

Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: IG DEP Updated Development of Wireless Sensing System for Factory

Date Submitted: January 19, 2016

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Re: IG DEP Development of Wireless Sensing System for Factory

Abstract Update of previous presentation of Nissan Automotive representative
Development of Wireless Sensing System for Factory

Purpose: This document has been prepared for response to call for interest(CFI) of IG-DEP(Dependability).

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IEEE 802.15 IG DEP
Review of Responses to Call for Interest(CFI)

**Updated Development of
Wireless Sensing System
for Factory**

**Ref. 15-15-0221-00-IG-DEP-Development-of- Wireless-Sensing-
System-for-Factory**

Atlanta, GA, USA

January, 2016

Hiroshi Kobayashi, Nissan Automotive

Agenda

Background

Updated New Type of Equipment Diagnosis
System by using wireless sensor devices

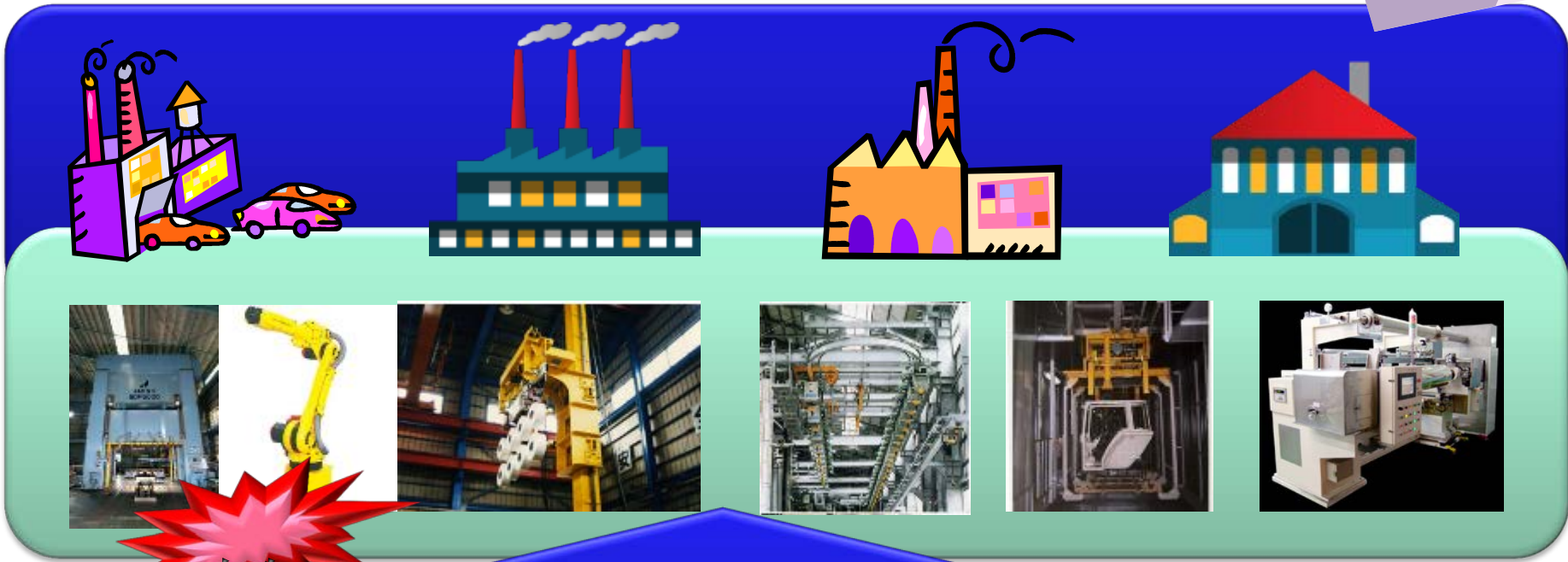
Required specification

Future Activity

Background

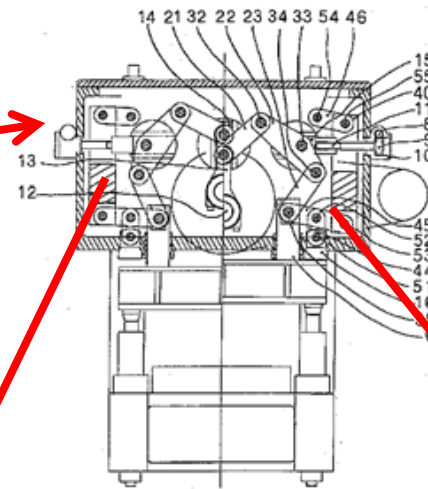
Reduce Cost

Improve OEE



Reliability

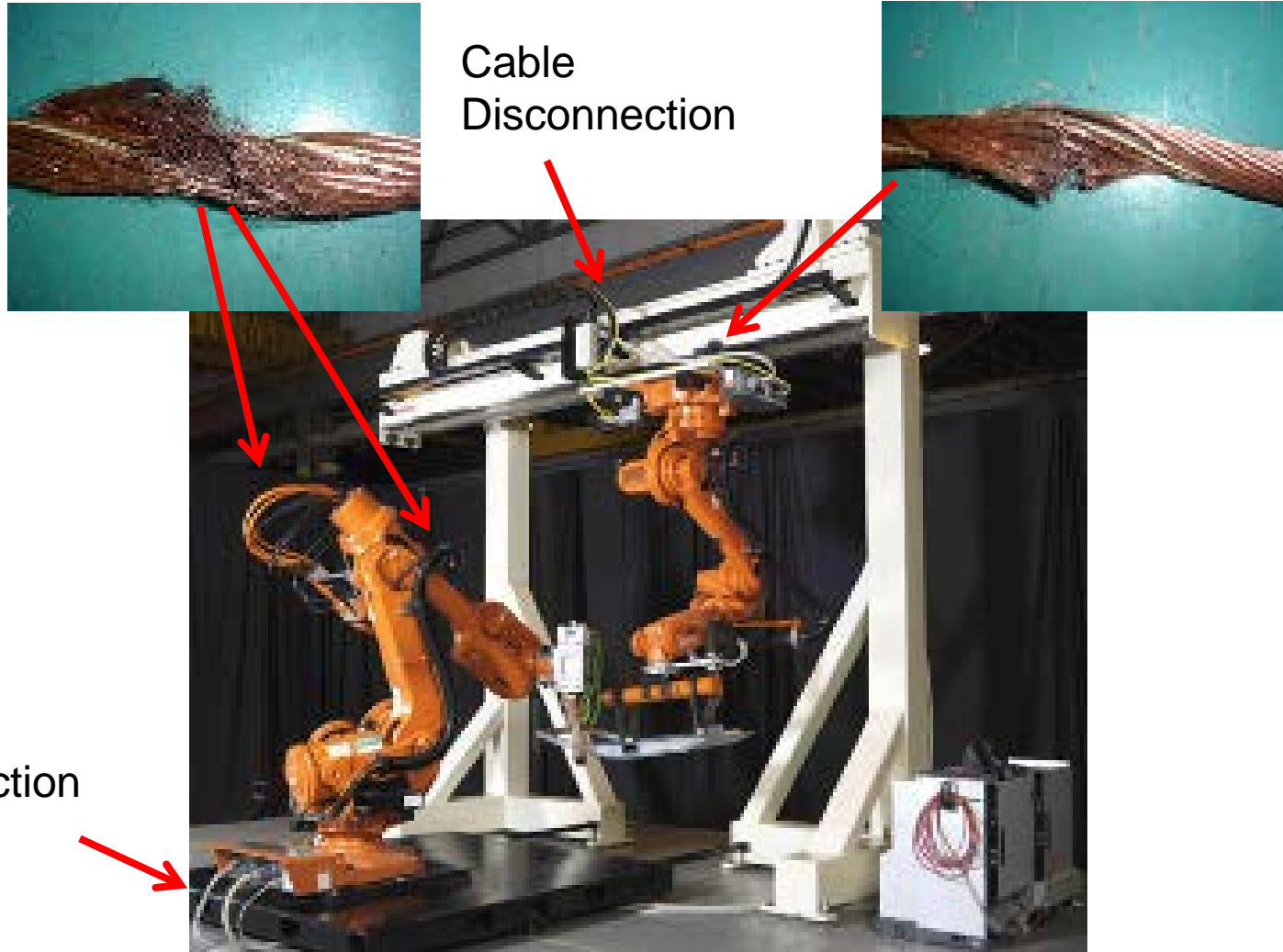
1) Example of Major Breakdown



Crack

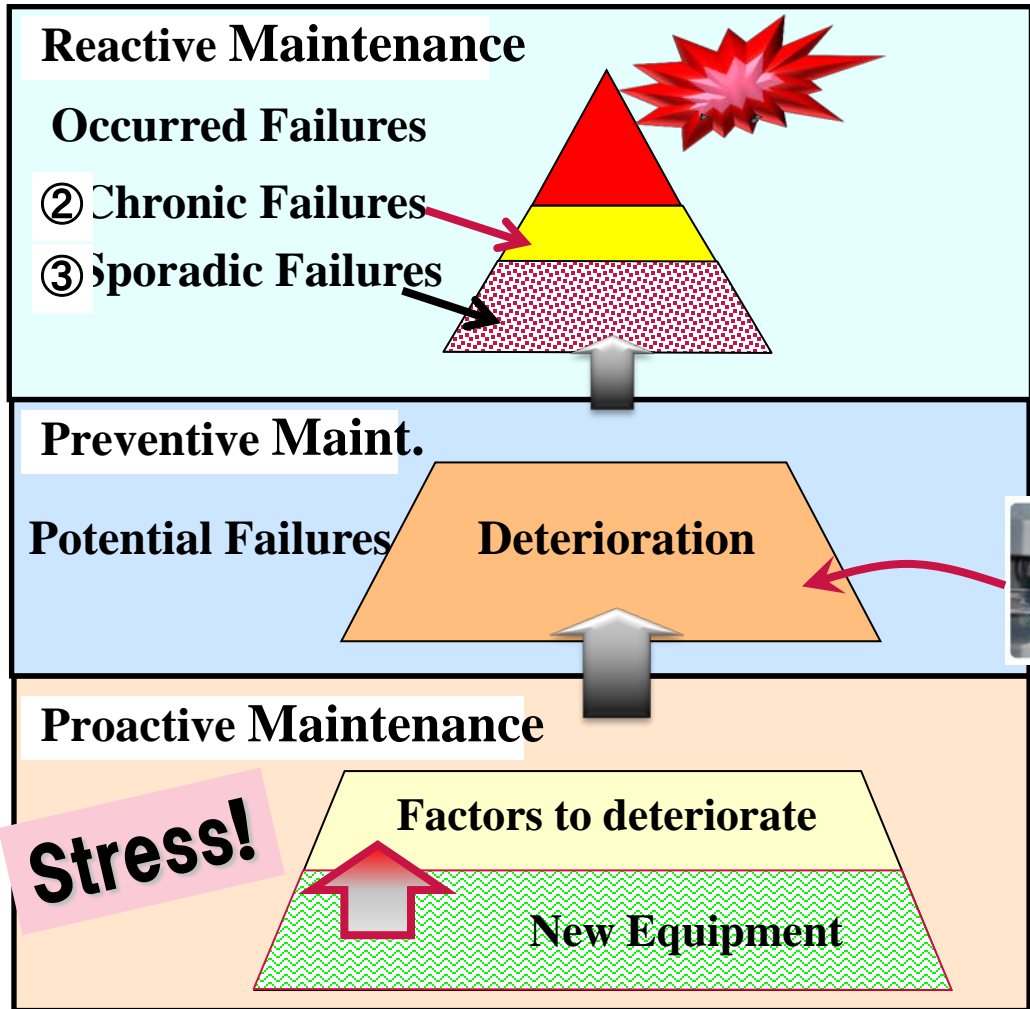


2) Example of Major Breakdown



Cable
Disconnection

TBM: Time Based Maintenance



Manual Inspection

Periodical check

We need a lot of man power of maintenance.

Other reasons why we need to improve “Equipment Reliability”

- a) Equipment automation rate is increasing.
=> No operator and More maint. tech.
- b) Production volume is increasing
=> No or less maintenance window &
maintenance time (2shift => 3 shift)
- c) Lack of skill for maintenance
=> We need new equipment diagnosis system
that does not require us new skill.

