge computing micro-datacenters will be $2.5B
  - This represents a massive increase in the number of devices.
    - This is facilitated by the density capacity of the mMTC feature of the 5G standard.
  - New application areas will open up for IIoT as the communication capabilities are deployed, either private or commercial.

Market Impact

Connected devices (billions)

Legend:
- M2M
- Connected consumer electronics
- PC/laptop/tablet
- Mobile phones
- Fixed phones
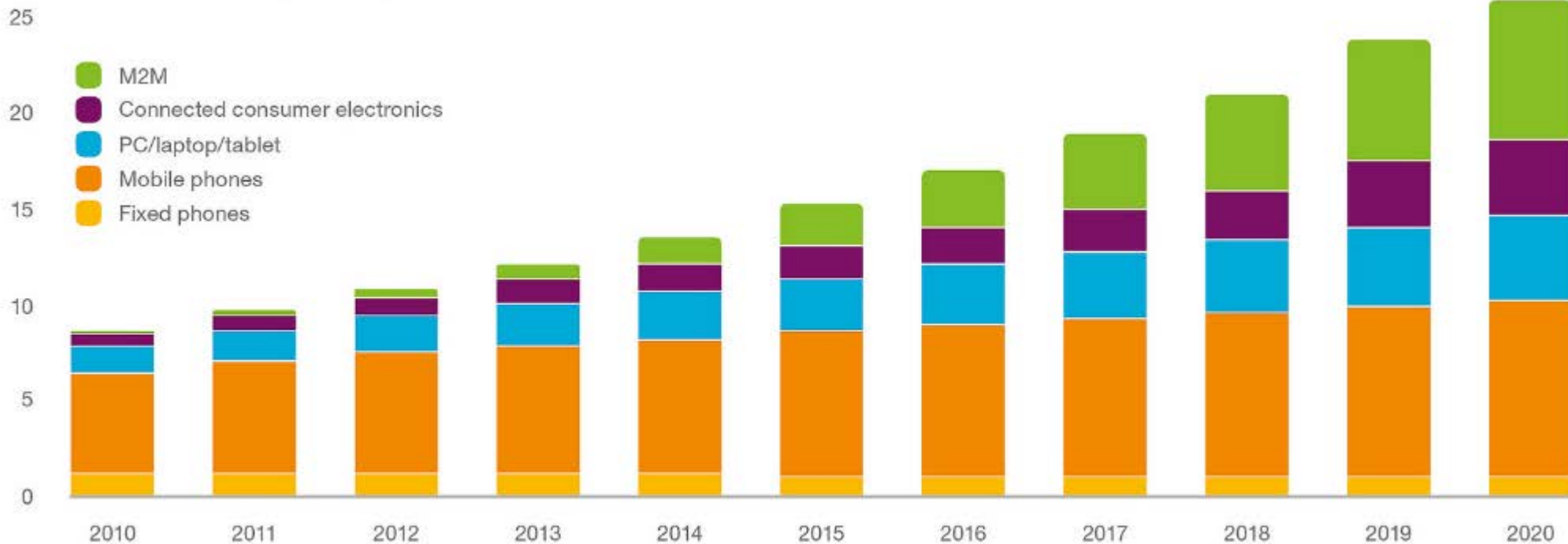
Examples of M2M: connected cars, machines and utility meters
Examples of consumer electronic (CE) devices networked TVs, digital media boxes, Blu-ray players, etc
Not included: passive sensors and RFID tags

Device Architecture

- Modularity is a key to implementation of 5G in IIoT devices.
- Typical designs use a separate communication module, which can be changed as different communication technologies are applied.
- Some device makers are supporting both 5G and 4G networks in their devices to ease the transition.
- There can be software impact to moving to 5G, which is manageable.
- Integration and packaging options have to be considered.

