

The IoT Show 2015 Asia
22-23 September
Suntec Convention & Exhibition Centre, Singapore

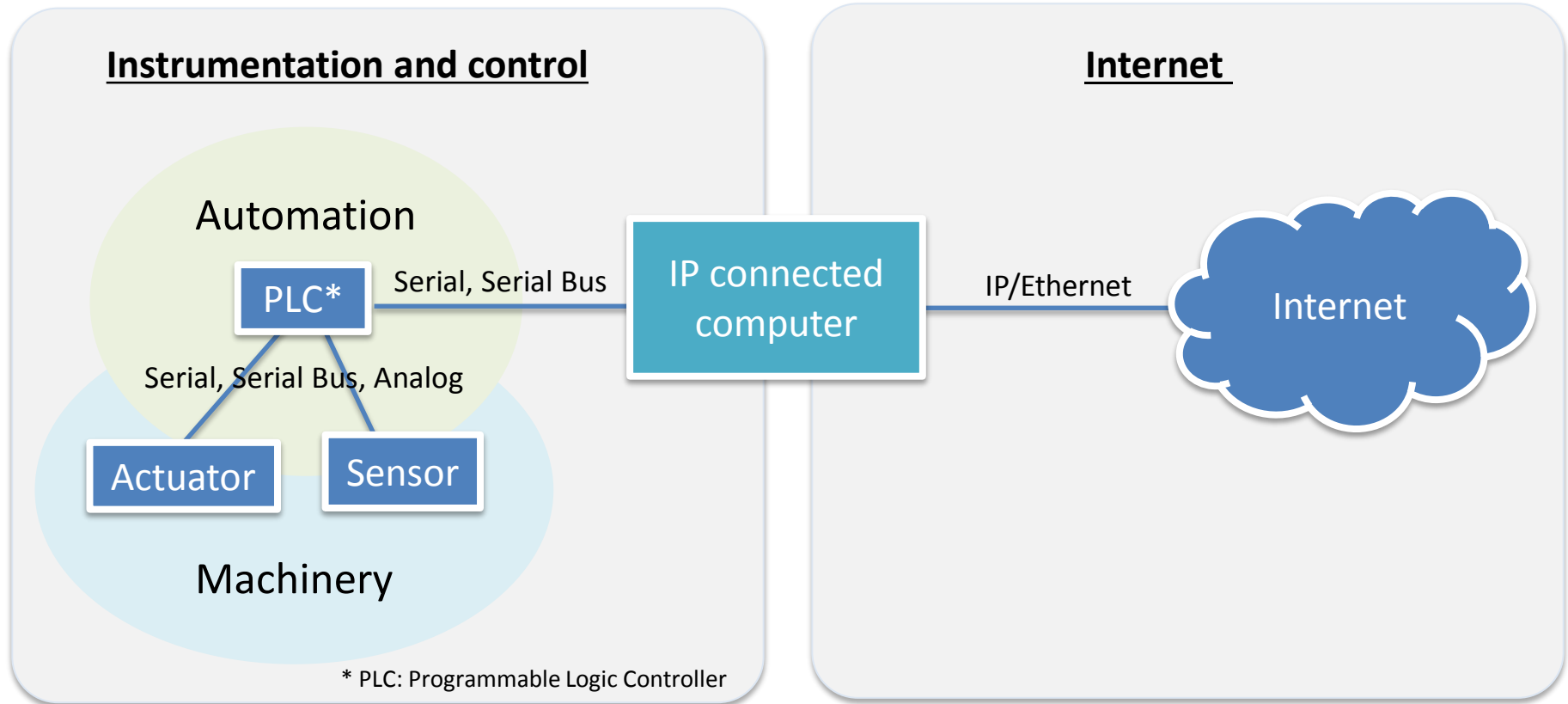
OPTIMIZING FLEET PERFORMANCE WITH SMART SHIP MANAGEMENT

22nd September 2015

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IoT (Internet of Things)