Agenda

Background

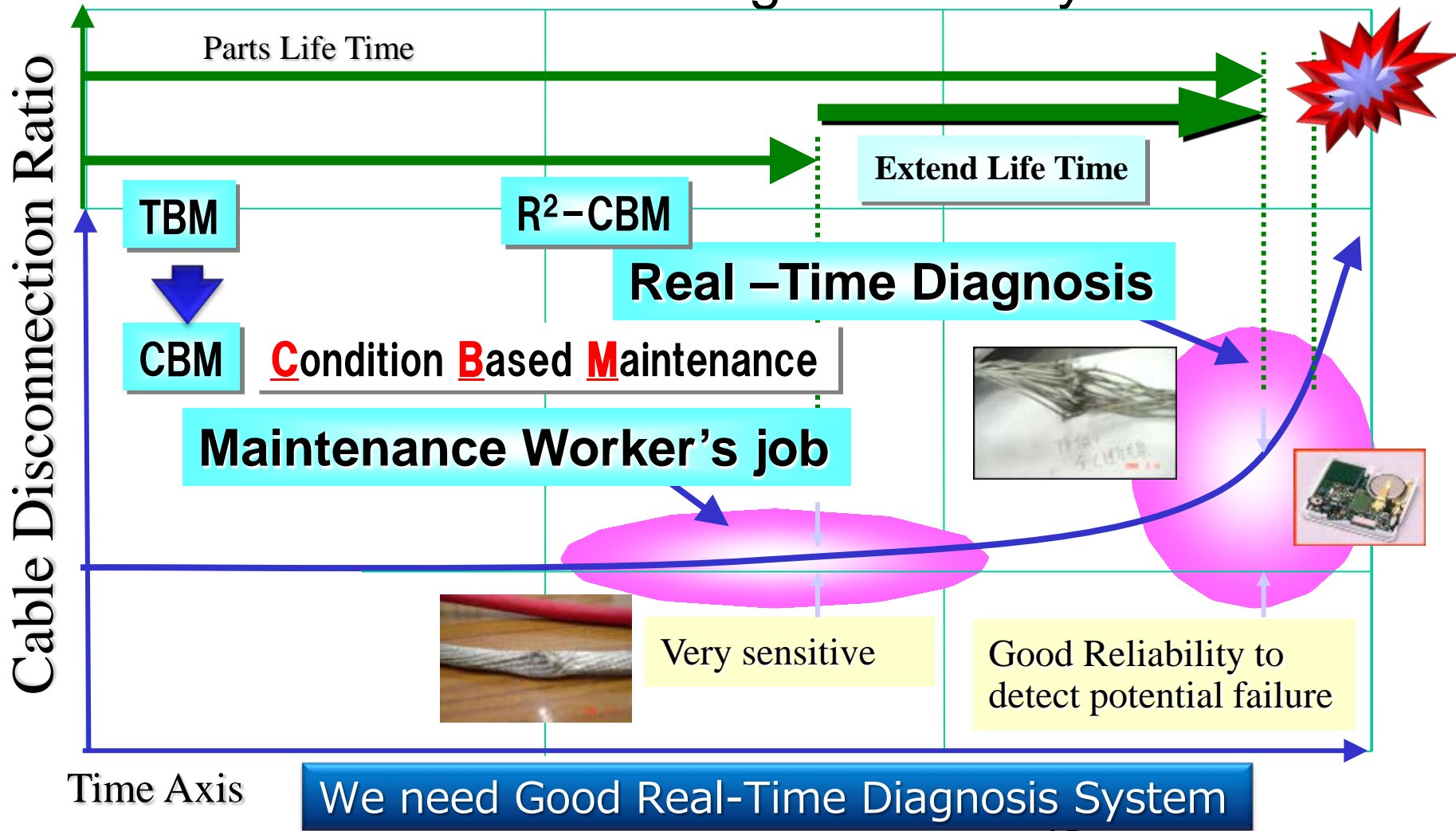
Updated New Type of Equipment Diagnosis
System by using wireless sensor devices

Required specification

Future Activity

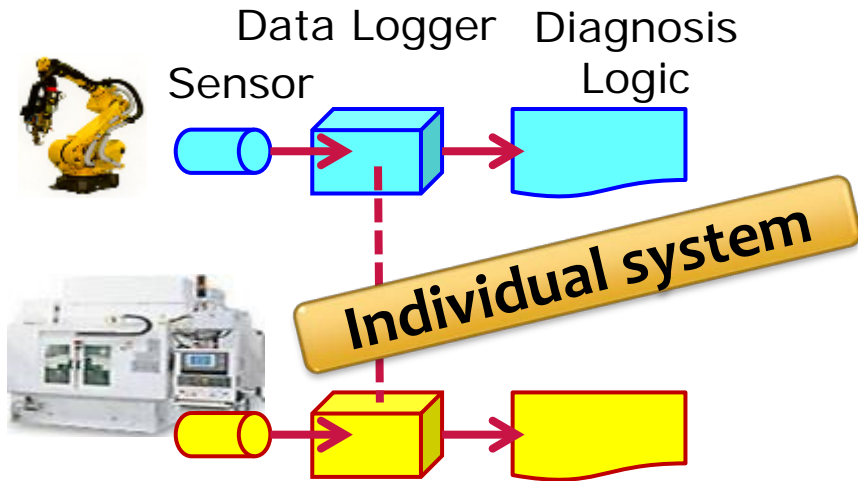
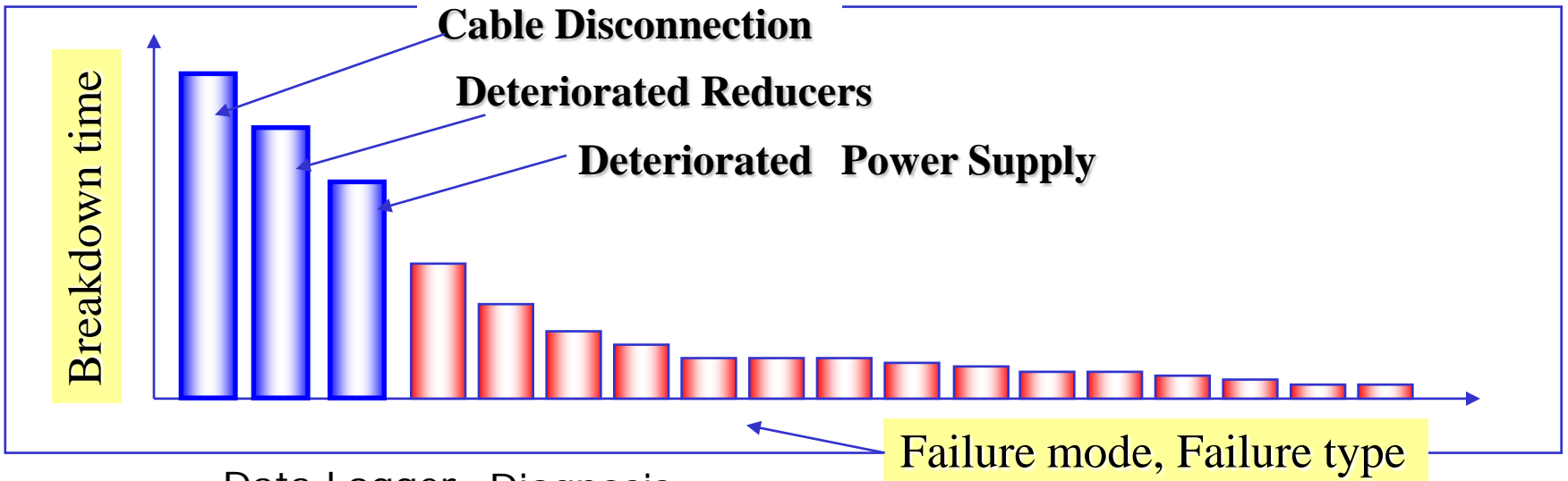
Concept for Equipment Diagnosis System

