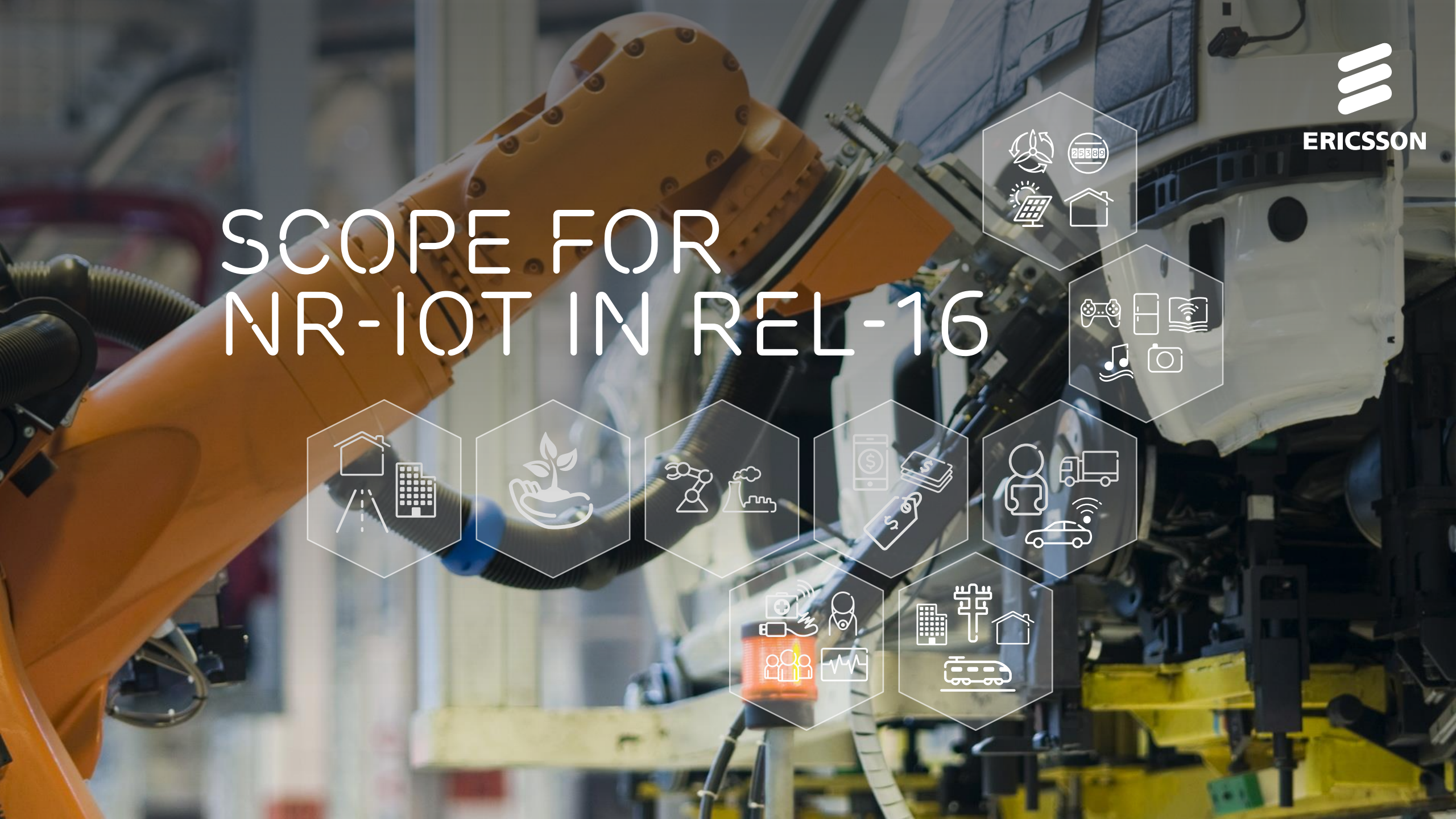
SCOPE FOR NR-IOT IN REL-16



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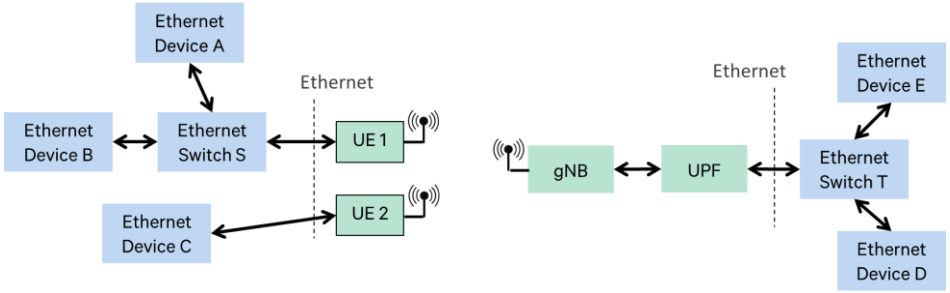
OUTLOOK

- First commercial 5G networks based on standalone 5G NR are expected to go live in 2019
  - Major network deployments start from 2020.
  - NR will be deployed in new bands as well as in refarmed spectrum.
- 5G enables new IoT use cases
  - LPWA and mMTC use cases are supported by LTE-M and NB-IoT, first steps towards 5G.
  - Interests in Industrial IoT (IIoT) are spreading rapidly
    - NR and LTE URLLC aims to support the most demanding use cases.
    - Use case needs are broad and often beyond pure radio link performance.
  - The 3GPP IoT platform needs to be expanded to also address the use cases that are defined by the requirement area in-between mMTC and URLLC.

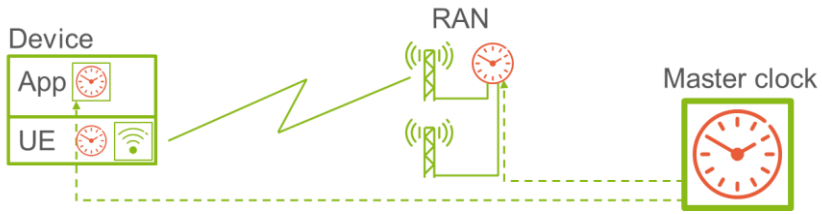
INDUSTRIAL IOT
OVERALL REQUIREMENTS

- Industrial IoT needs extending beyond radio link performance
  - Interwork with industry-grade Ethernet
  - Reliability / redundancy enhancements.
  - Diverse requirements for different types of services:
    - 3GPP TS 22.261 “Service requirements for the 5G system”
    - 3GPP TS 22.804 “Study on Communication for Automation in Vertical domains”
    - 3GPP TR 22.821 “Feasibility Study on LAN Support in 5G”

