

JOGMEC Techno Forum 2015

IoT Solution for Oil&Gas Production Facilities ~Application of Big Data Analysis Technology into Plant Monitoring~

29th Oct, 2015

Yutaka Ukegawa

NEC Corporation

Senior Vice President

Transportation and City Infrastructure Division

NEC IoT Solutions

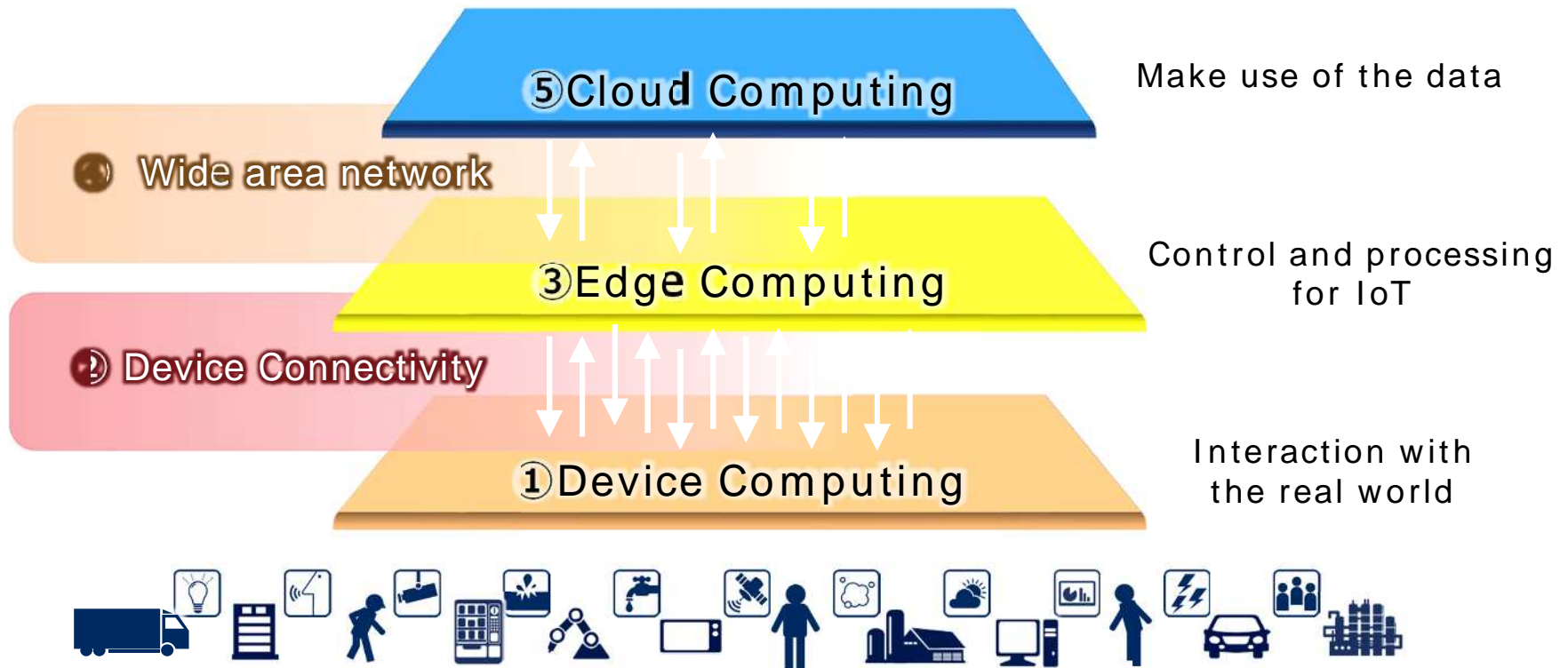
Create new value by tapping into the fluctuation of the real world A reliable, flexible and adaptive system

Rapid increase of data interaction

Ensure real-time computing even in remote environment

Continuously create new value through analysis

Keep optimizing the system



IoT: Internet of Things

NEC's Understanding of Oil & Gas issues

Cost, operation rate, and safety have always been a big issue, and is increasingly becoming more important.