The marine industry started considering **Connected Ship**

Big data in shipping



Examples of Big data in shipping

Voyage data

- Automatically collected data (IoT)
- Noon report

Machinery data

- Automatically collected data (IoT)
- Manual report data
- Maintenance data

AIS data

- Satellite AIS / shore AIS

Weather data

- Forecast / past statistics

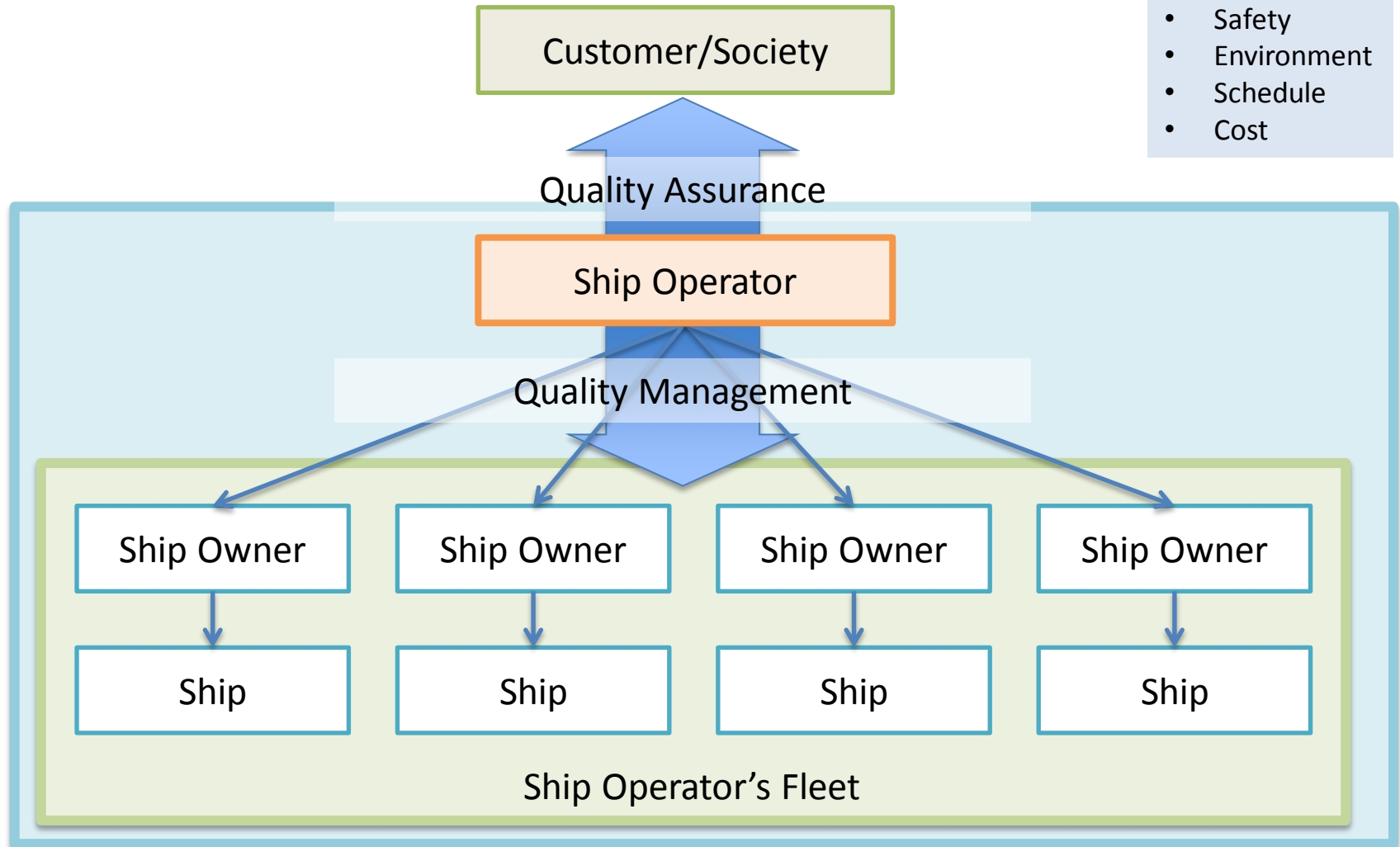
Business data

- Container transport data

Ship operator's view

Quality Shipping

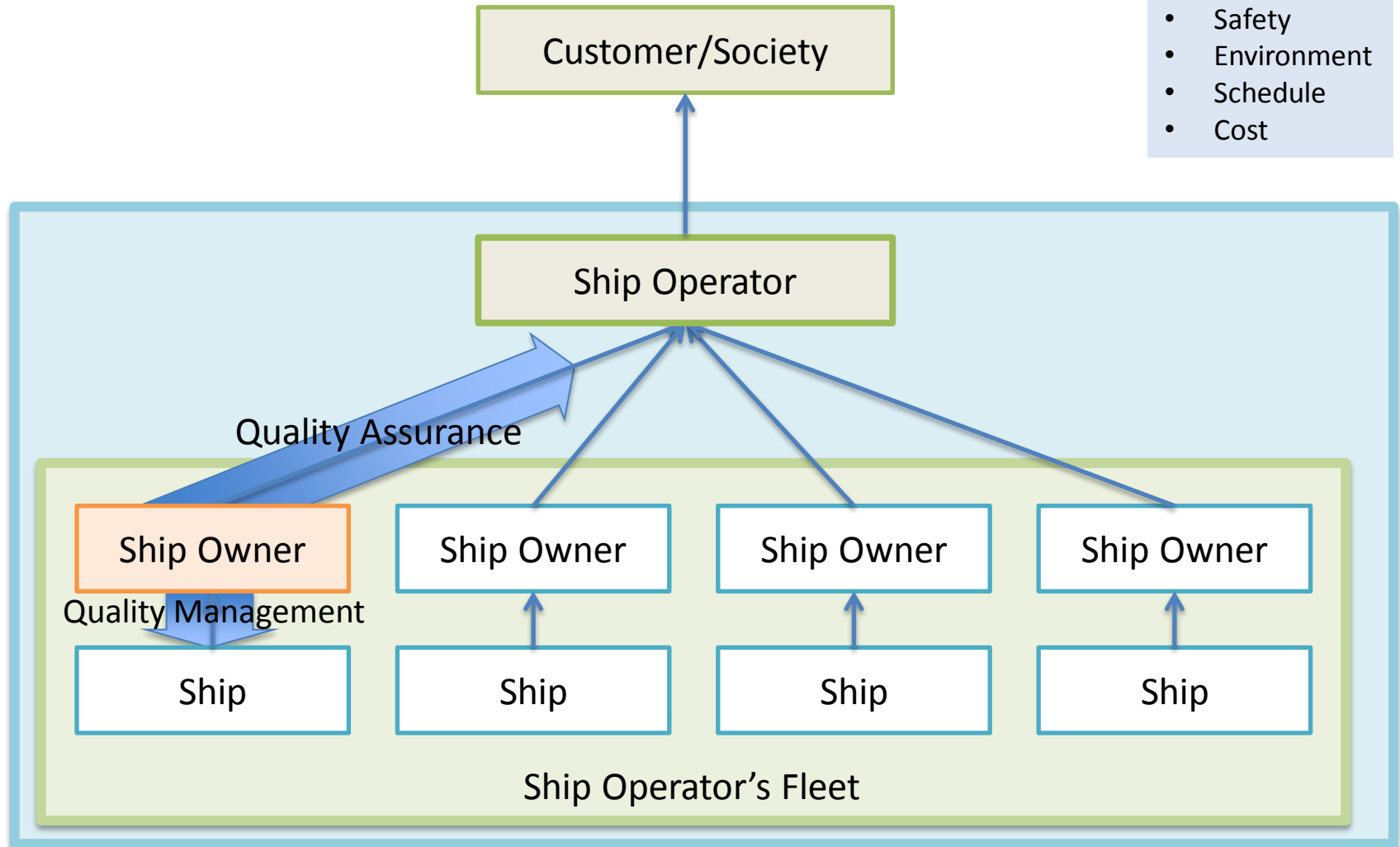
- Safety
- Environment
- Schedule
- Cost



Ship owner's view

Quality Shipping

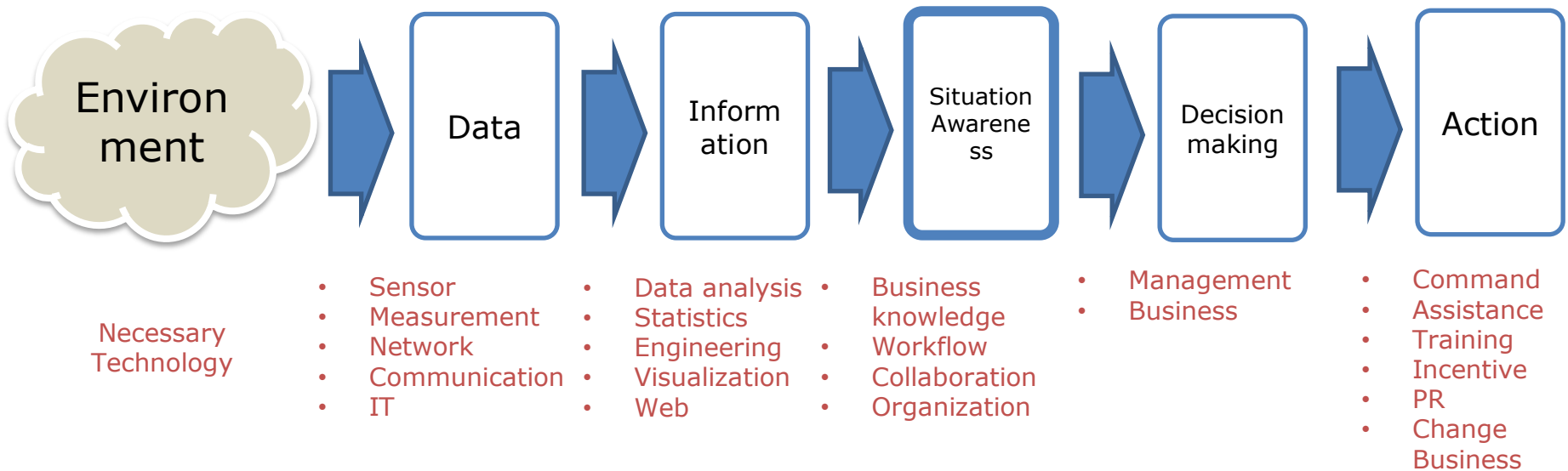
- Safety
- Environment
- Schedule
- Cost



