

Integration of 5G and TSN

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Outline

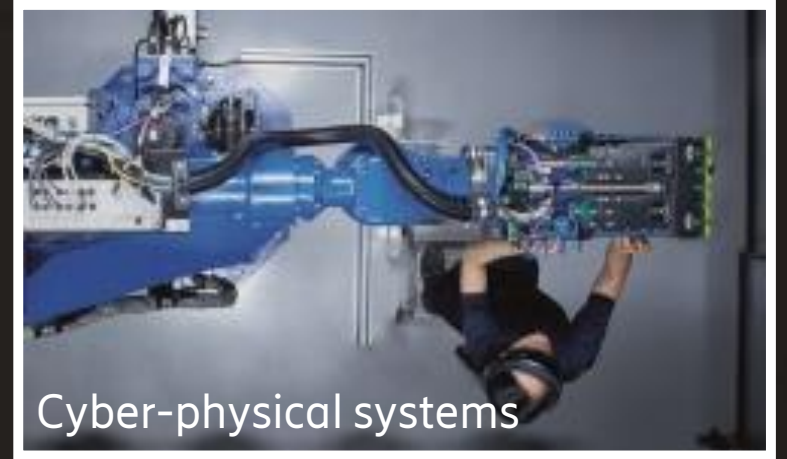


- 5G
 - Using for Industrial IoT
- Building blocks
 - 5G: Ultra-Reliable and Low-Latency Communication (URLLC)
 - TSN: IEEE components
- Putting it all together
- Proof of concept
- Summary



5G for ...