Characteristic in Development

Huge Investments

- Huge investments from exploration to productions over decades

Extreme Conditions

- Shift to extreme environments such as deep water

Unexpected market change

- Huge price fluctuations and environmental issues

Requirements for plants

Safety

- ✓ Safety under extreme conditions
- ✓ Coping with new technologies, environments and regulations

Operation Rate

- ✓ High operation rate to recover huge investments
- ✓ Maximization of profit in changing environment

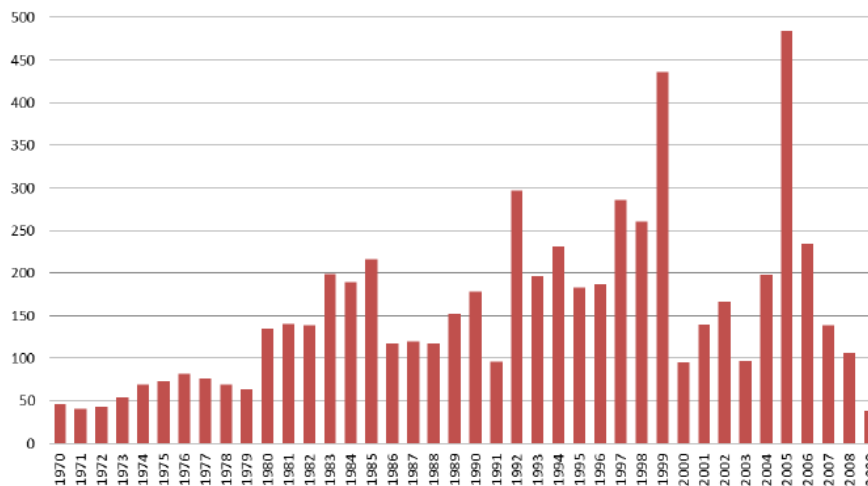
Cost

- ✓ Low cost operations under aging facilities and extreme environments
- ✓ Low cost operation to compete in challenging market

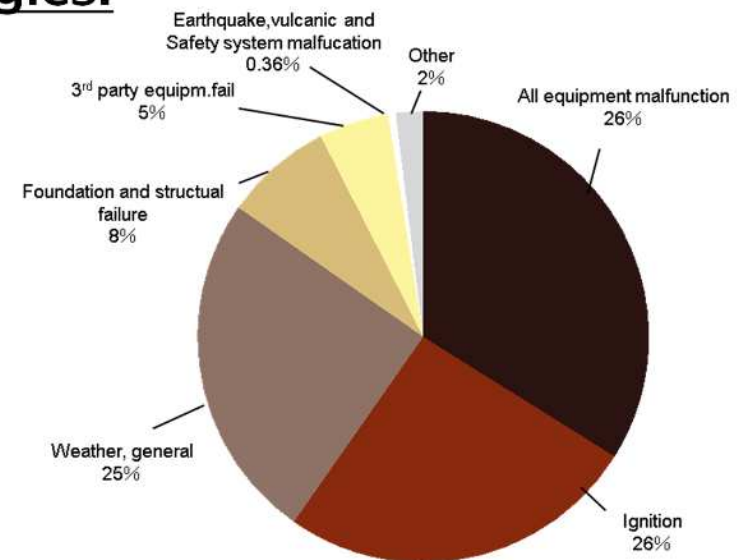
NEC's Understanding of Oil & Gas issues

Defects that do not result in accidents frequently happen in oil and gas facilities, and measures to improve safety and stability is under high need

- Though the size and affect may differ accidents such as in the Mexican Gulf happen worldwide frequently
- Huge loss in case of stop of operation
- A threshold model based system already exists, but optimization of O&M is ongoing with new technologies.