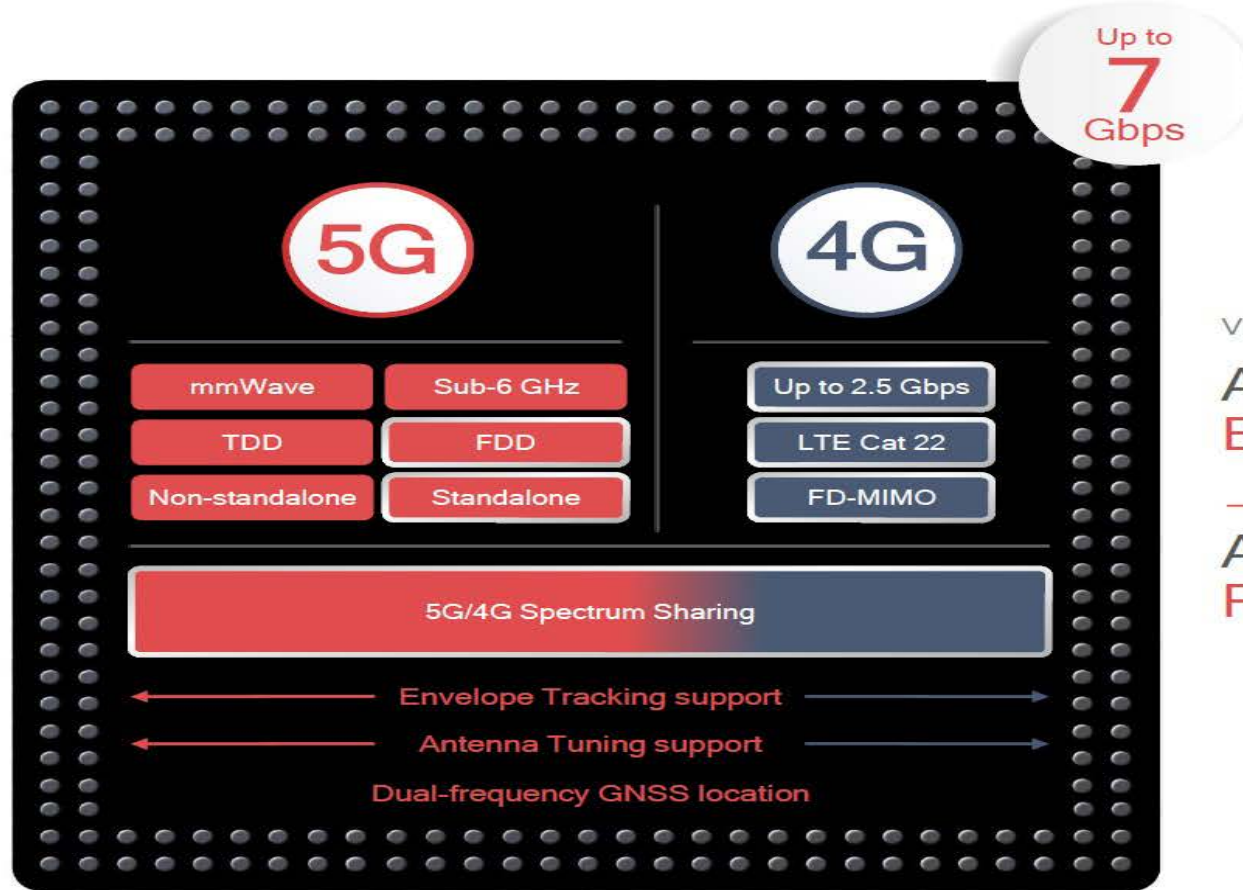This slide is a placeholder for a participant question.