A digital infrastructure for
industrial and societal
transformation



Cyber-physical systems



Future IoT

Autonomous networks



Mobile edge computing

Network security

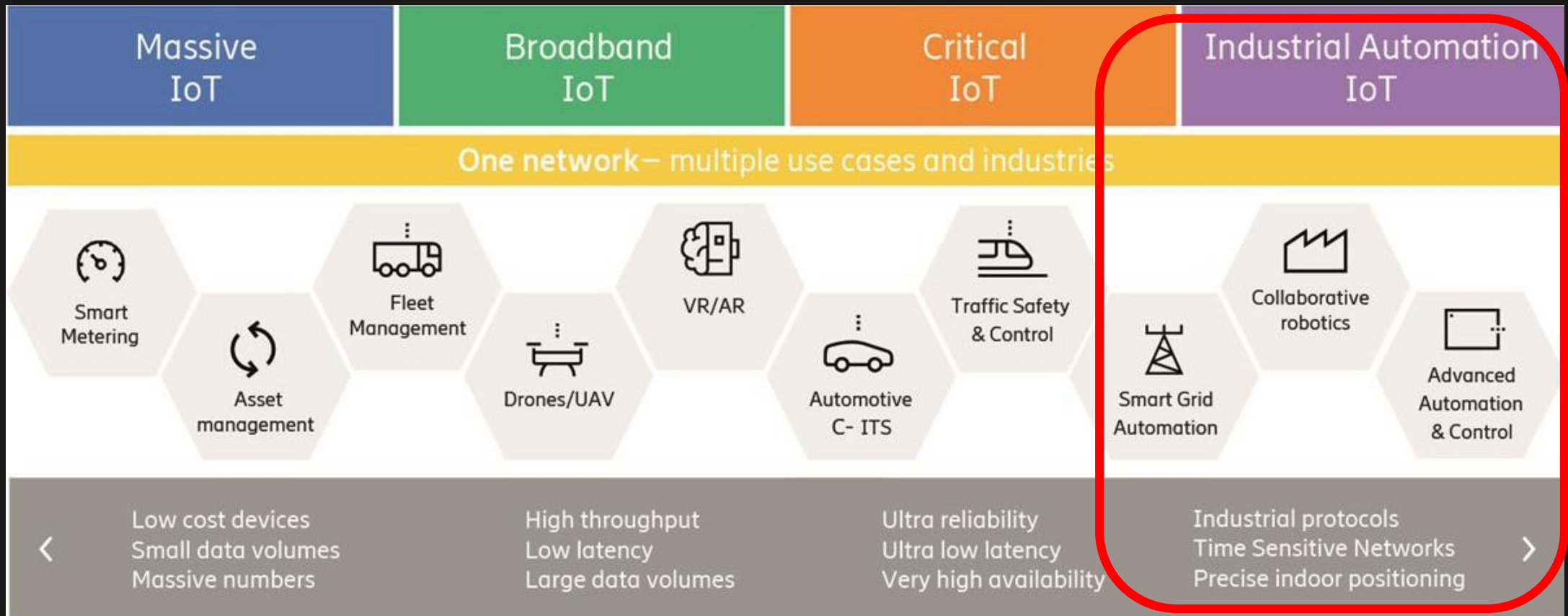


Cellular IoT Segments

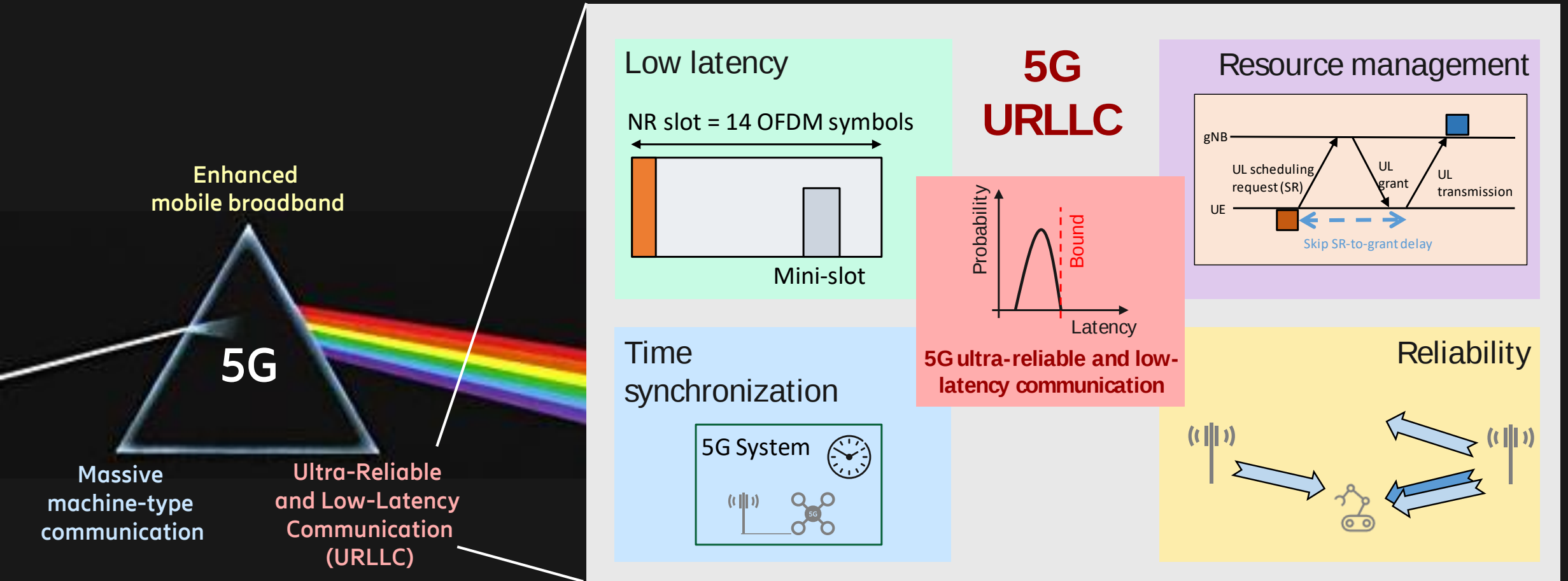


Commercial – Growth

Early pilots – Standardization



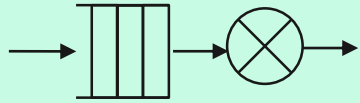
5G URLLC Components



TSN Components

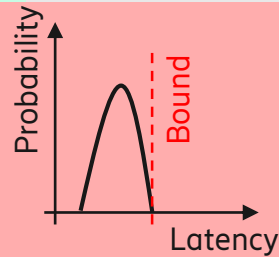
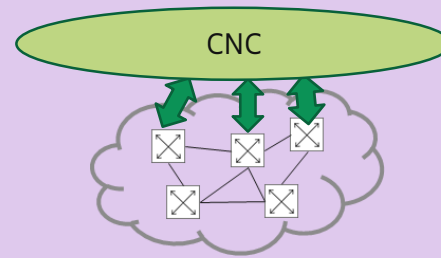