Big data application areas

Role	Function	Examples of Big data applications
Ship operator	Operation	<ul style="list-style-type: none"> • Energy saving operation • Safe operation • Schedule management
	Fleet / service planning	<ul style="list-style-type: none"> • Fleet planning • Chartering • Service planning
Ship owner	Technical management	<ul style="list-style-type: none"> • Safe operation • Hull & propeller cleaning • Condition monitoring and maintenance • Environmental regulation compliance • Energy saving retrofit
	New building	<ul style="list-style-type: none"> • Design optimization

Big data processing flow



It is cross functional and organizational process to change action

Ship performance in seaways

6500TEU Container Ship

Wave height 5.5m, Wind speed 20m/s, BF scale 8, Head sea



@ engine rev. 55rpm

Calm sea performance

speed: 14 knot
Fuel: 45 ton/day



Performance in the rough sea

speed: **8 knot**
Fuel: **60 ton/day**

Effecting factors

1. Weather (wind, wave and current)
2. Ship condition (draft, trim, cleanness of hull and propeller, and aging effect of engine)
3. Ship design (hull, propeller and engine)

Ship performance model in all weather

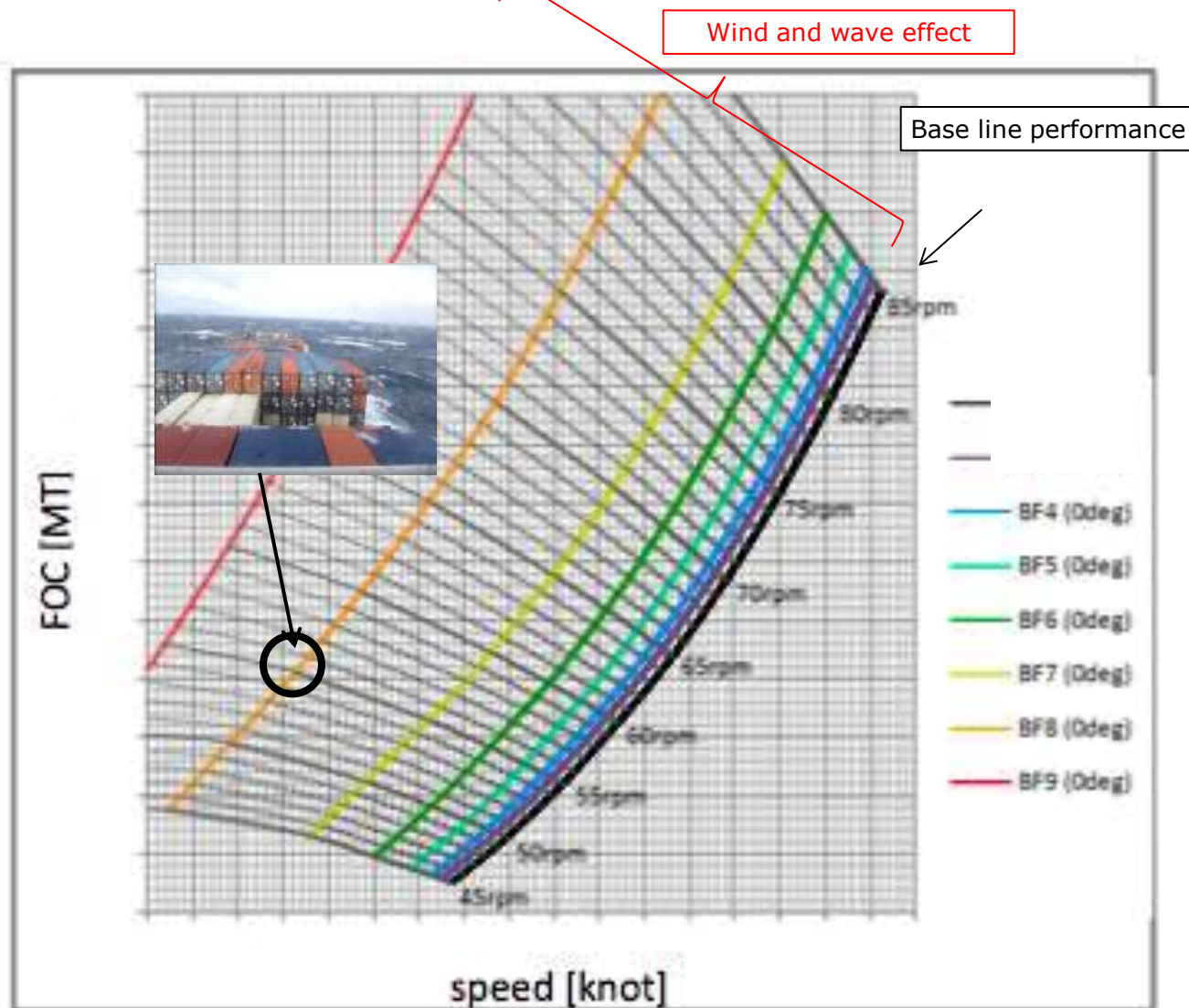
<Target vessel>
6500TEU Container
Draft 12m even