Cost Minimum and High Reliability



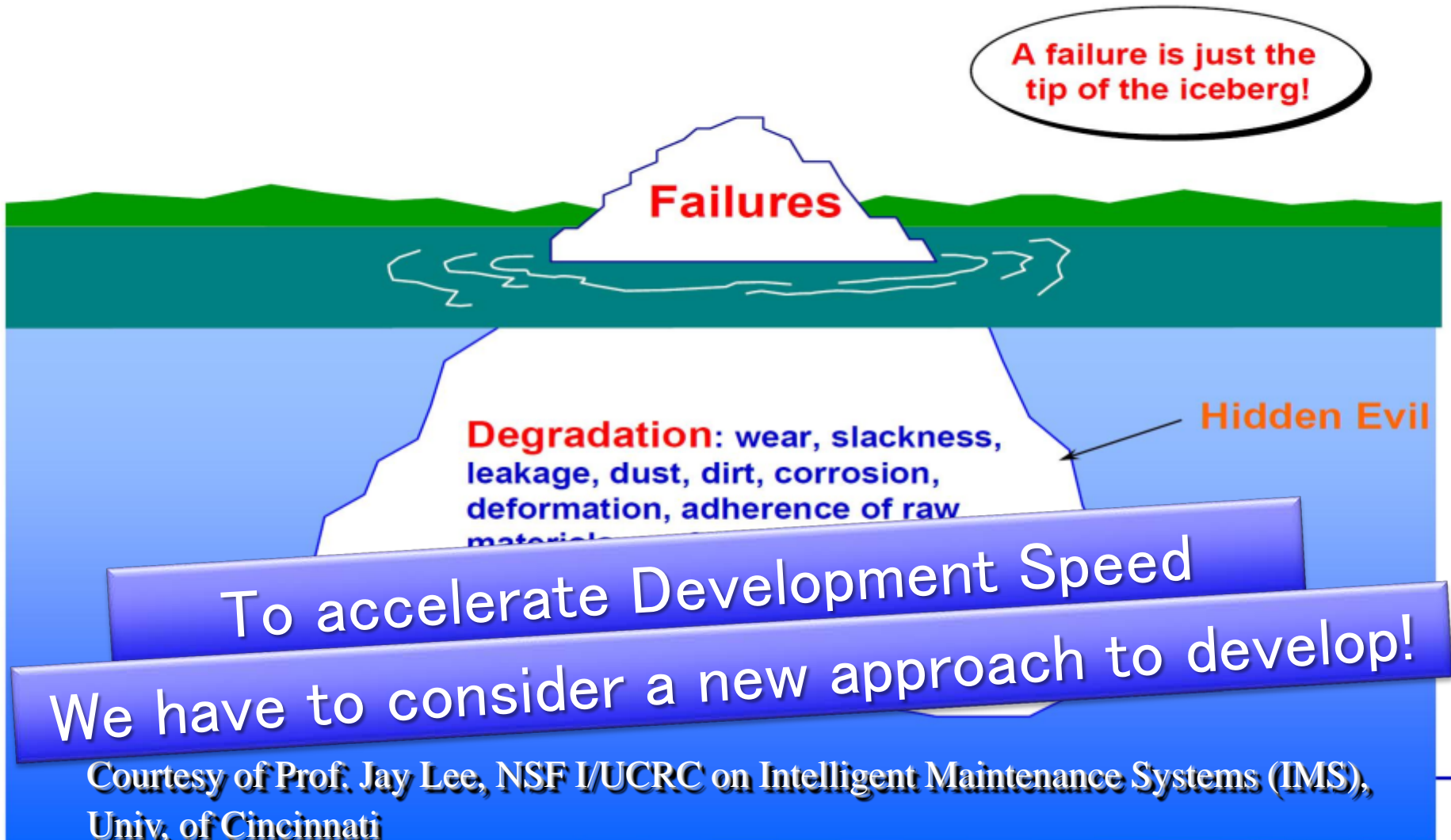
Ordinary approach to develop "Diagnosis system"

< Conventional Development Procedure >



This method requires us a lot of time and cost to develop.