Bounded low latency



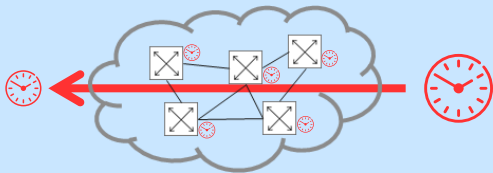
TSN

Resource management

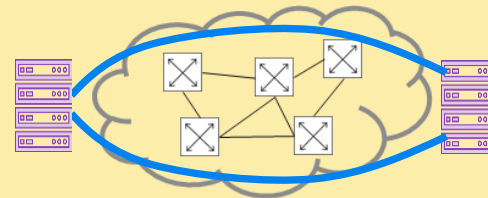


Guaranteed delivery in a guaranteed time window

Time synchronization



Reliability



TSN Components

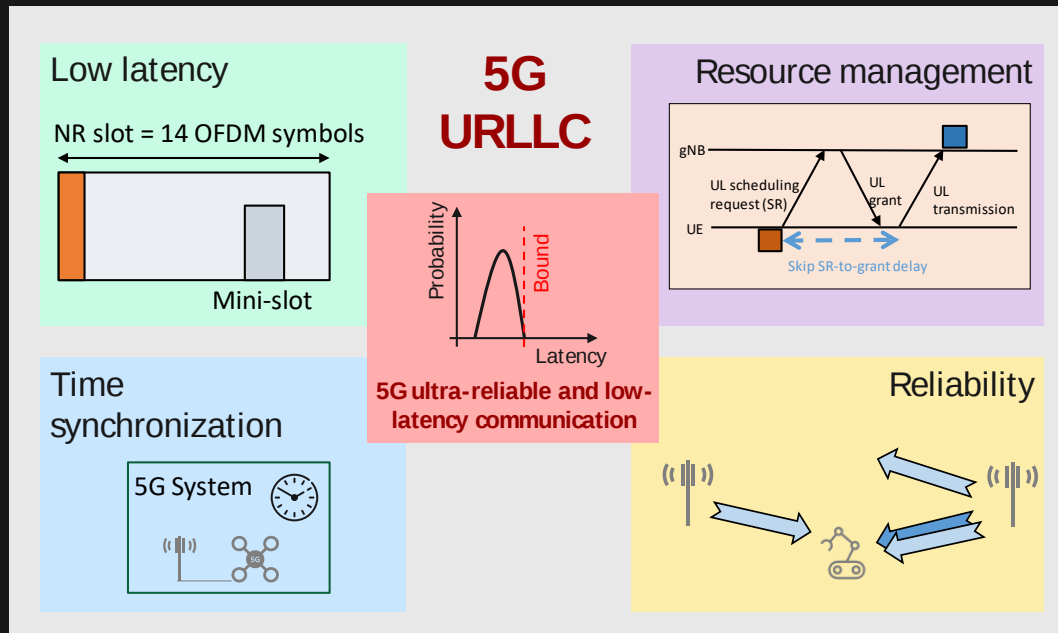
Latency

Resource Mgmt

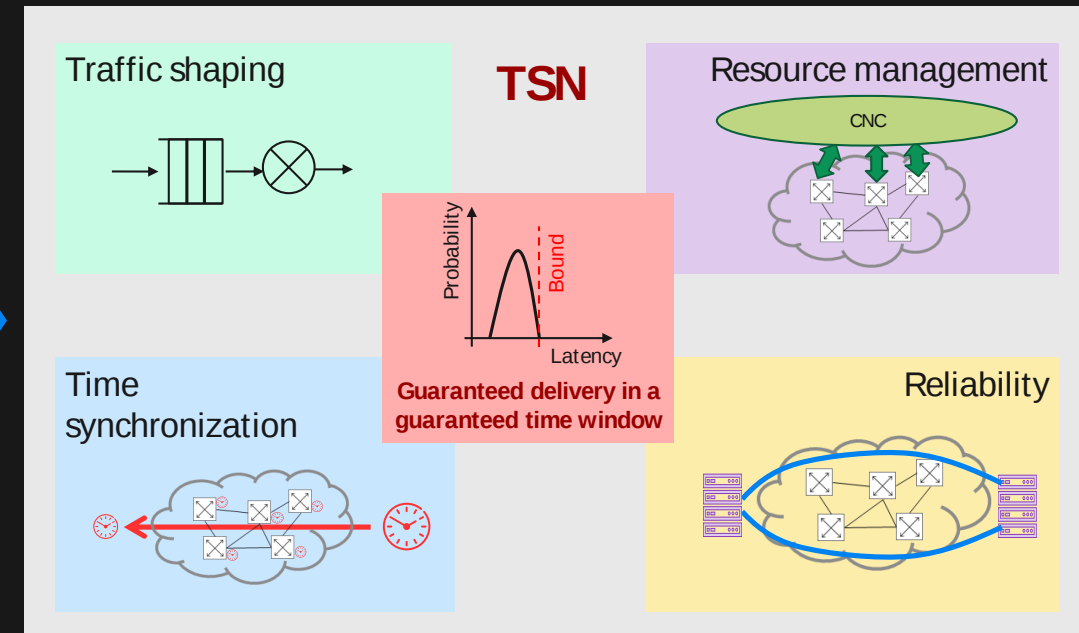
Synchronization

Reliability

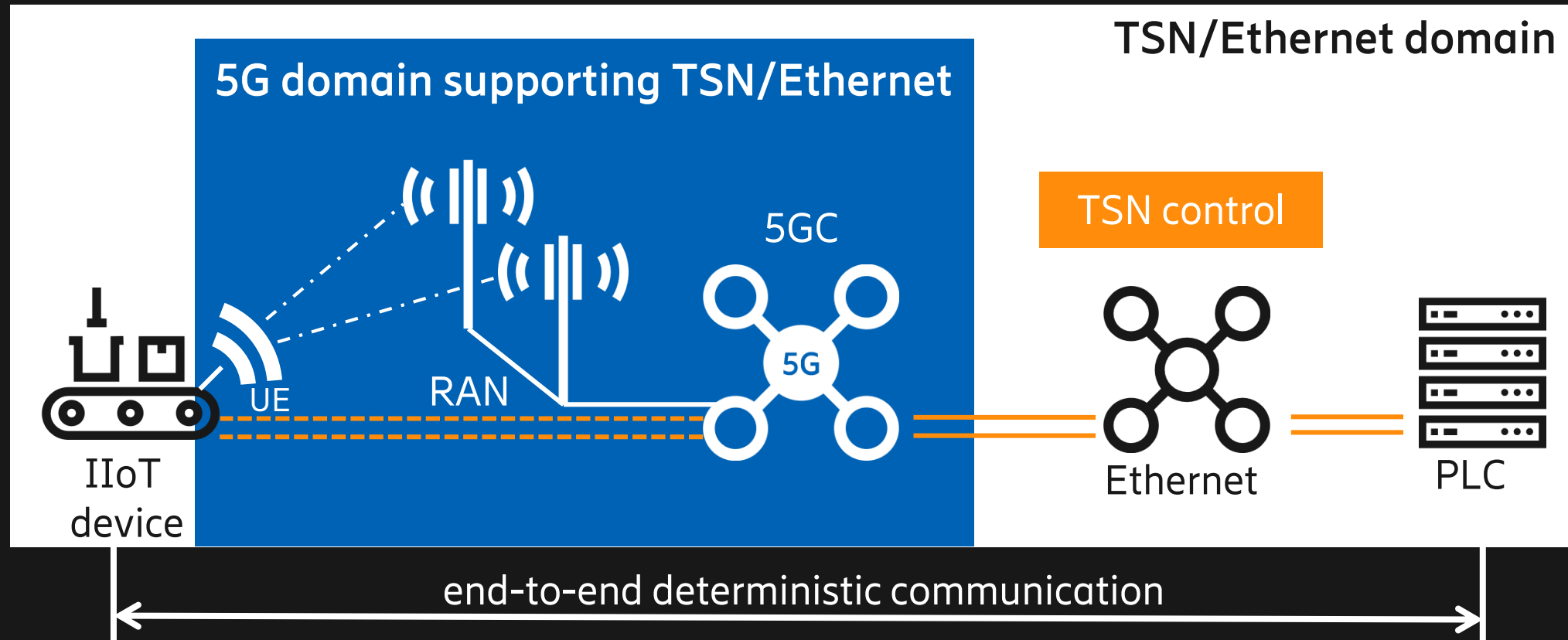
Perfect Match between 5G URLLC and TSN



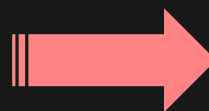
