QoS extension in dense and heterogeneous wireless networks for industry usage - Part 1: Motivation -

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Introduction

- This presentation has been prepared to express an intention to propose a new work item in the IEEE802.1 working group.

Scope

- The proposal concerns QoS extension for industrial wireless applications, e.g., dense and heterogeneous systems in a closed space.

Usage	Network Density	System Complexity	Dominant Data Flow
Mobile, Home, Small office	Low	Independent system	Downstream
Large office, Conference room	High	Homogeneous system	Downstream
Factory, Warehouse, Shopping mall, Station, Airport, Stadium	**High**	**Multiple independent systems, Heterogeneous systems**	**Fragmented, Upstream**

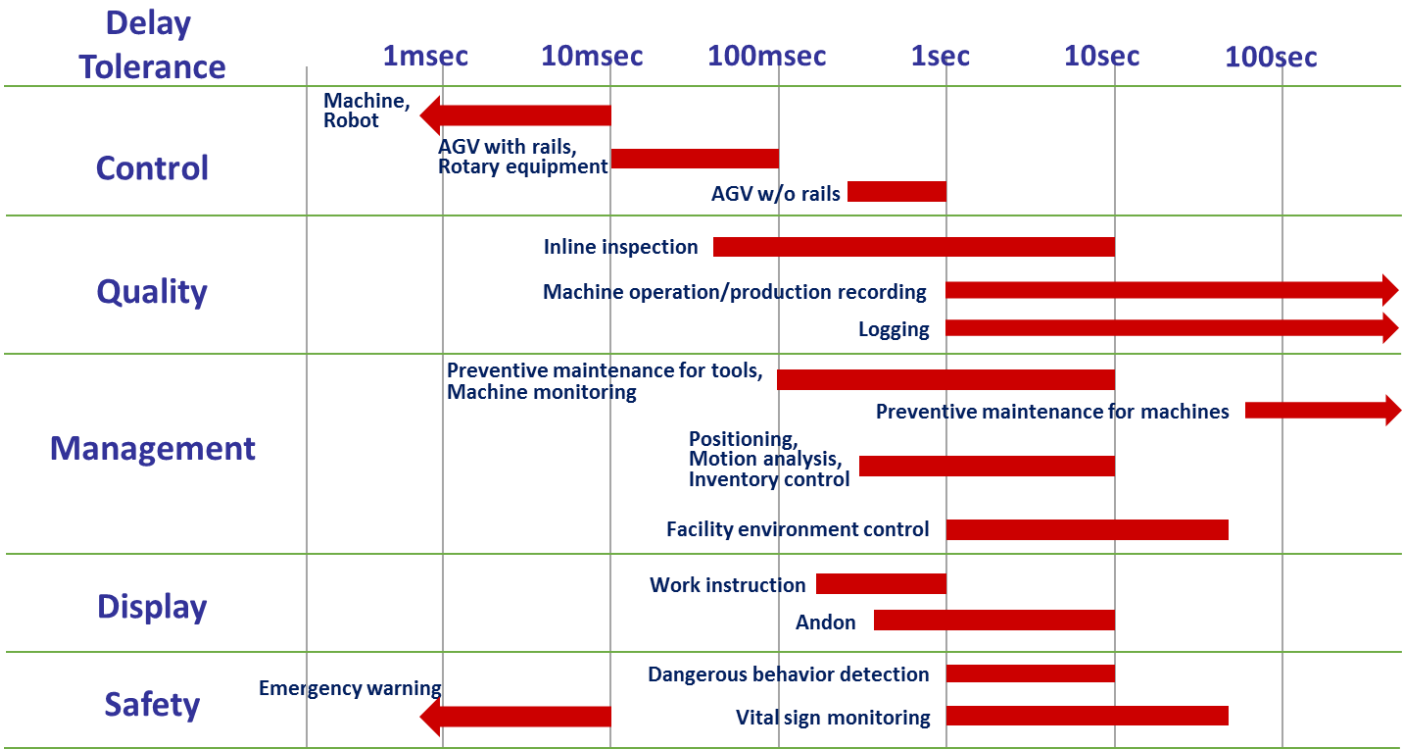
Factories as a first choice

- McKinsey Global Institute reported IoT will offer a potential economic impact of $3.7 trillion at the most in 2025 for the factory section [1] .
- **Dense**: due to wide-spreading IoT devices, e.g. sensors and cameras, the number of wireless nodes is rapidly increasing in factories.
- **Heterogeneous**: in a usual case, step-by-step installation of wireless devices for each equipment or process flow results in coexistence of new and legacy and/or different kinds of systems.