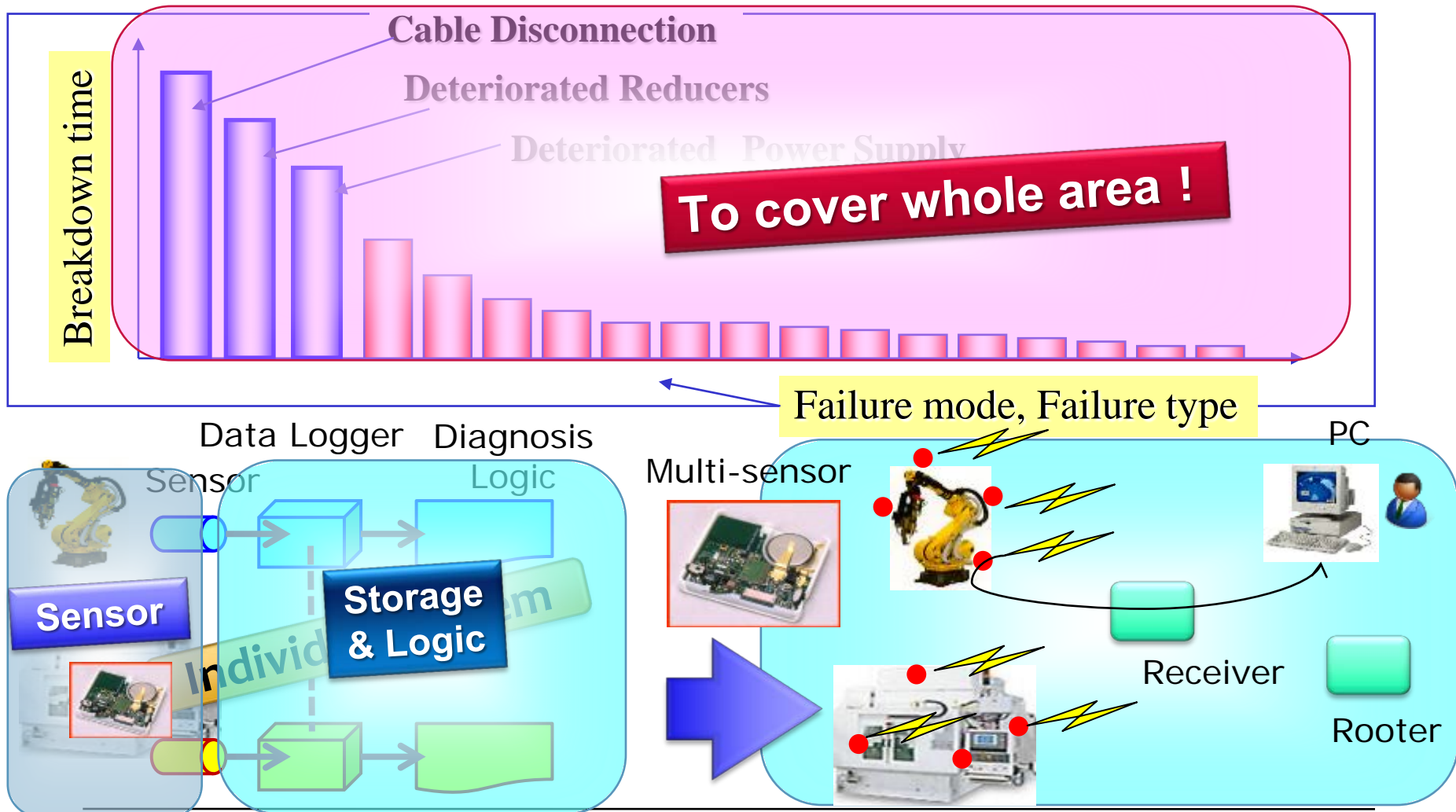
Unmet Needs and IMS Opportunities (The Iceberg Model)



Courtesy of Prof. Jay Lee, NSF I/UCRC on Intelligent Maintenance Systems (IMS),
Univ. of Cincinnati

New approach to develop "Diagnosis system"

< Conventional Development Procedure >



Failure mode, Failure type

Data Logger Diagnosis

Sensor Logic

Sensor

Storage & Logic

Multi-sensor

PC

Receiver

Router

Submission

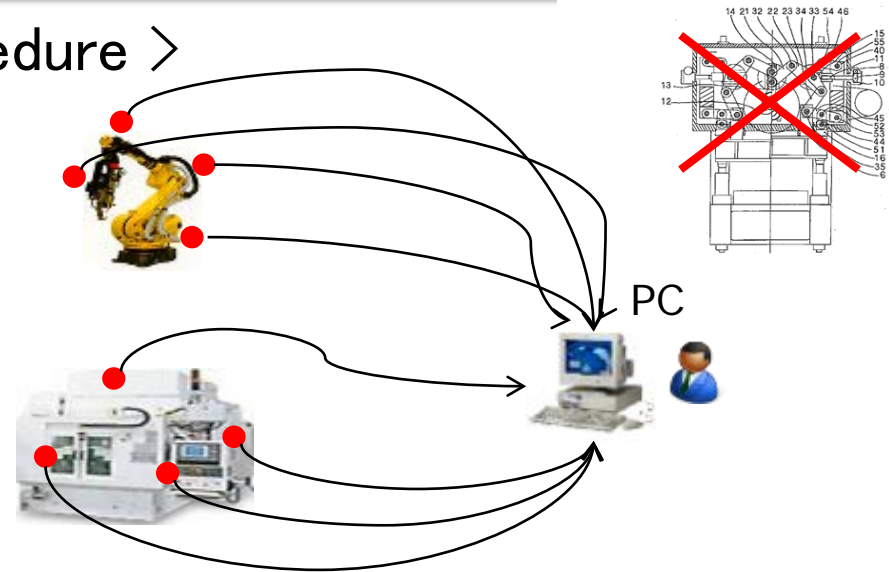
Slide 13

Hiroshi Kobayashi(Nissan),
Ryuji Kohno(YNU/CWC-Nippon),

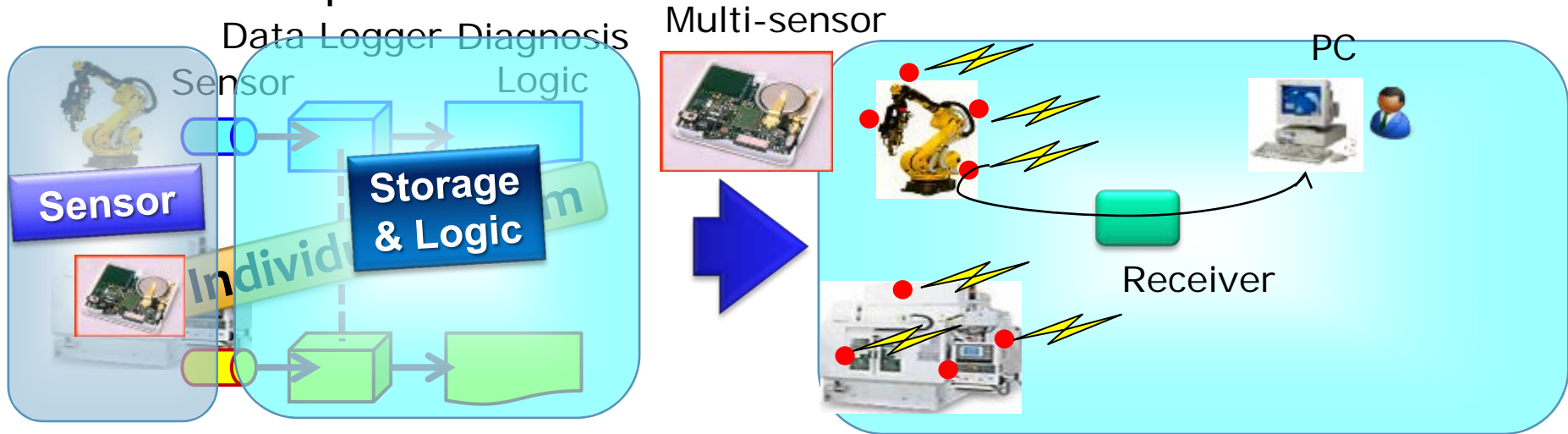
Comparison between "wired system" and "wireless system"

< Conventional Development Procedure >

- Installation Issues**
- Installation Cost**
- Restriction of installation**
- Reliability of wires**