match



Putting It All Together

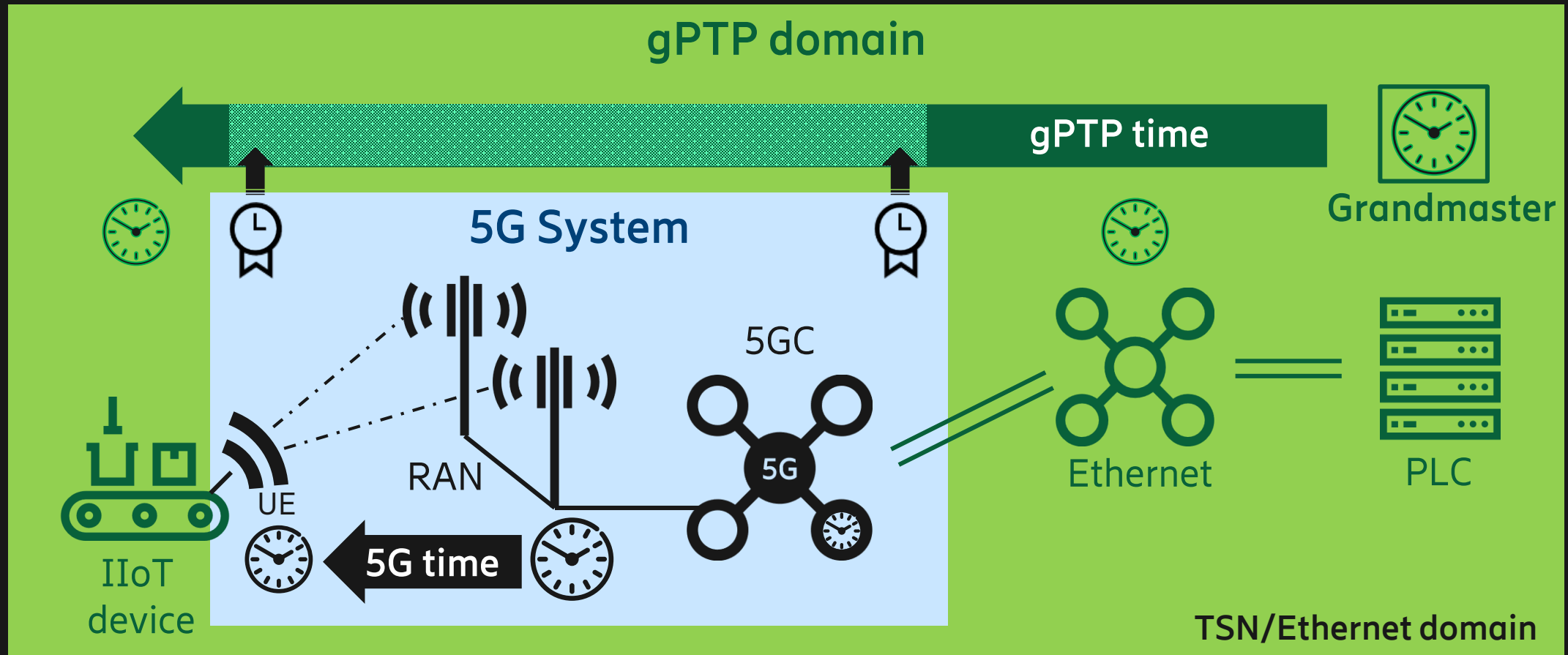


Integration for reliability, low latency,
and time synchronization

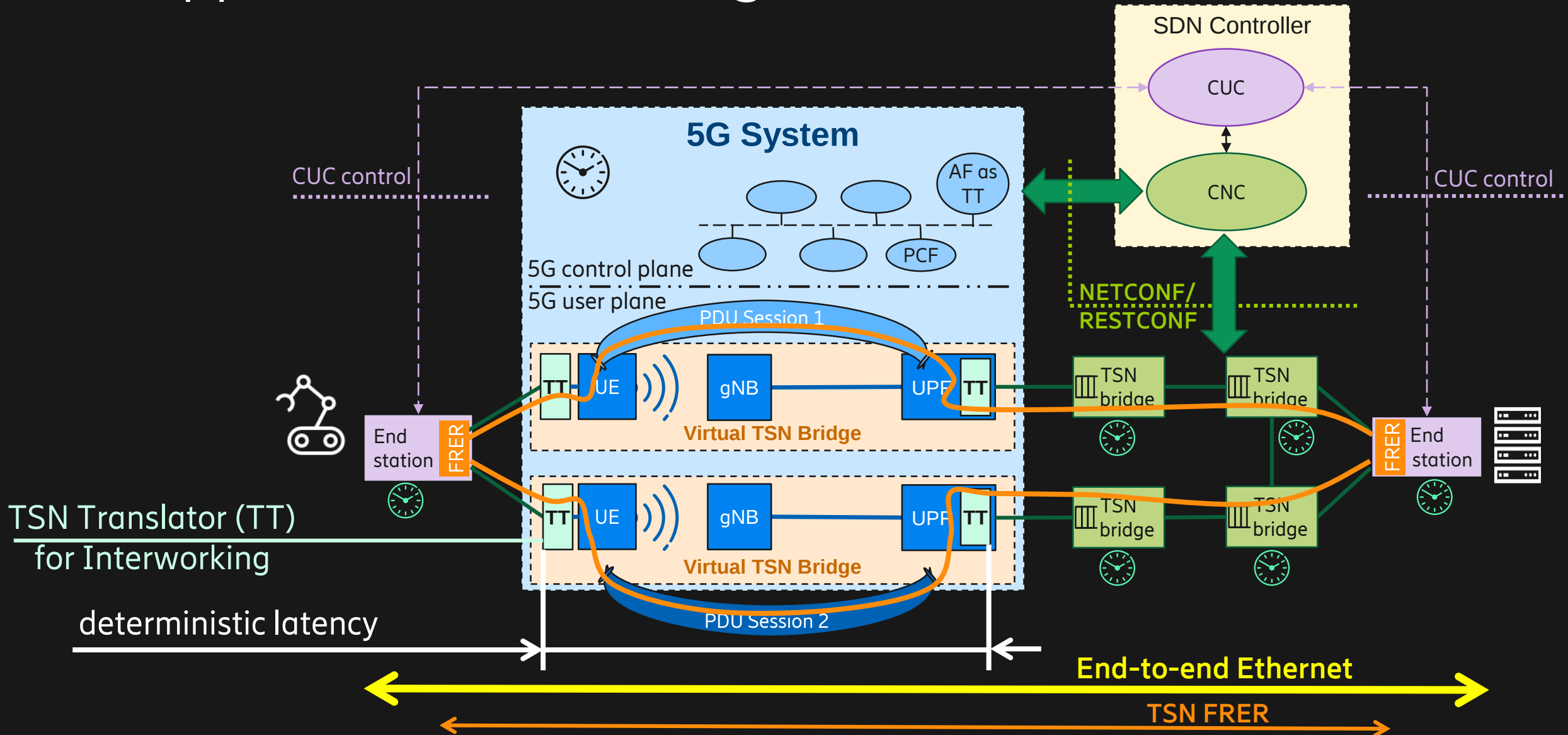


**Guaranteed data delivery in
a guaranteed time window**