Chronological distribution of accidents



Distribution of accidents per type of equipment related causes for accidents

Source : Safety of offshore oil and gas operations: Lessons from past accident analysis, European Commission, 2012

NEC's IoT Solution for Oil&Gas Production Facilities

Asset management using BigData analysis technologies



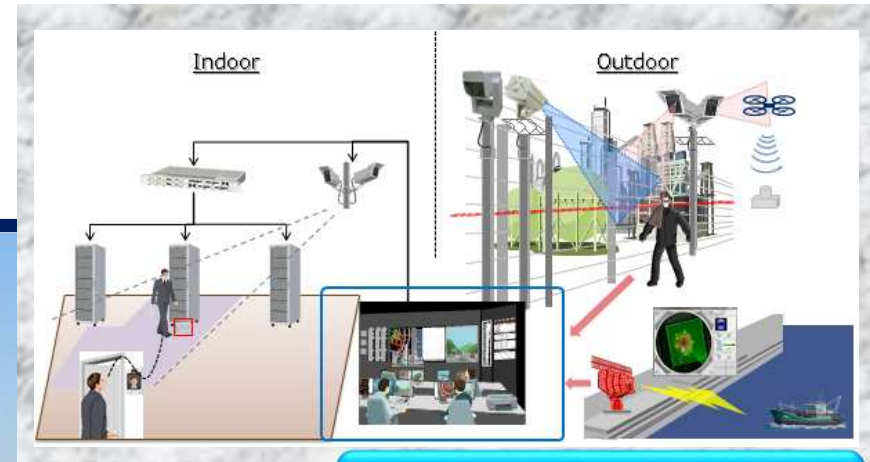
Enhancement of Safety

Increase of
Operation Rate

Decrease of
Maintenance Cost



Security Solution



Enhancement of Safety

Increase of
Operation Rate



Increase of
Operation Rate
Decrease of
Maintenance Cost

Network Solution

NEC's unique Big Data technologies

NEC's unique and ranked world #1 big data technologies

Unique

Visualization of correlations between sensors and early Discovery of anomalous behavior

System Invariant Analysis Technology

e.g. Earlier anomaly detection in Plant operation

Unique

Several principles can be simply Derived from diverse data in many categories

Heterogeneous mixture learning

e.g. Spare parts demand forecast

Learning from a vast amount of data with quick and accurate matching

RAPID Machine Learning

world No.1

1

world No.1

2

More sophisticated solution of problems through understanding the total meanings of sentences rather than single words

Textual inference recognition

1 PTP: Penn Treebank Project 2011 (The world's most prestigious contest for language processing algorithms)

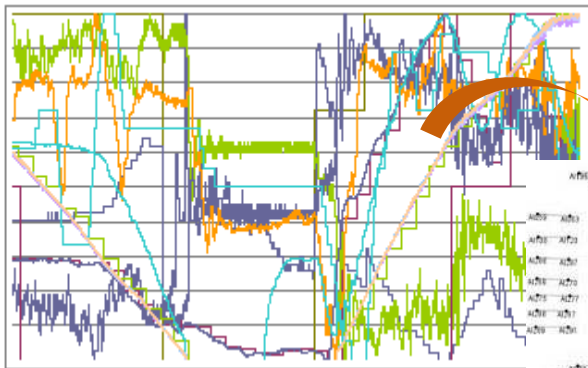
2 Results of a contest sponsored by the NIST, National Institute of Standards and Technology, in the United States.

SIAT Overview

SIAT: System Invariant Analysis Technology

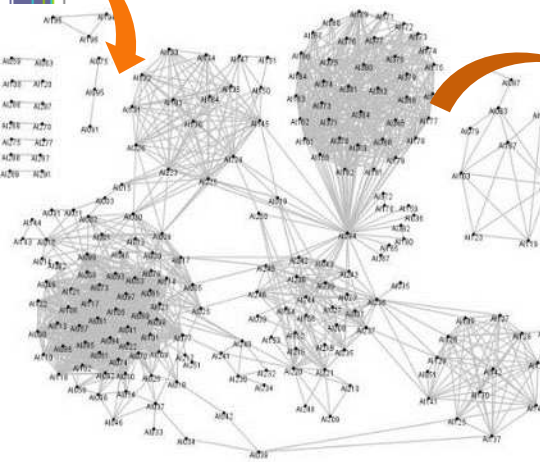
SIAT, NEC's proprietary big data analysis, focuses on the comprehensive relationships between sensors and detects anomalies "Far Faster" than human monitoring