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Device Architecture

Device Architecture
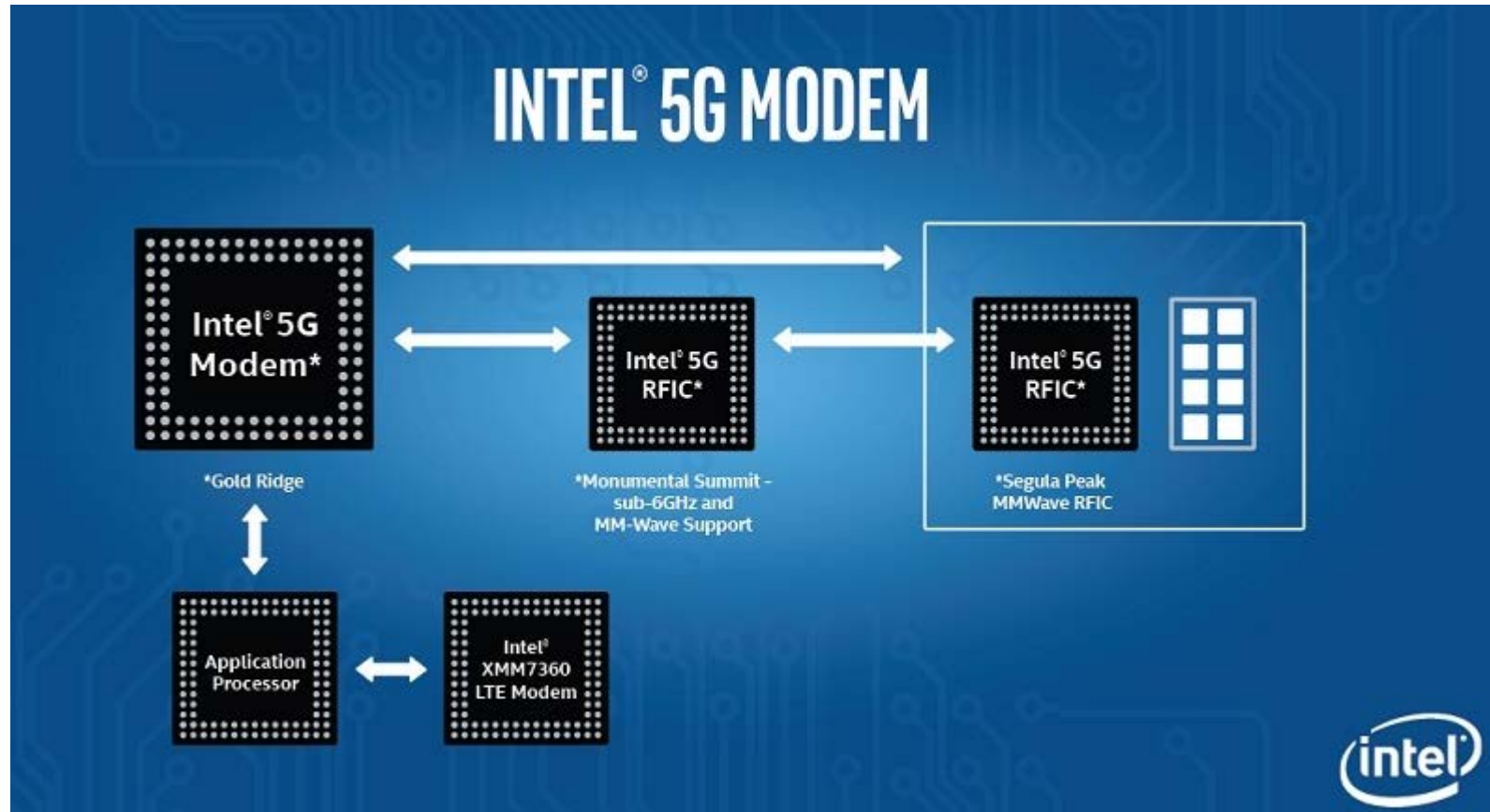
Device Architecture

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