5G Appears as a Time-Aware System

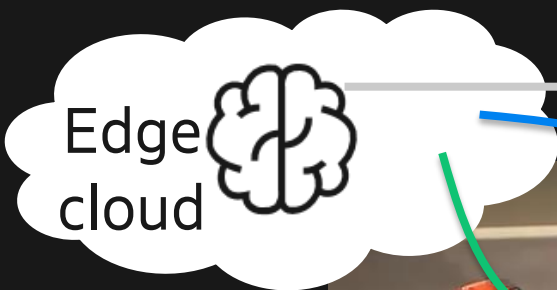


5G Appears as Virtual Bridge



End-to-End URLLC for Massive Robot Collaboration

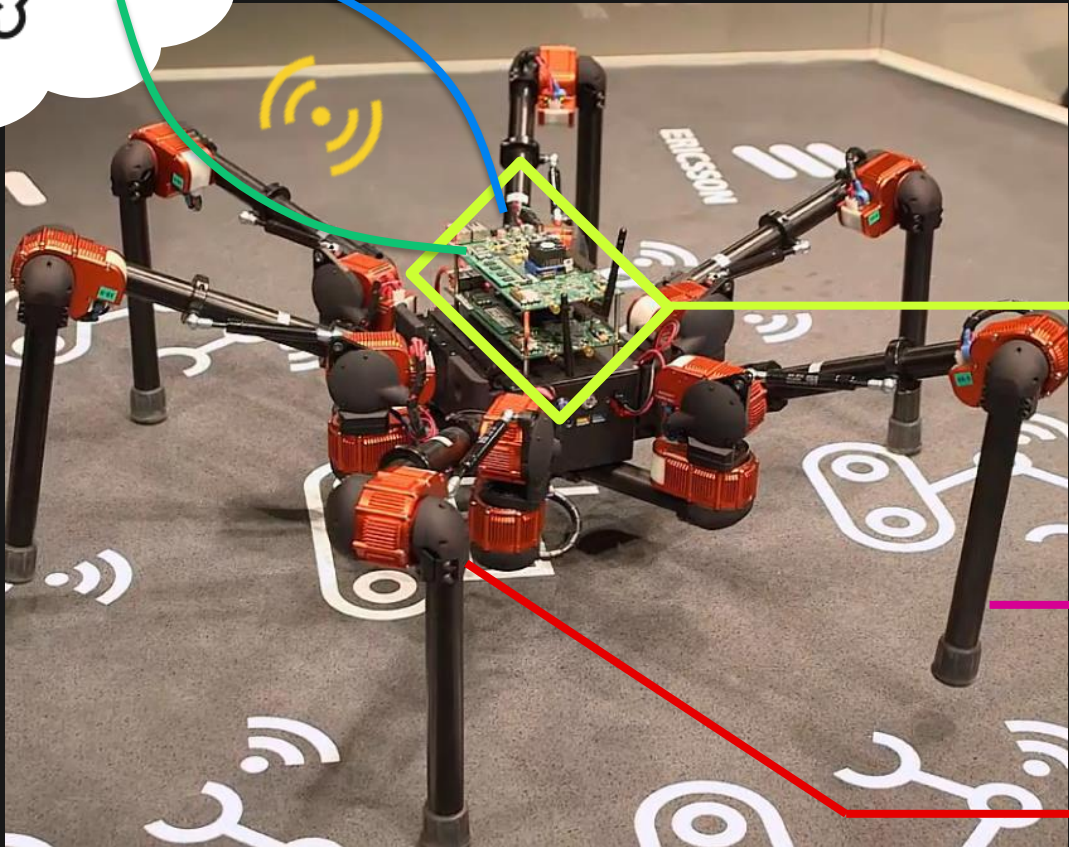




Edge cloud

Edge cloud runs motion control

- 5G reliability integrated with TSN reliability
- Replicated copies of motion control messages over disjoint paths (blue and green) as per IEEE 802.1CB FRER
- Demonstrated in 2019 at [Mobile World Congress](#) and [Hannover Messe](#)