< New Development Procedure >



Agenda

Background

Updated New Type of Equipment Diagnosis System by using wireless sensor devices

Required specification

Future Activity

Required specification

3 type of Diagnosis System

1. Equipment Diagnosis System in Real-time with rea-time feedback



1. Real-time measuring
2. Judge immediately with a certain threshold level

2. Equipment Diagnosis System in Real-time (1)



1. Real-time measuring and sending data in real-time
2. Judge based on the comparison with the past data




3. Equipment Diagnosis System in Real-time (2)



1. Real-time measuring and sending data **intermittently**
2. Judge based on the comparison with the past data

Required specification

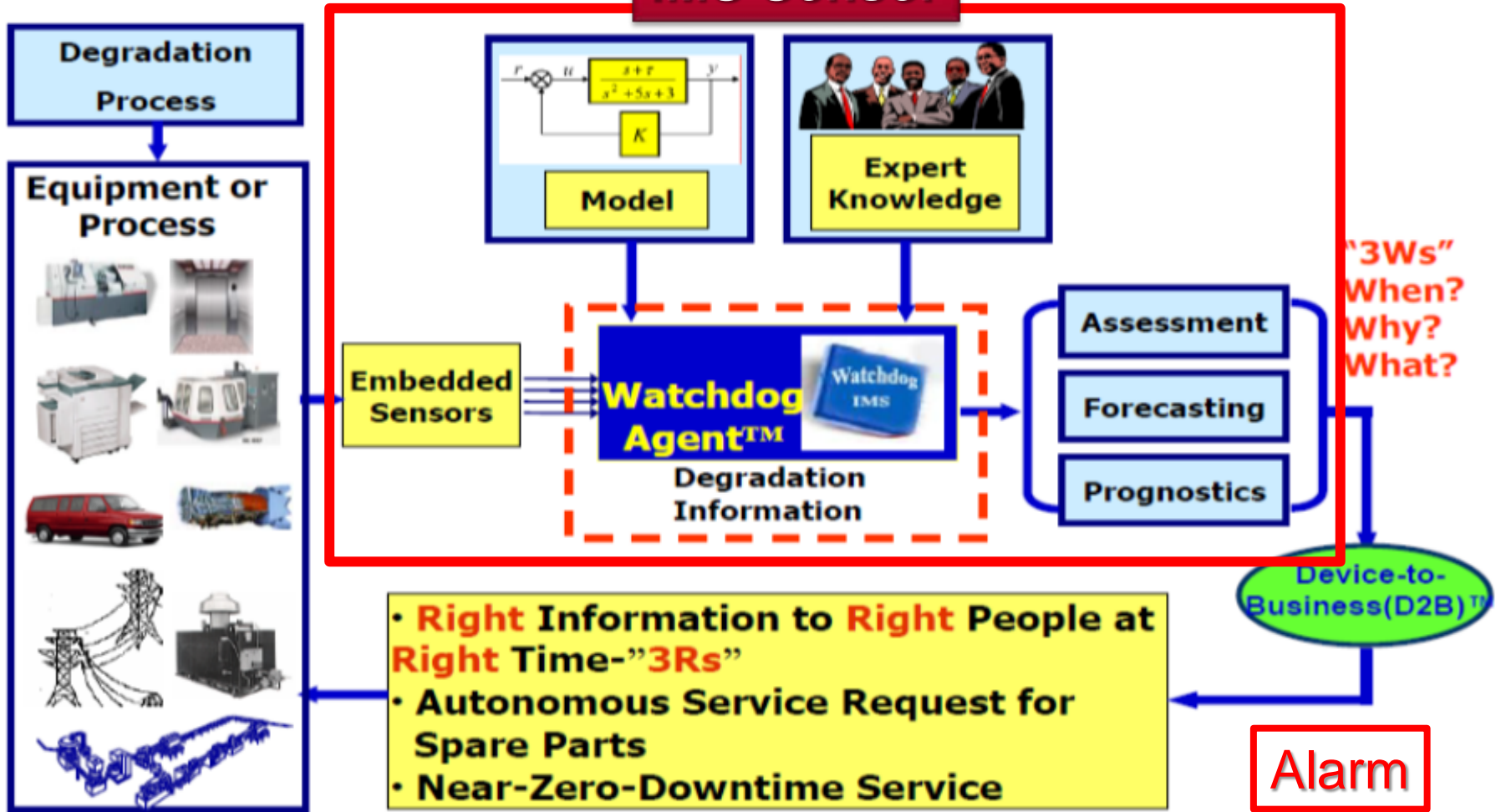
3 type of Diagnosis System

1. **Equipment Diagnosis System in Real-time with rea-time feedback** 
 1. **Real-time measuring**
 2. **Judge immediately with a certain threshold level**
2. **Equipment Diagnosis System in Real-time (1)** 
 1. Real-time measuring and sending data in real-time
 2. Judge based on the comparison with the past data
3. **Equipment Diagnosis System in Real-time (2)** 
 1. Real-time measuring and sending data **intermittently**
 2. Judge based on the comparison with the past data

A

Intelligent Maintenance Systems (IMS)