Massive sensor data



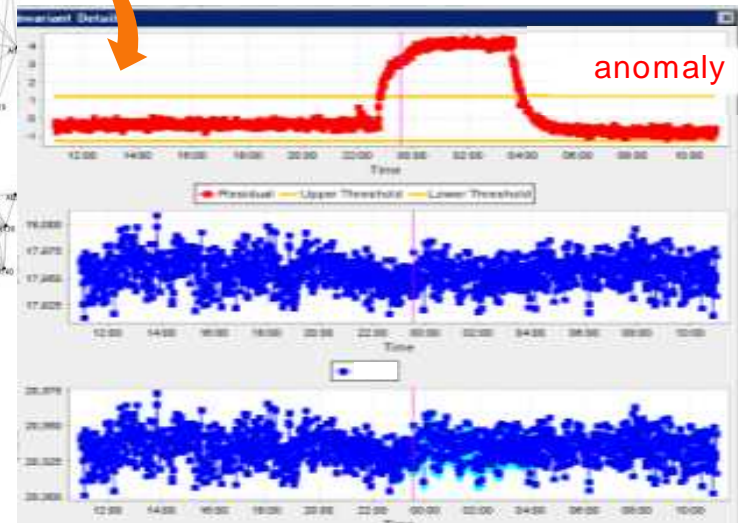
Time series

Automatic model of relationships (invariants)



Profile system behaviors

Real-time monitoring of breakdown of relationships



Early anomaly detection (predictive analysis)

Fleet-wide Monitoring by SIAT

Integrated Operation

Control Center (Headquarter etc)



- ✓ Fleet-wide Analysis by archiving past incidents of fleet
- ✓ Fleet-wide Health diagnostic (e.g. Degradation due to Aging)



Offshore Rig Fleet



SIAT

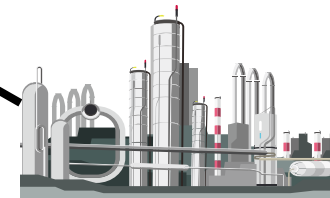
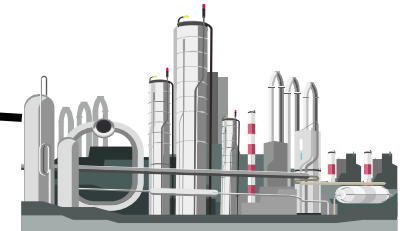


SIAT



SIAT

Processing fleet

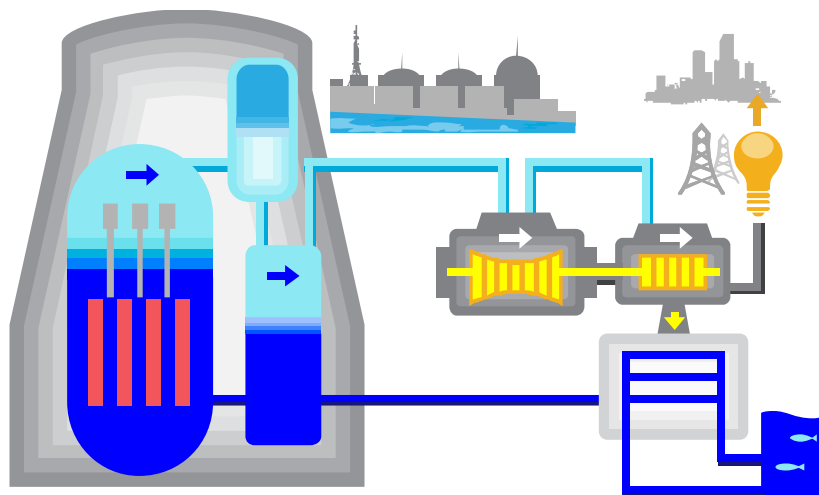


- ✓ 24/7 Real-time Analysis
- ✓ Comparison Analysis with the past status

Track record

- 1) Nuclear - Installed in nuclear power plant
- 2) Oil & Gas - Detect past failure cases faster than operators
- 3) Thermal - Detect past failure cases faster than operators