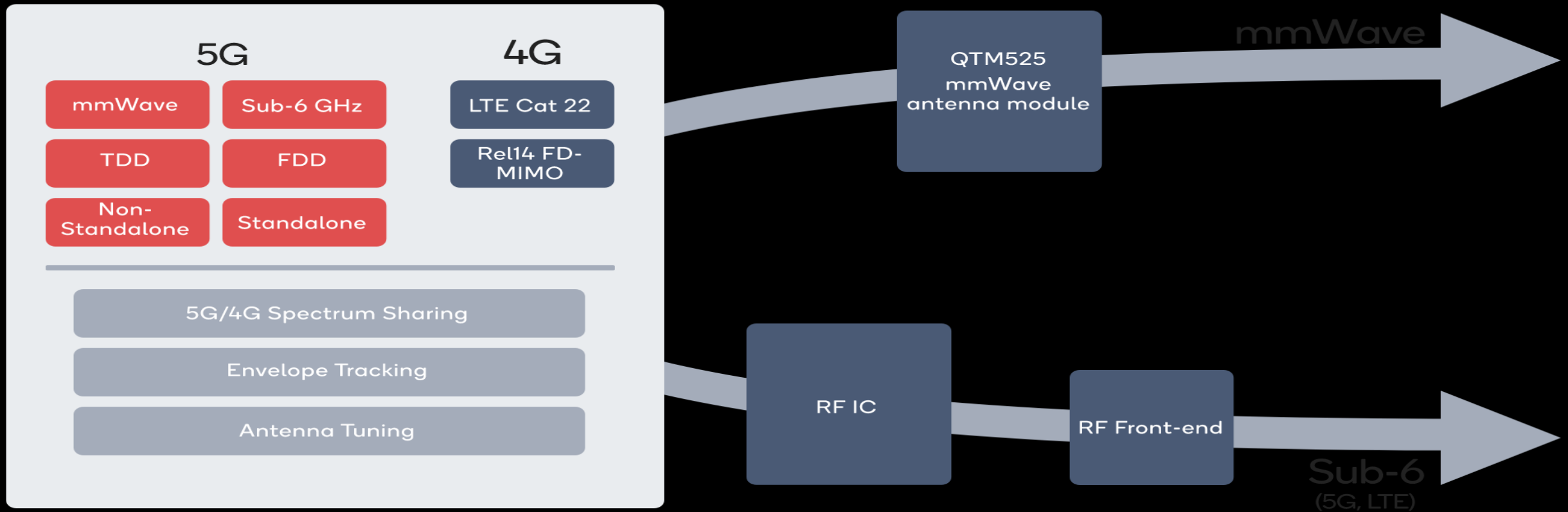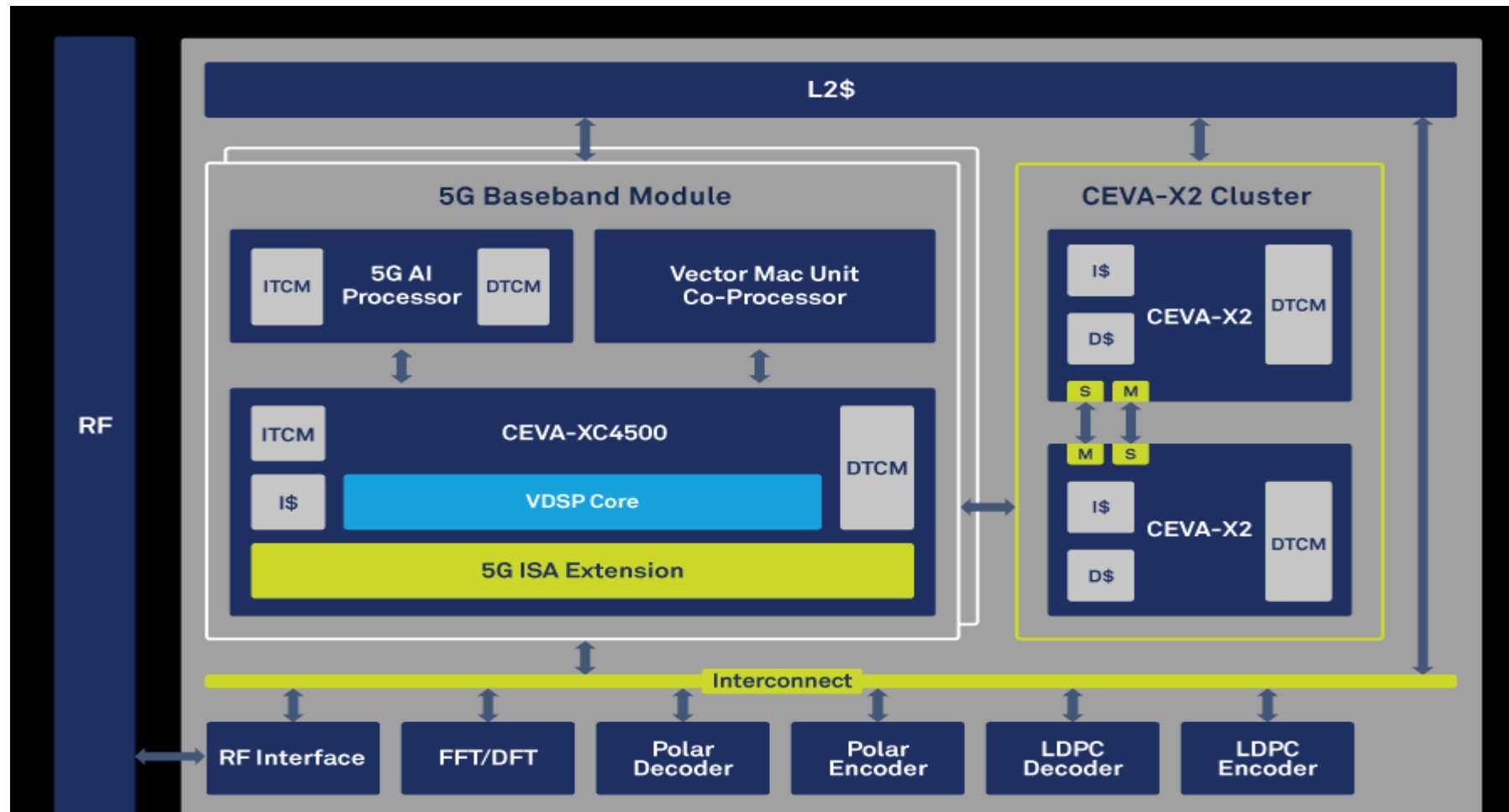
Device Architecture