IMS Sensor



Required specification

3 type of Diagnosis System

1. Equipment Diagnosis System in Real-time with rea-time feedback



1. Real-time measuring
2. Judge immediately with a certain threshold level
3. Send alarm

2. Equipment Diagnosis System in Real-time (1)



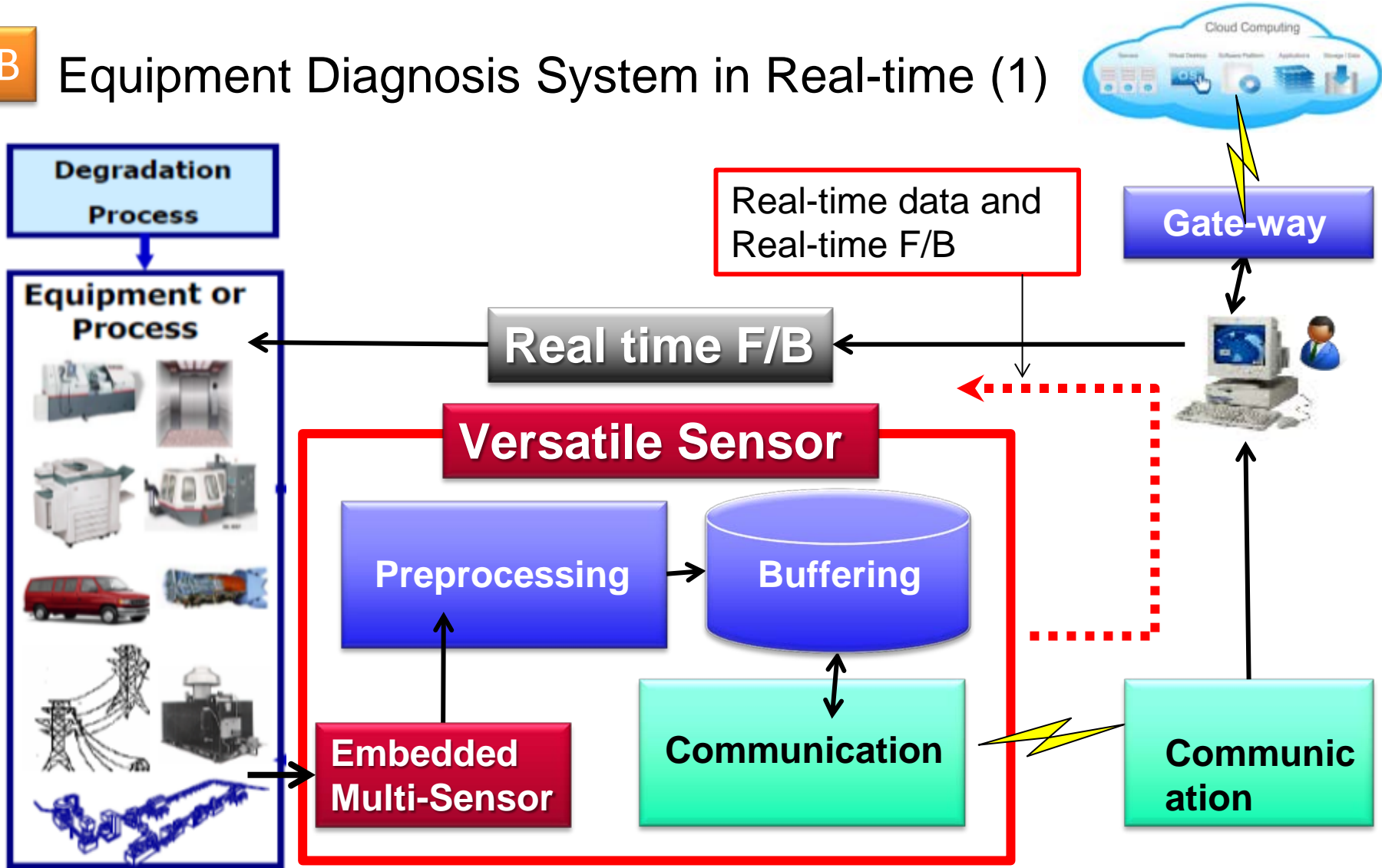
1. Real-time measuring and sending data in real-time
2. Judge based on the comparison with the past data

3. Equipment Diagnosis System in Real-time (2)

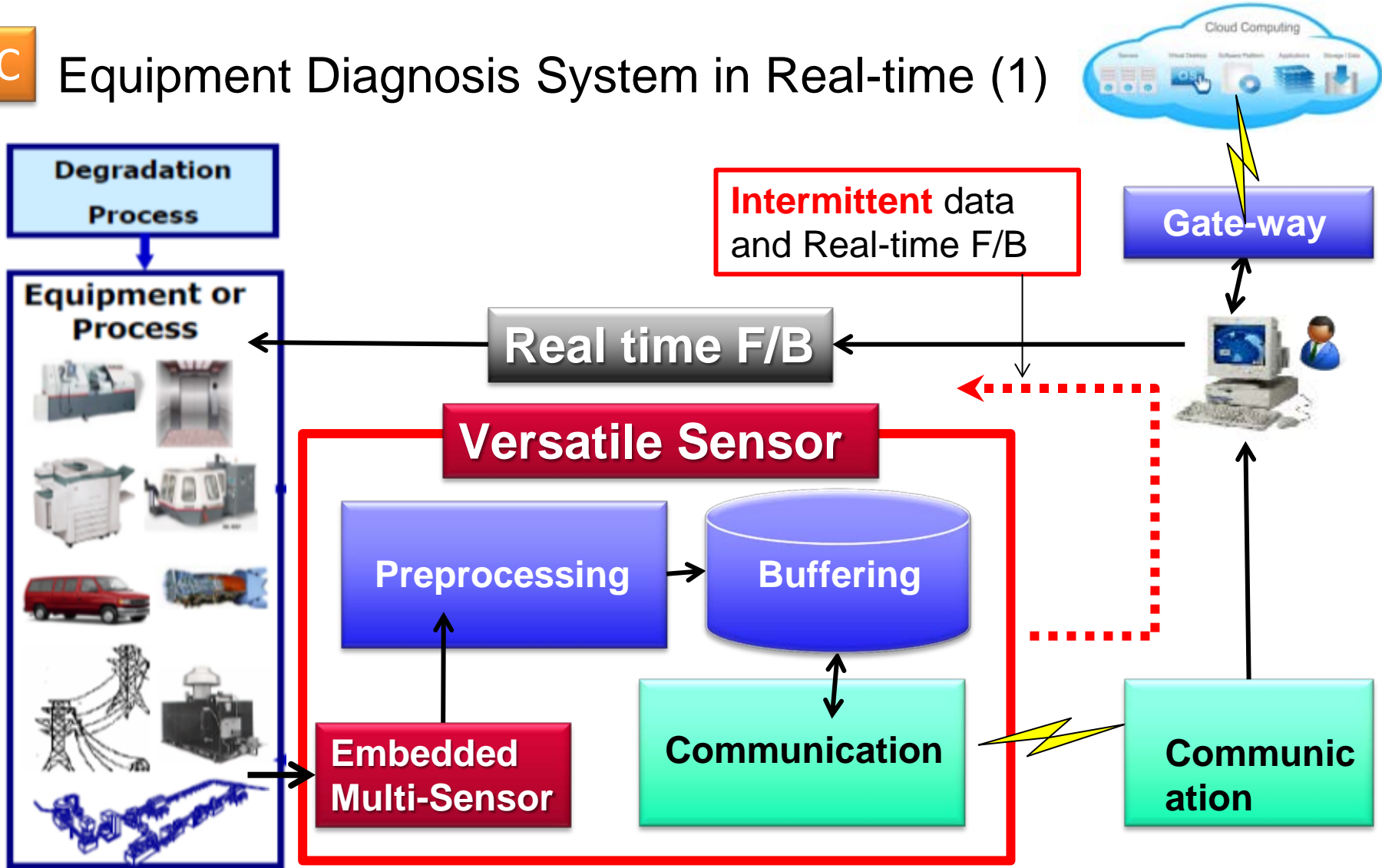


1. Real-time measuring and sending data **intermittently**
2. Judge based on the comparison with the past data

B Equipment Diagnosis System in Real-time (1)

