

# How We See Needs for Coordination and Interworking from Higher Layer among Heterogenous Wireless & Wired Networks

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# Today's Common Situation for Factories

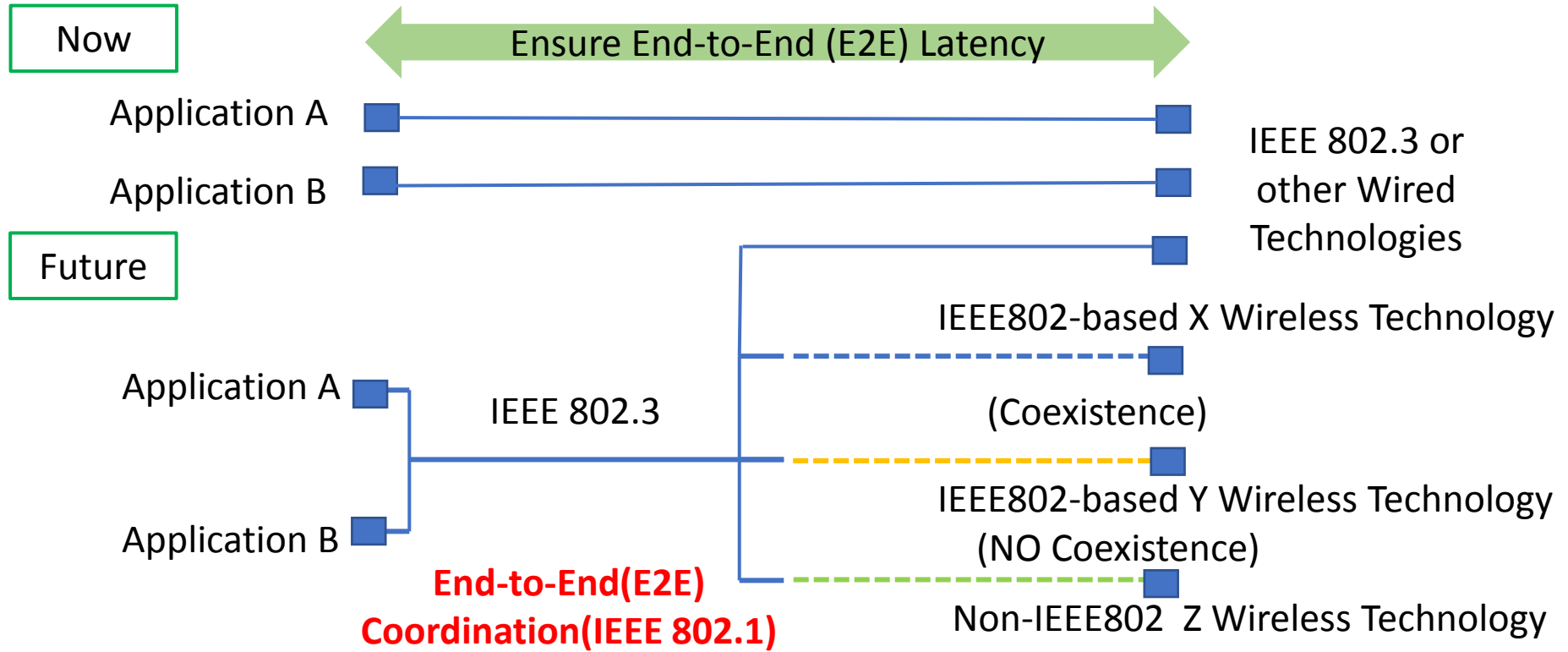
- IEEE802 wireless technologies are successful. They are used with IEEE802-based wired networks for industry applications.
- Especially, 802.11 and 802.15 are selected in accordance with requirements of system applications.
- Some non-IEEE802 wireless technologies, sometimes very old radio and unique, have been also applied.
- Each connected machine/equipment/sensors/monitoring systems cannot support multiple radio interface or cannot coordinate unified radio interface. Replacing all radio interfaces embedded in these systems is unrealistic.
- Thus, heterogenous environment exists and will continue to exist in industry applications.

# Future Direction

- Towards Industrie 4.0, we expect that there will be more wireless-based connected devices. This will be a good trend for IEEE802 wireless standards.
- Frequently, production operation will dynamically change environment and radio propagation as well. This will create further difficulty and complexity for controlling priority classification among data under heterogeneous radio technologies.
- Technically we will see limitation of current coexisting mechanism and need for coordination to ensure End-to-End (E2E) latency for integrated networks.