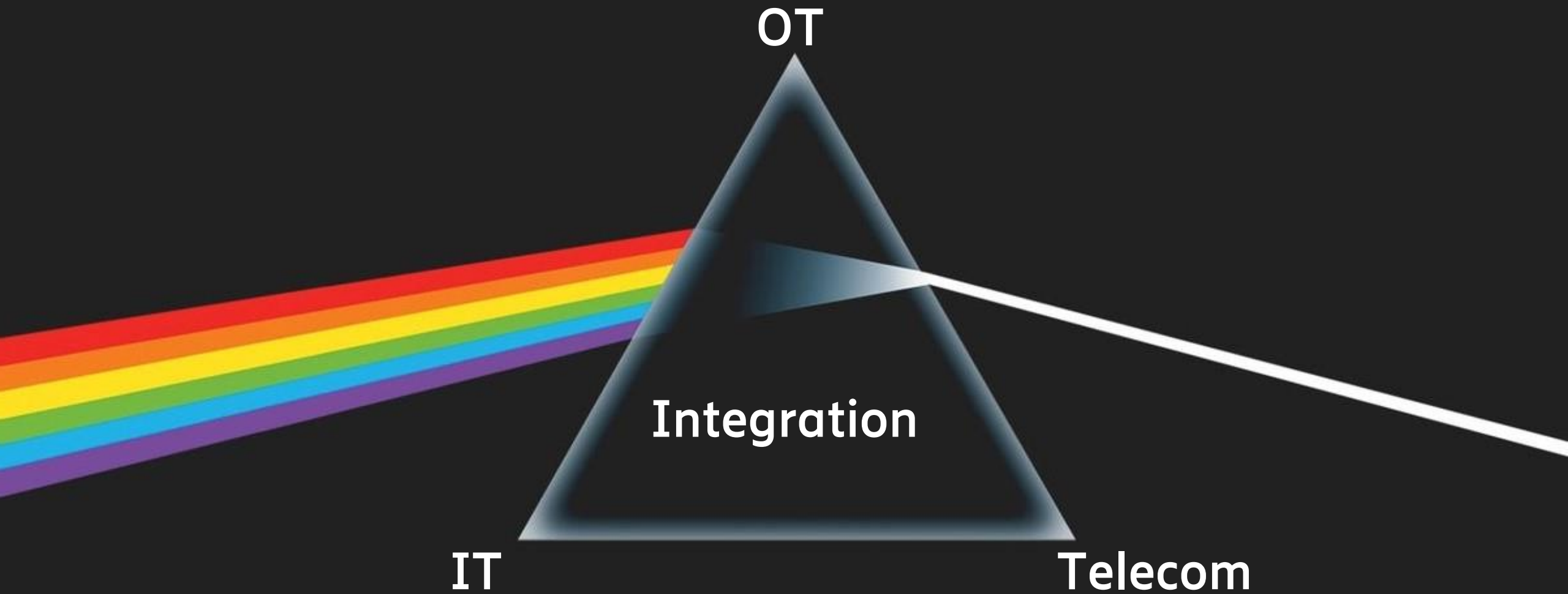
Redundant and low-latency 5G radio prototype

6 robot arms collaborate

18 flexible servo-modules

[video](#)

Network Convergence



Summary

- Integration of 5G and TSN meets networking requirements for industrial automation
- Basic tools for 5G and TSN integration
 - Integrated time synchronization
 - Bounded low latency
 - Control plane: fully centralized model
- 5G standardization for enhancements ongoing





<https://www.ericsson.com/en/networks/offerings/cellular-iot>