Device Architecture

Device Design

- The IIoT device may be in a fixed environment or may be mobile. 5G enables both modes and simplifies device design.
  - The 5G modem operates in any of these situations without modification.
  - Integration of the modem is through standard interfaces.
  - For high volume applications we may see the modem integrated onto the same silicon as the processing element of the device.

Application Areas

- As we have seen, IIoT encompasses many application areas. We often hear this called Manufacturing 4.0.
  - Factory automation
  - Robotics
  - Automation in agriculture (industrial scale argriculture)
  - Warehousing and logistics

Application Areas

- In the factory, most applications will be fixed or have short distance movement (such as a mobile robot) and will operate within the facility
- Other application areas will use fixed sensors and actuators, in conjunction with mobile devices.
- In some cases we can share the 5G modem between several, collocated devices.

Application Areas

- Robotics may use both low latency capabilities as well as high bandwidth features integrating robot control with machine vision. 5G enables mobile as well as stationary robots.
- In agricultural applications there may be fixed ground sensors, as well as UAV based sensor applications. The later are becoming more common as a way to monitor large areas in great detail.
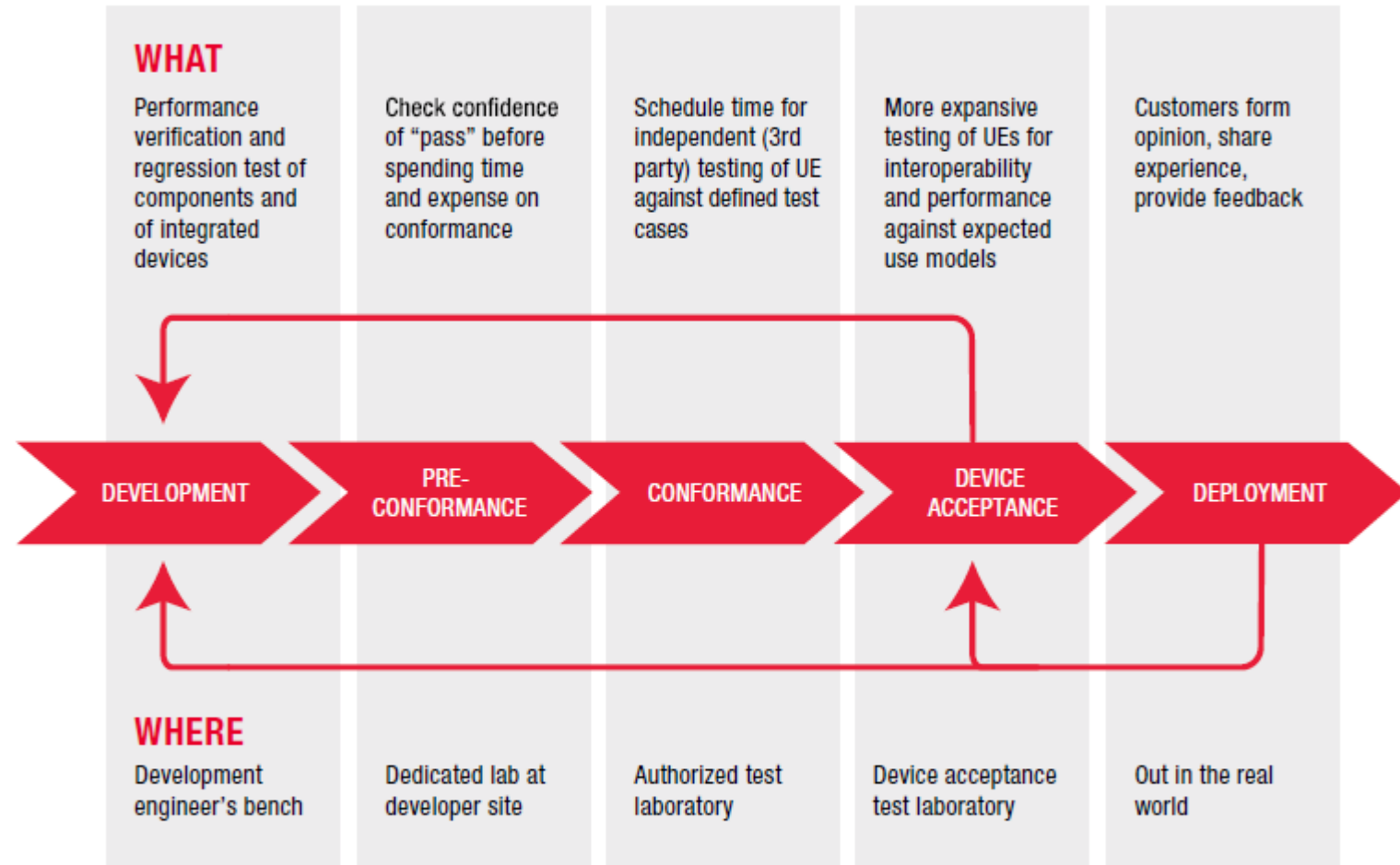
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Standards

- In designing devices we need to adhere to a well-defined communication architecture within the device.
- Theses follow the OSI 7-layer model.
  - This will facilitate the expected rapid evolution that is expected both within the communications device and the 5G standard itself.
- Adherence to standards also simplifies design and implementation and testing.