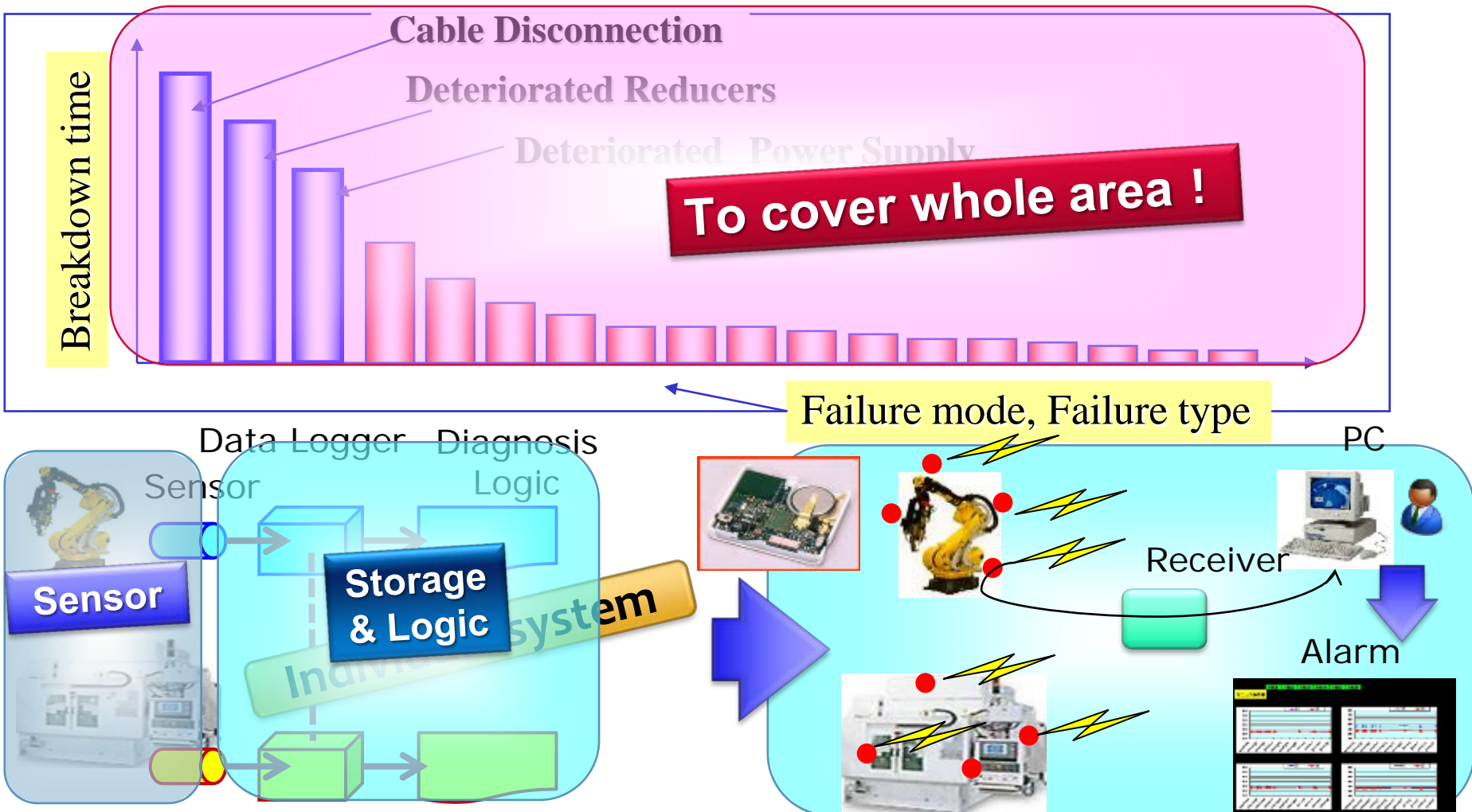


C Equipment Diagnosis System in Real-time (1)



New approach to develop "Diagnosis system"

< Conventional Development Procedure >



Required specification

Specification for Equipment Diagnosis System

1. Response

1. Real-time measuring function to communicate with receiver in real-time
2. Judge immediately with a certain threshold level

2. Energy consumption

1. In order to prolong a life time of measuring device save energy and have good efficiency regarding communication power * At least 1 year or more

3. Bilateral communication ability

1. In order to change some parameters in the device
2. and give some triggers to start and end measuring from outside

Required specification

Specification for Equipment Diagnosis System

4. Distance to communicate with devices

- 1) In order to reduce the number of receivers device have to have some distance to communicate. At least 20m or more

5. Data transfer speed

- 1) This sensor will have multi-sensors. So data transfer speed is very important.

6. Communication capability with many sensors

- 1) How many sensors can communicate at the same time

7. Kinds of Sensors

- 1) Vibration sensor
- 2) Thermal sensor
- 3) Voltage
- 4) Current
- 5) AE

Agenda

Background

New Type of Equipment Diagnosis
System by using wireless sensor
devices

Required specification

Future Activity

Future Activity

1. Prototyping Equipment Diagnosis System in Real-time with real-time feedback with Dependable Short Range Wireless Networks
 1. Highly reliable real-time measuring with short range radio sensor network
 2. Highly secure decision immediately with measured data by wireless network of various sensors and past recorded data
 3. Strongly protected alarm and commands to equipment in a line for dependable remote monitoring and maintenance
2. IoT/Big Data/Mining through Cloud Network Using Equipment Diagnosis System in Real-time with real-time feedback
 1. Build up Nissan in-house equipment diagnosis system in real-time sensing and controlling with dependable wireless feedback network
 2. Entire remote sensing and controlling FA equipment diagnosis system with IoT/Data Mining server through cloud network
3. International Standard Establishment with All other Institutes and Companies
 1. Though associations of automotive industries and other manufactures, common standard equipment diagnosis system using wireless dependable short range sensing and controlling will be established.
 2. IEEE802.15 may be the best venue of establishing a standard of dependable wireless feedback network for global common equipment diagnosis system.

Future Activity

Issues of traditional method

1) Takes a lot of time to develop

2) Difficult to deploy

3) Cost issue

4) Some special person just use

Versatile Sensor (Standardized Diagnosis System)

1) Multi-sensor Wire-less ⇒ Shorten Dvpmt. time

2) Easy to deploy because of same structure

3) Cost minimum and reduce developing cost

4) Everybody can create a diagnosis logic