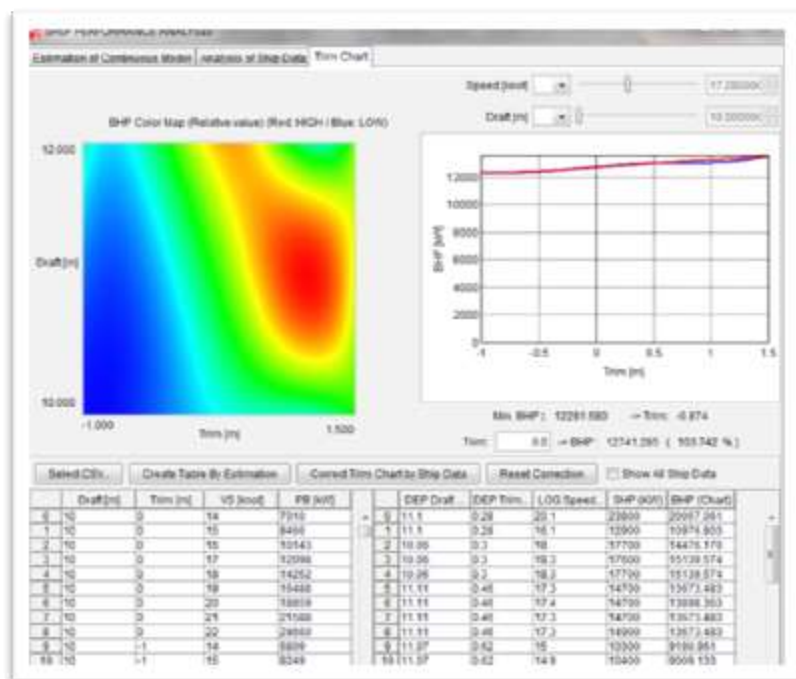
Sea condition
Beaufort scale

	wind speed (m/s)	wave height (m)	wave period (sec)
BF0	0.0	0.0	0.0
BF3	4.5	0.6	3.0
BF4	6.8	1.0	3.9
BF5	9.4	2.0	5.5
BF6	12.4	3.0	6.7
BF7	15.6	4.0	7.7
BF8	19.0	5.5	9.1
BF9	22.7	7.0	10.2