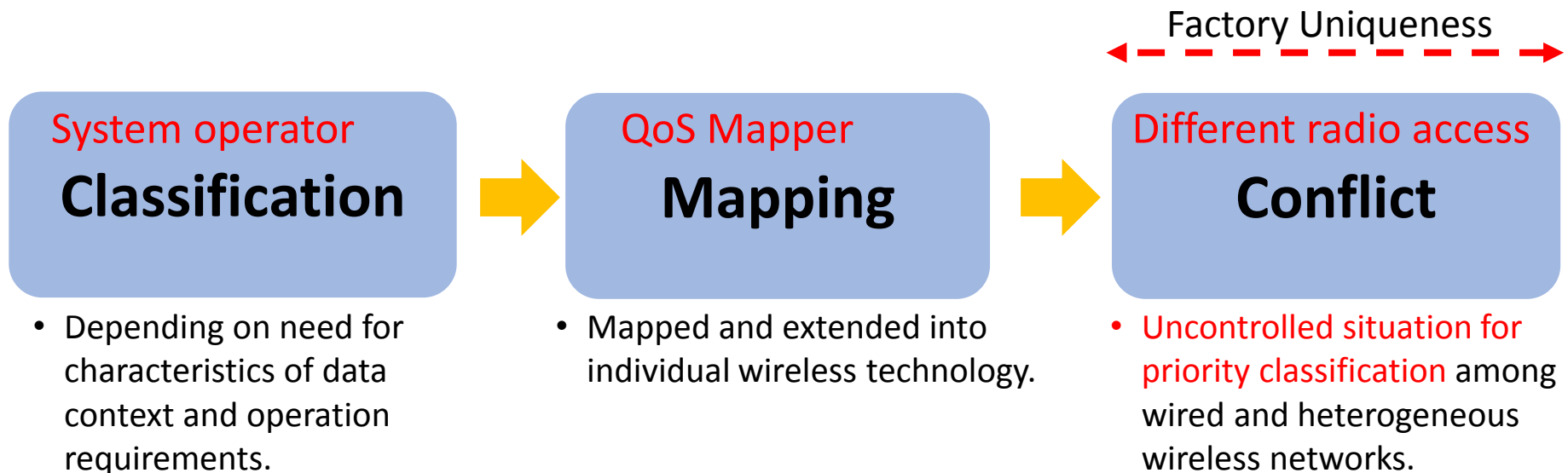
# E2E Network Topology for Factory IoT

- E2E network topology for a factory today is configured by combination of wired LAN, such as 802.3, IEEE802-based and non-IEEE802 wireless technologies.
- In order for factory IoT system to work well under such network topology, data frame is treated in a mix of different technologies by high-level E2E coordination.



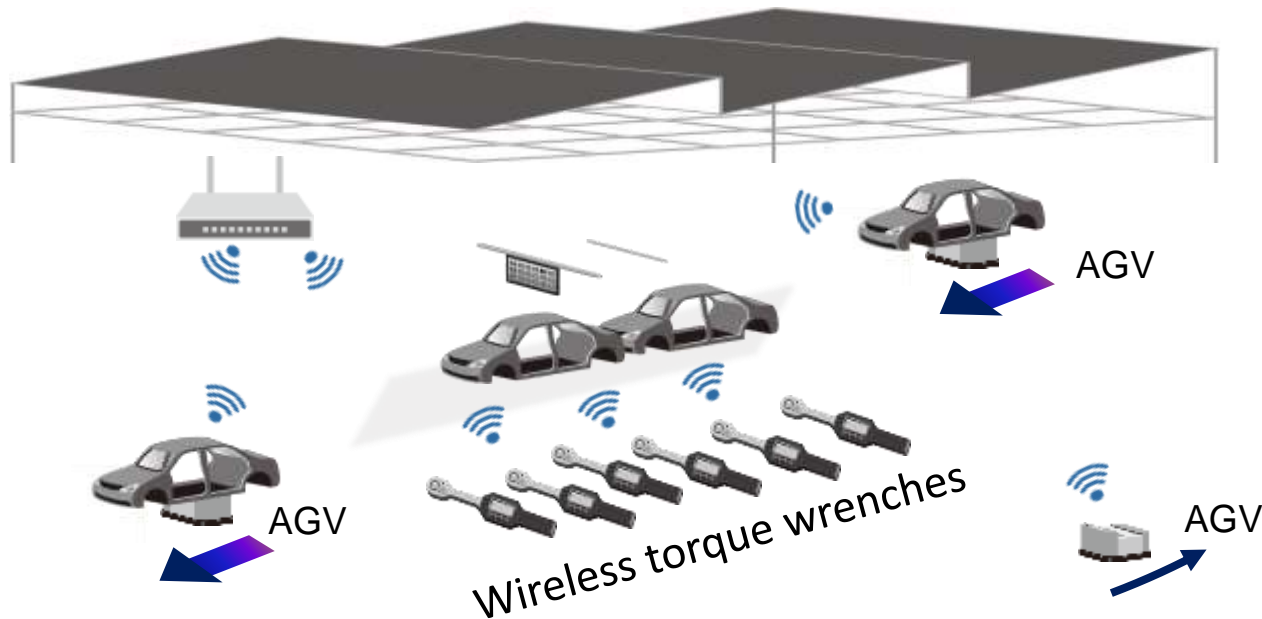
# Issue of Priority Classification Control

- An uncontrolled situation for priority classification to ensure E2E latency occurs among wired and heterogeneous wireless networks in factories due to:
  - Different characteristics of each MAC/PHY
  - Old legacy and proprietary wireless links.