- Examples:
  - Industrial Ethernet services over 5G



  - Synchronization as a service to time-synchronize devices



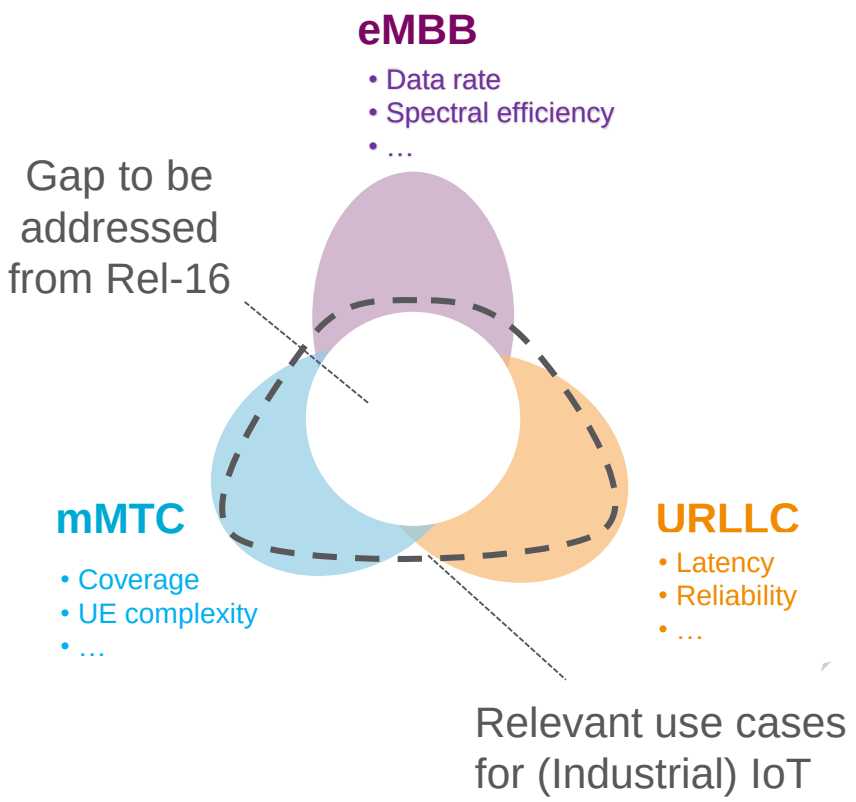
INDUSTRIAL IOT
RADIO REQUIREMENTS

- The majority of the Industrial IoT use cases do not need to achieve the extreme KPIs of eMBB, mMTC, and URLLC.
- A NR Release 16 study item can start with study and address the requirement space between these extremes.

Requirements & Characteristics	mMTC	Rel-16 NR-IoT SI	URLLC
Latency	High	Low - Medium	Low to ultra-low
Reliability	Medium	High	Ultra-high
Data rate	Low	Low - Medium	Medium - High
Device complexity	Low	Medium	High
Coverage	Extreme	Normal	Normal
Battery life	Very long	Medium or not applicable (e.g. mains powered)	Not applicable (e.g. mains powered)
Positioning accuracy	Low	High	High
Connection density	Very high	Low – High	Low - High
BW requirement	Narrow	Normal - Wide	Normal – Wide

OVERVIEW

- NR coexistence with LTE-M/NB-IoT
- NR performance and service requirements for IoT
- NR UE category for IoT



NR COEXISTENCE WITH LTE-M/NB-IOT

- Study coexistence scenarios between NR and LTE-M/NB-IoT [RAN1 lead, RAN2, RAN4]
  - Study frequency bands suitable for NR, LTE-M/NB-IoT coexistence
  - Study deployment scenarios for NR, LTE-M/NB-IoT coexistence including at least in-band and adjacent frequency deployments
  - Study numerologies suitable for NR, LTE-M/NB-IoT coexistence
  - Study transmission modes (i.e. FDD, TDD, dynamic TDD) suitable for coexistence
- Study the performance of NR, LTE-M/NB-IoT in identified coexistence scenarios [RAN4 lead, RAN1]
- Identify potential NR features that can improve coexistence performance or the deployment flexibility [RAN1 lead, RAN2, RAN4]
- Identify potential LTE-M/NB-IoT features that can improve coexistence performance or deployment flexibility [RAN1 lead, RAN2, RAN4]

NR PERFORMANCE AND SERVICE REQUIREMENTS FOR IOT

- Identify services suitable for NR-IoT [RAN1 lead, RAN2]
  - Study TS 22.804 *Study on Communication for Automation in Vertical domains* and TS 22.261 *Service requirements for the 5G system* and identify requirements suitable for NR-IoT
  - Map the identified set of service requirements to radio requirements relevant for TSG RAN including at least requirements on data rate, latency, reliability, positioning accuracy, and timing accuracy
  - Enable data transmissions with sufficiently low latency and high reliability, to e.g. address use cases of real-time sensing
  - Investigate positioning options with sufficient positioning accuracies for demanding IoT use cases

- Enhanced Ethernet service support [RAN3 lead]
  - Ethernet service support shall be enabled as identified in study TS 22.804 *Study on Communication for Automation in Vertical domains* and TS 22.821 *Feasibility Study on LAN Support in 5G*
  - Support for enhanced Ethernet services is expected to mainly impact 5G system architecture and SA2 is expected to address this
  - In this study aspects shall be identified in the support enhanced Ethernet services for which RAN support is required

NR UE CATEGORY FOR IOT

- Study a NR UE category relevant for NR-IoT [RAN1 lead, RAN2]
  - Based on the identified coexistence scenarios, performance and service requirements, identify NR Rel-15 features and parameters that should be supported by the new NR-IoT UE category
  - Balance UE complexity with sufficient performance

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