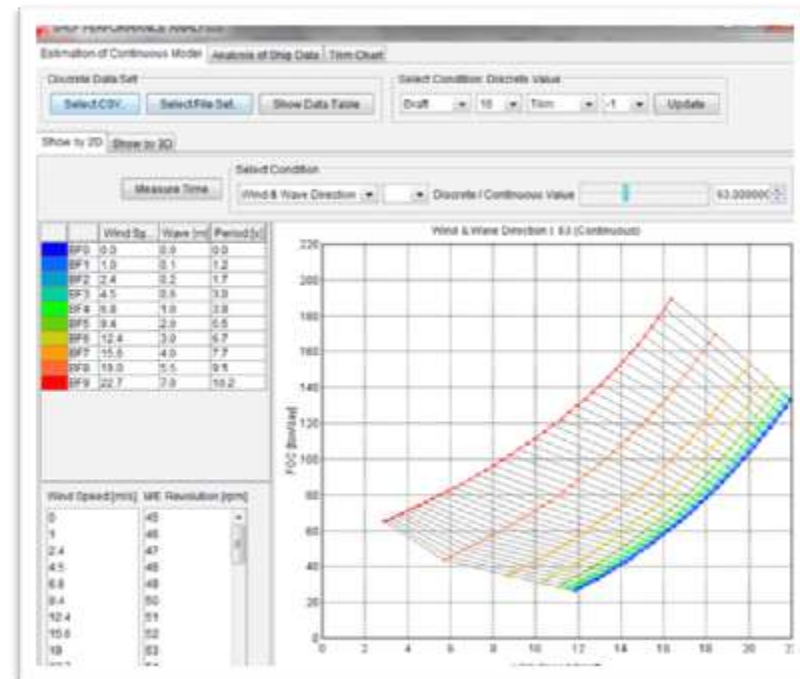
0deg (wind, wave) – head sea



Ship performance model calibration with IoT data



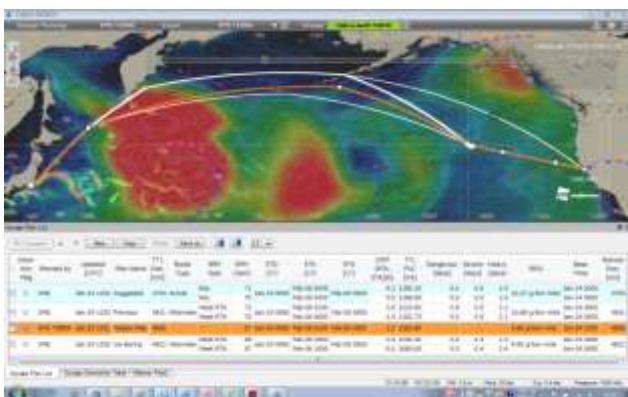
Base model



Weather effect model

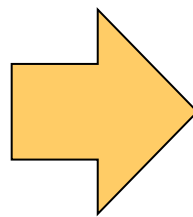
IoT data is used for calibrating engineering models.
It is a semi-automatic process to capture each ship performance precisely.

Optimization of voyage with IoT data



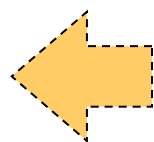
Weather Routing (PLAN)

- Voyage plan
 - + course, speed, RPM, FOC, weather
 - + ship performance model



Monitoring (CHECK)

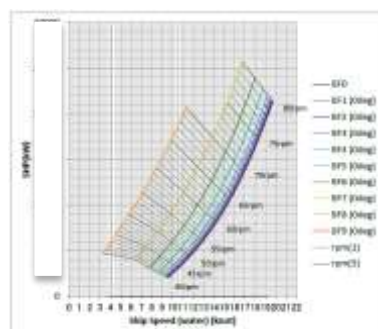
- Voyage actual
 - + actual speed – RPM, RPM - FOC
 - + actual weather



Feedback

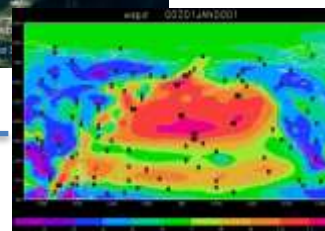
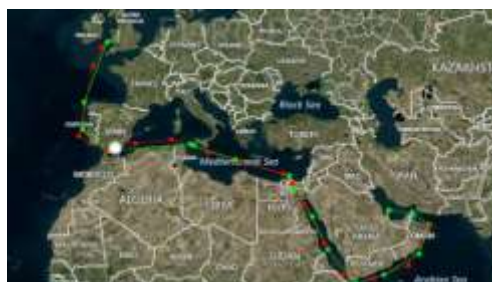
Ship model and weather forecast are inherently include errors.
But feedback loop by monitoring can make this system work better.