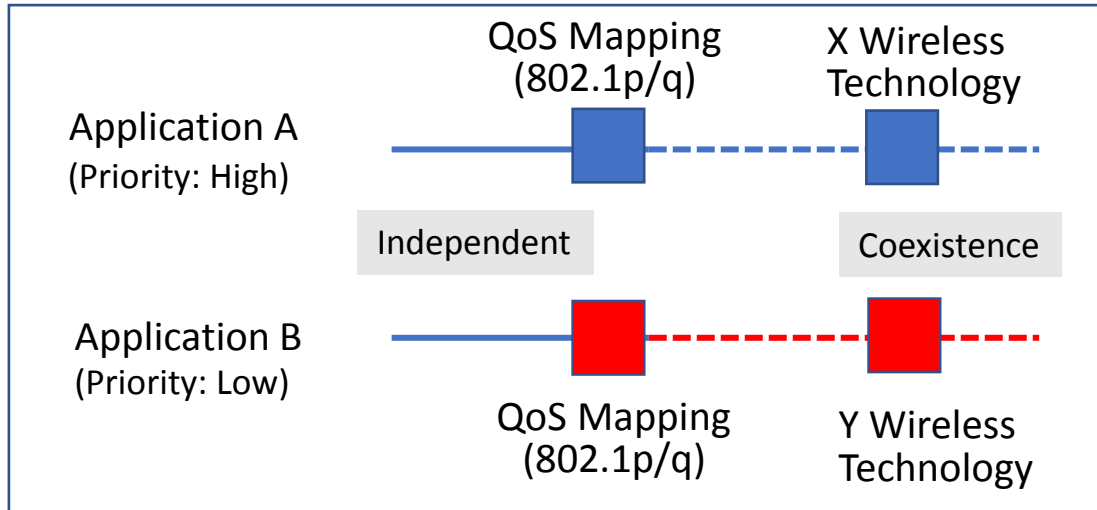


# An Example of Dynamic Situation in Factories

- Higher priority is assigned to AGV control, but may keep balance with that for wireless torque wrenches not to stop the assembly line when:
  - Available bandwidth drops due to wireless environment change, or
  - Data transmission increases instantly.

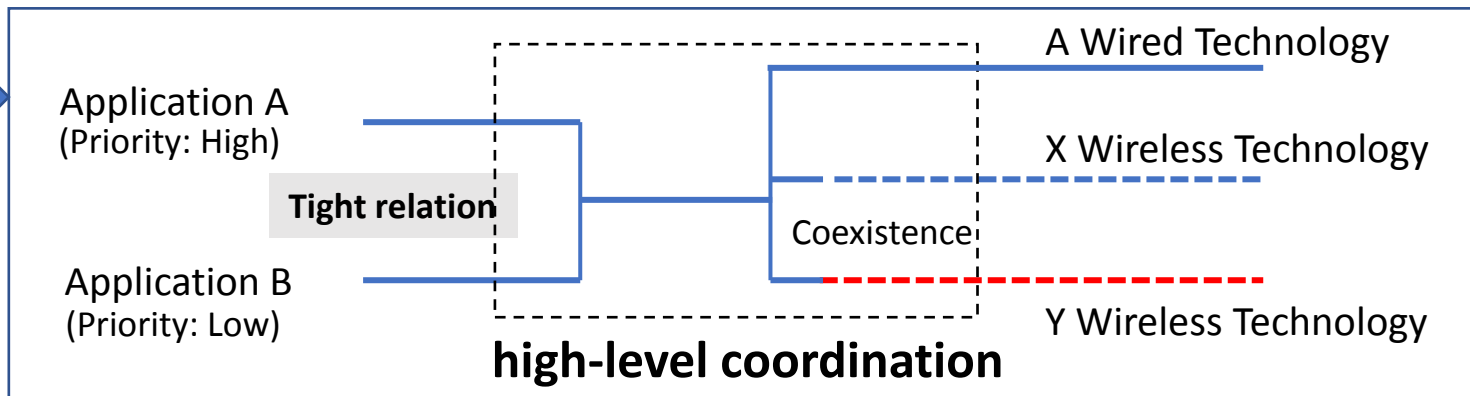


# Network Topology for E2E Priority Classification Control



Can priority classification be kept appropriately?