Standards: Testing

WHAT

DEVELOPMENT	PRE-CONFORMANCE	CONFORMANCE	DEVICE ACCEPTANCE	DEPLOYMENT
Performance verification and regression test of components and of integrated devices	Check confidence of "pass" before spending time and expense on conformance	Schedule time for independent (3rd party) testing of UE against defined test cases	More expansive testing of UEs for interoperability and performance against expected use models	Customers form opinion, share experience, provide feedback

WHERE

Development engineer's bench	Dedicated lab at developer site	Authorized test laboratory	Device acceptance test laboratory	Out in the real world

The typical development to deployment workflow requires testing new devices at multiple stages

Standards: Testing

Shielded box or environmental noise chamber

OTA probe antennae

DUT

Channel emulator

Base station network emulator
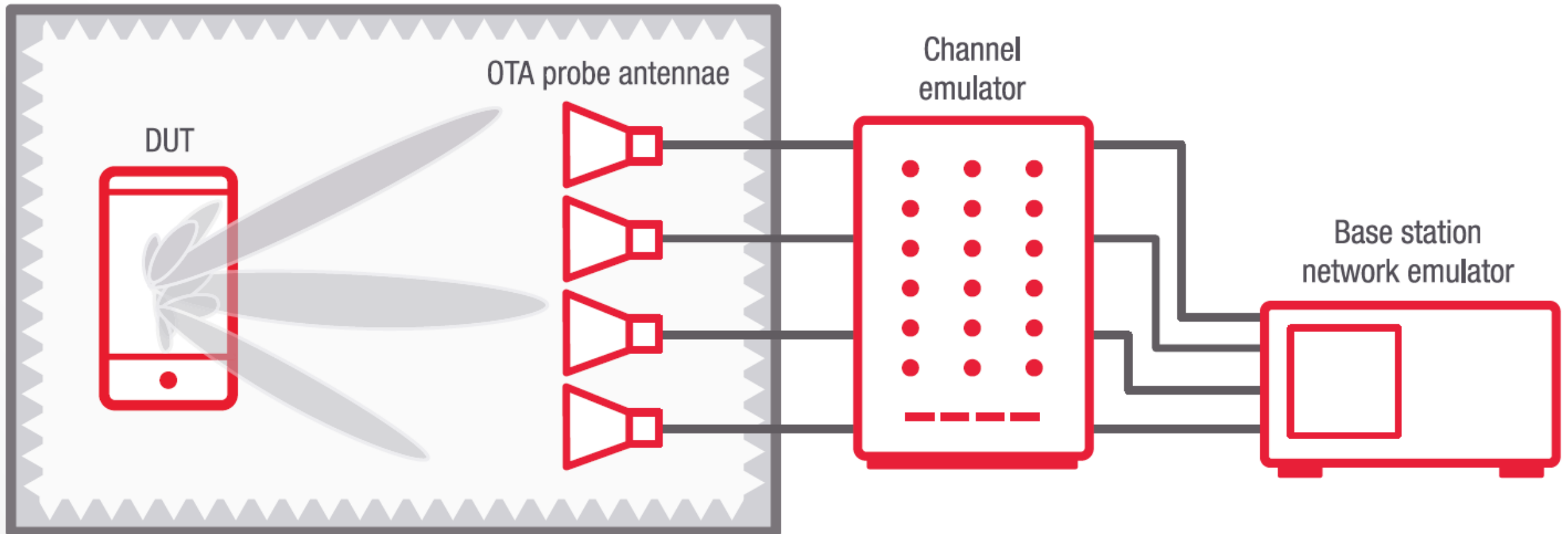
Thank you for attending

Please consider the resources below:
- 3GPP site for standards
- Keysight Technologies for Design, Test and Verification
- Modem Vendors such as QUALCOMM and Intel

Thank You

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