Optimization of operation plan with Big data

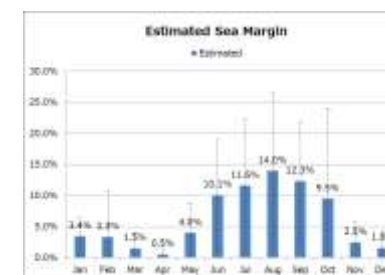
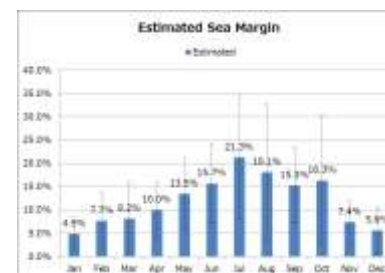


Ship performance model

Service route



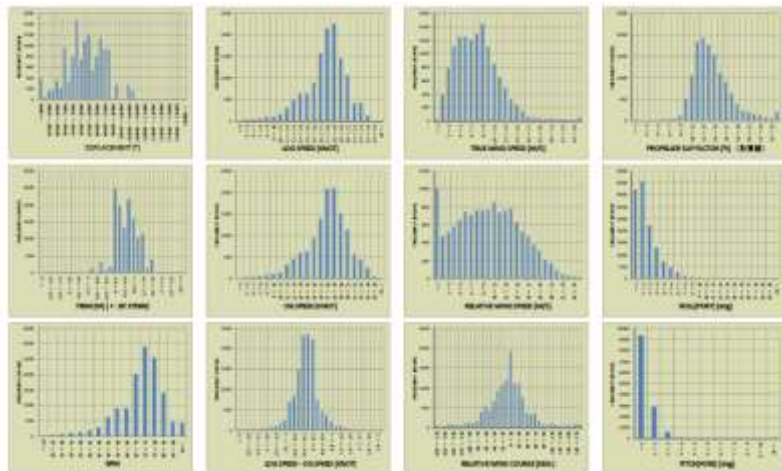
Hindcast weather data



- Estimation of
- Sea Margin
 - Sailing time
 - Average Speed
 - Total FOC

Monte-Carlo simulation by using ship performance model and past weather records

Energy saving modification based on Big data



**23 % CO2 reduction
was confirmed**

Operation profile (Big data)

- Speed, RPM, Power
- Draft, trim, displacement
- Weather
- Sea margin
- etc

Energy saving modification

- Bulbous bow modification
- Install energy saving device (MT-FAST)
- etc

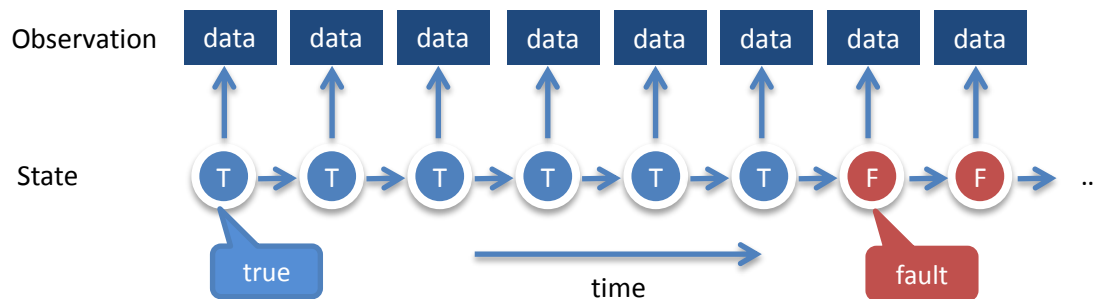
IoT for engine and machineries

Target

- Prevent unpredicted downtime
- Energy efficiency in operation
- Reduce maintenance cost

Measure

- Condition monitoring
- Big data analysis
- Support service engineer
- Intelligent machinery
 - Self diagnostics



Ship main engine



Shore dashboard

Smart Ship Application Platform (SSAP) Project

- Japanese Society of Machinery and Equipment Manufacturer -

<http://www.e-navigation.net/index.php?page=ssap-smart-ship-application-platform>



- Submitting Organization: Japan Ship Machinery and Equipment Association (JSMEA) Smart Ship Application Platform WG
- Point-of-Contact: Dr. Hideyuki Ando (MTI : Research company of NYK group), hideyuki_ando@monohakobi.com
- Functional Capabilities: Provide current and past numerical data on Weather routing, Trim, Performance monitoring, Engine monitoring, Hull and cargo condition monitoring, Power plant energy management and Remote maintenance.
- Intended Purpose: The target is to design a master database, interface prototypes, specifications of communication system between ships and shore facilities and international standards of data server requirements and structure of mainboard machinery and equipment so that as many application services as possible can be provided.
- Portrayal examples: Not specified special display devices for this SSAP.
- Last edited: April 22, 2014

Proposal for new ISO in May 2015

- **ISO/NP19847 - Shipboard data servers to share field data on the sea**
 - Specifications of ship data server
- **ISO/NP19848 - Standard data for machinery and equipment part of ship**
 - Specifications of dictionary and format