- Radio propagation
- MAC access control performance
- Link quality
- Hidden terminal interference
- Connection/association



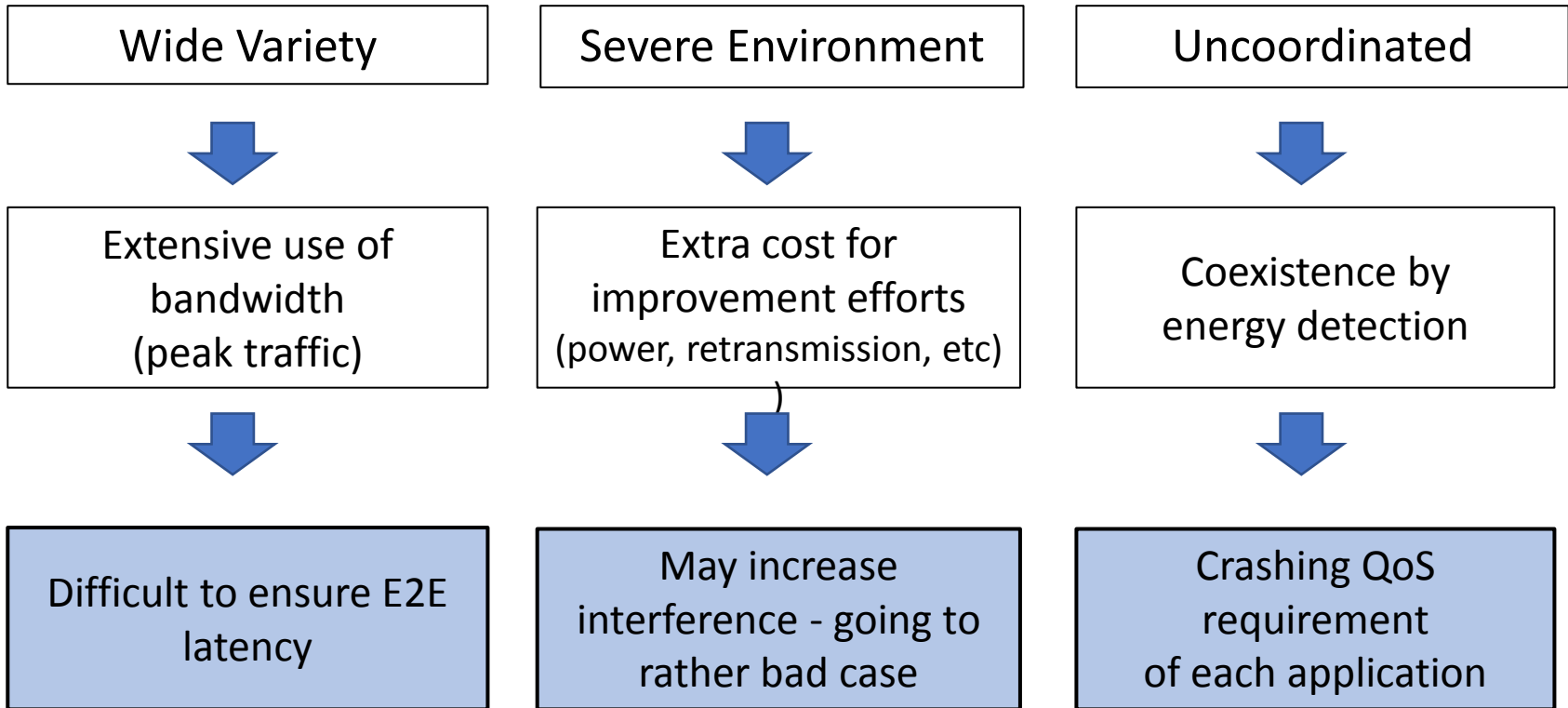


# Where to be Solved

- As we observed under heterogeneous wireless environment, priority classification control to ensure E2E latency, which is required by variety of systems in factories, cannot be realized by a single wireless technology alone.
- We believe the issue we see for future promised market needs a coordination function at high-layer over different wired and wireless technologies, and it shall be discussed at 802.1 WG.
- At First, focus on coordination of priority classification for data packets and control based on IEEE 802.1 mechanisms.
- Higher layer coordination beyond priority classifications for data packets and delivery such as configuration, PM and FM across the whole E2E network is the subject for future consideration.

Backup slides

# What are Happening or will Happen?



Single wireless technology may not address these problems above.  
Sophisticated coordination mechanism is promising.