Example of Nuclear Power Plant



Real-time

- No. of sensors per power plant: >3,000
- 100 of data from each sensor in a second

Advanced analysis

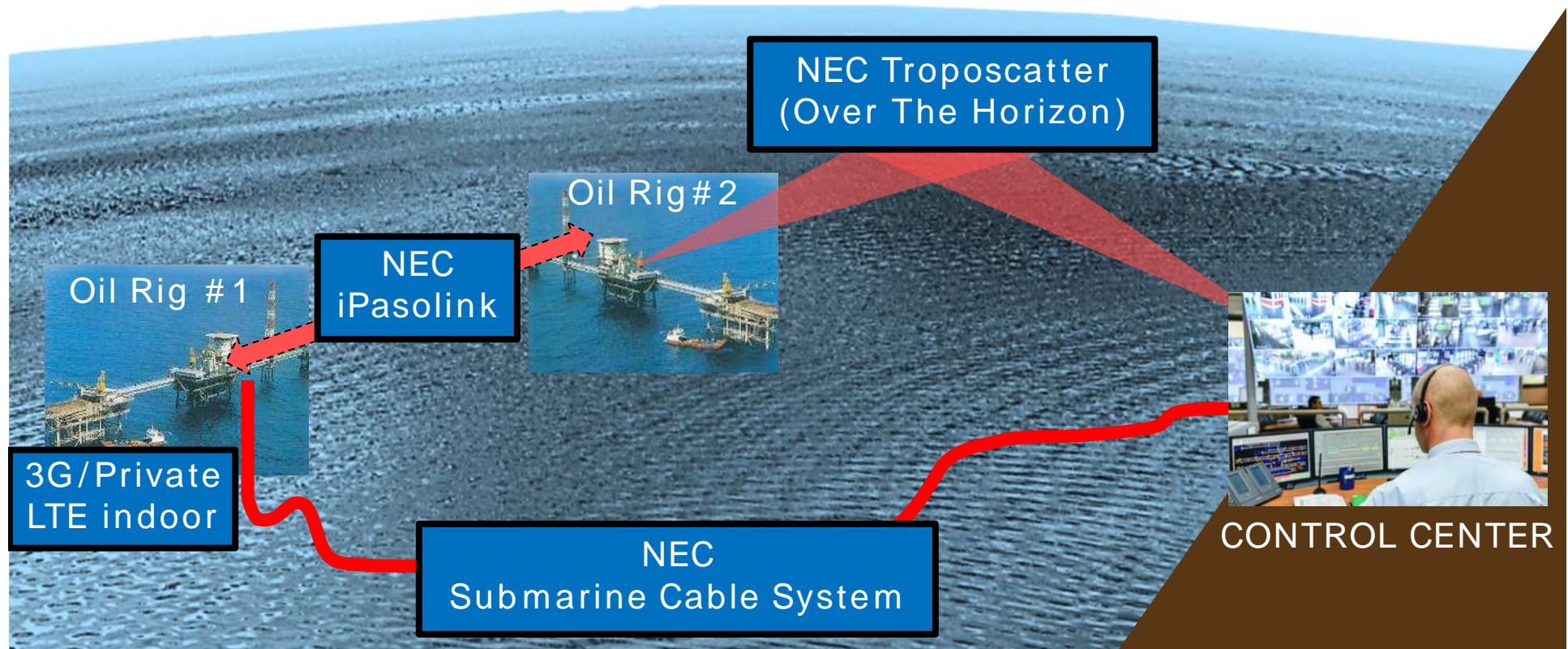
- Detect “different than usual” situation from relation between 3000 x 2999 sensors

Expert in data utilization

- Increased precision of predictive monitoring by collaboration of NEC data analysis expert and customers plant operation expert

Network solution

- Provide stable communication between land and oil rig
- Provide optimum solution from both cost and quality perspective
- Centralized monitoring for asset management and security solution utilizing the network infrastructure



The excellence of NEC's IoT solutions
for a secure, high-efficiency,
cost-effective Oil & Gas
production Facilities



 **Orchestrating** a brighter world

NEC