[1] http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world

QoS: Delay tolerance

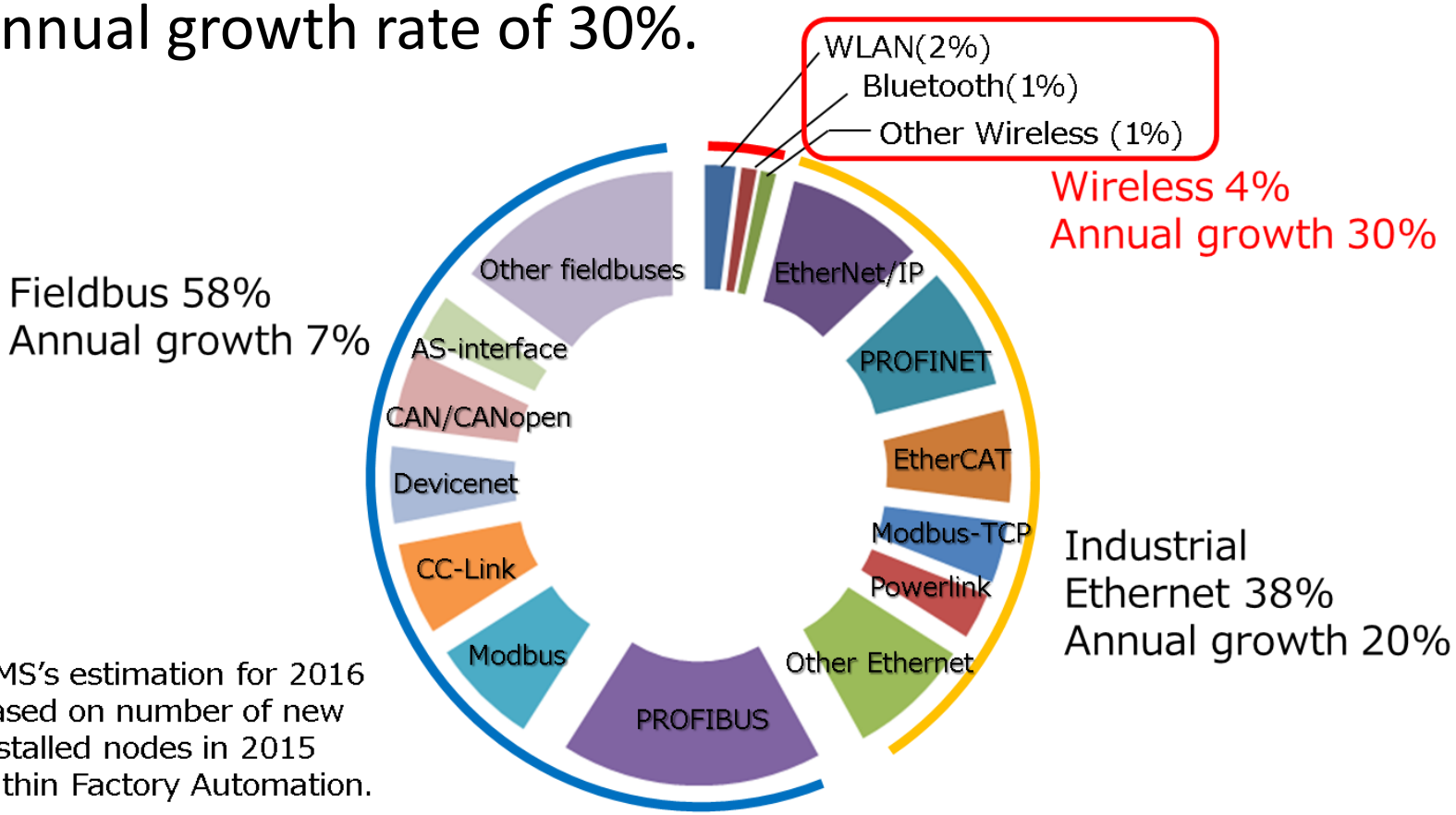
- IoT utilization changes production management from daily to in-real-time.
- For most wireless applications, 10msec- 10sec delay is acceptable.



Source: Flexible Factory Project

Communication nodes for factory automation

- Share of wireless nodes is 4%, but is increasing at an annual growth rate of 30%.



[2] http://www.automationinside.com/2016/03/industrial-network-market-shares-2016.html

What disturbs wireless use in factories?

- The most frequent answers from managers in the fields are risks that system does not work occasionally and the problem can not be fixed.
- There exist multiple issues in this problem such as network design, hidden terminal, co-channel interference.
- It is difficult to handle them in the dynamically changing wireless environment where human and objects move, and reallocation of machines frequently occurs in a closed space i.e., a factory, in addition to the difficulty coming from nature of dense and heterogeneous wireless systems.

Problem statement

- Even for the dense and heterogeneous systems, CSMA/CA does work but does not provide required QoS at the application level.
- Widely used energy detection-based coexistence cannot maintain fairness of QoS treatment in heterogeneous wireless network.

QoS requirements in industry environment are found to be precise and fine. Collecting various data at desired timing cannot be ensured.

Toward dense and heterogeneous networks

- Harmonized and dynamic QoS over different wireless systems utilizing limited and fluctuating radio resources.
- Application-aware coexistence procedure of heterogeneous systems in the tough environment of factories.

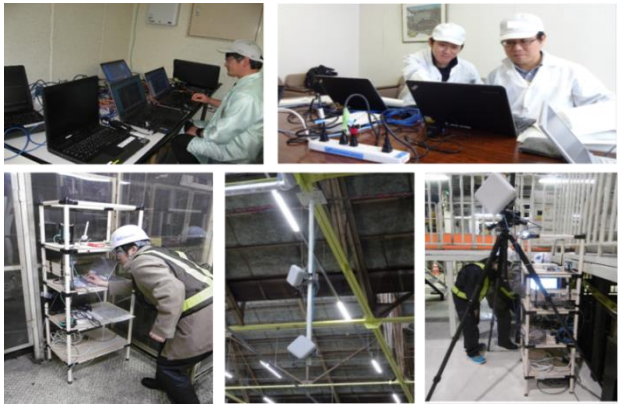
New functions will be effective not only for factories but also other facilities with dense and heterogeneous wireless systems for industrial IoT.

Additional information

- We will provide information on use cases and requirements for wireless usage in factories, which is outcome from our collaborating work, namely Flexible Factory Project (FFPJ) since 2015.

- FFPJ members:
  NICT, OMRON, ATR, NEC, NEC Communication Systems, Fujitsu, Fujitsu KCN, Mobile Techno, Sanritz Automation, Murata Machinery

- FFPJ partners:
  7 factories of 5 companies.



More Information
https://www.nict.go.jp/en/press/2017/03/01-1.html