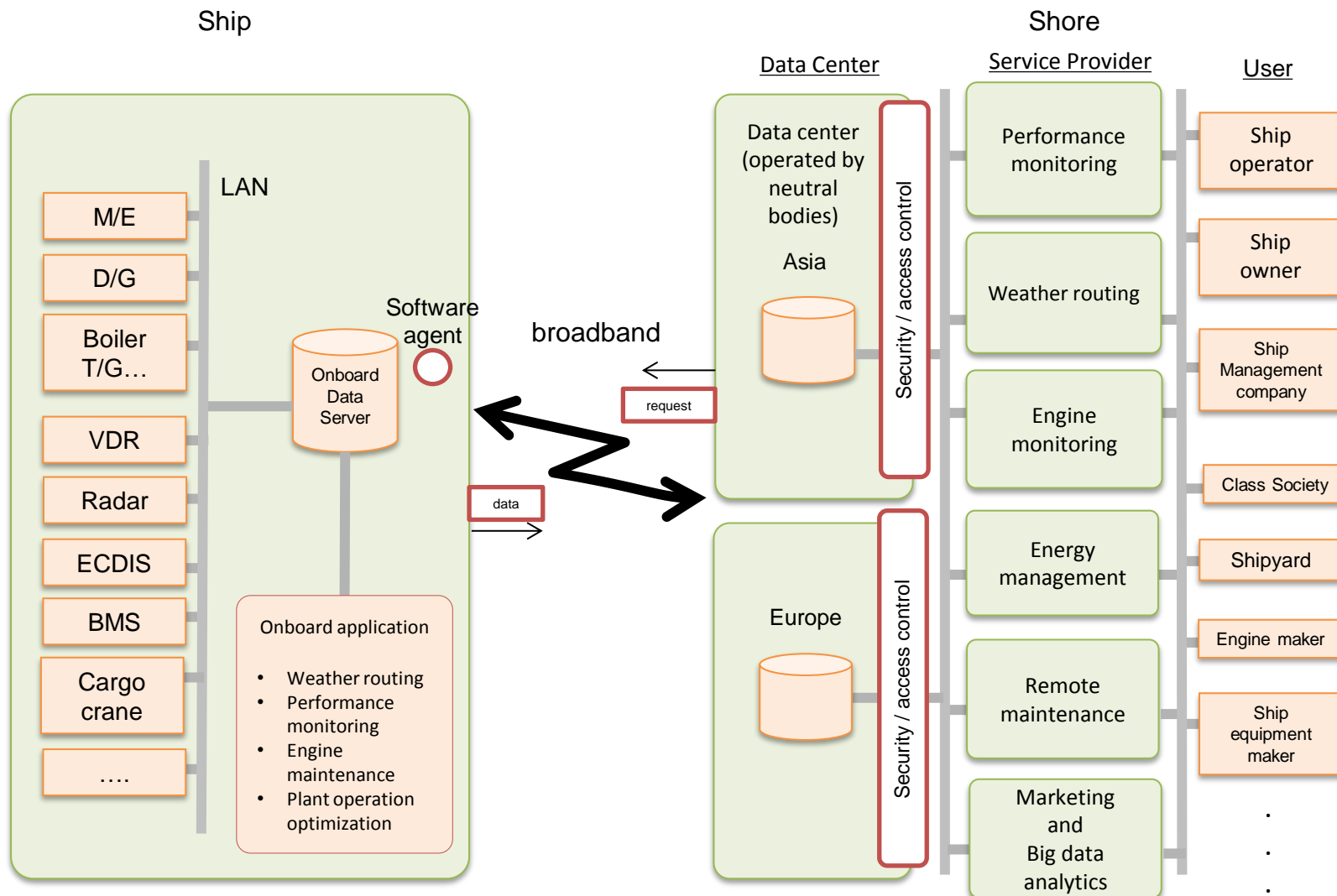
Description

Smart Ship Application Platform Project (JAPAN)

1. General information

Project name	SSAP (Smart Ship Application Platform)
Name of testbed	Application platform for data sharing at sea

Concept of ship – shore open platform for marine industry



Courtesy of Smart Ship Application Platform (SSAP) Project of JSMEA 2014-15

Summary

- IoT and Big data will gradually become prevalent in the marine industry. Application areas of IoT and Big data will be different for ship owners and operators.
- Applications of IoT and Big data in energy efficiency are shown. Calibrated engineering models with IoT data enhance fleet operation optimization.
- Smart Ship Application Platform (SSAP) project aims at developing open platform for the marine industry to promote further application development.



Thank you very much for your attention

