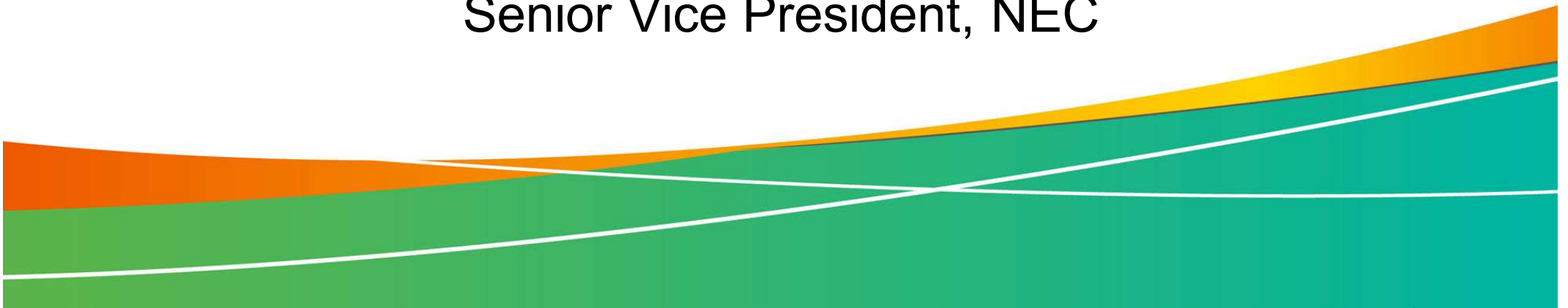


# R&D Activities for Social Value Innovation

December 9, 2014

Katsumi Emura

Senior Vice President, NEC



1. NEC and Social Value Innovation
2. NEC R&D Contributes to Solutions for Society
  - 2-1. R&D Contributing to Solutions for Society
  - 2-2. Refining the Solutions Structure
3. Aiming to Create New Solutions for Society
  - 3-1. Reinforce Technology to Create New Business
  - 3-2. Initiatives for Innovative Technologies
4. Creating Global Solutions
  - 4-1. Strengthen Global R&D Solutions
  - 4-2. Promote Open Innovation
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# The Earth in 2050

Energy demand

**1.8 times**

Greenhouse gas

**1.5 times**

Demand for food

**1.7 times**

Demand for water

**1.6 times**

Urban population

**6.3 billion people**

(currently 3.5 billion people)

**1.8 times**

Japan's population is expected to decrease from 120 million people today to 80 million people in 2050

# The Earth

Requires effective infrastructure  
with capability to handle  
twice as much as  
current demand









# Japan

Requires effective  
infrastructure that  
can be supported by  
60% of current population

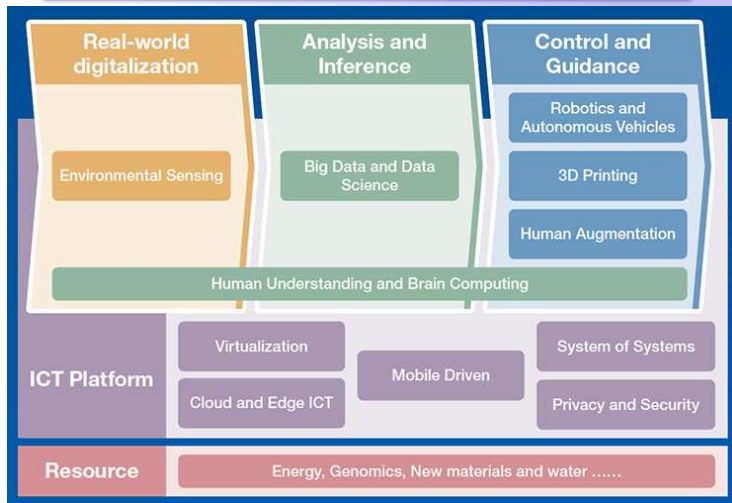
# Challenging the issues in society

Identified seven themes for social value innovation by observing megatrends and technology trends

## 6 Megatrends

-  Chain of resource & environmental issues
-  Emerging countries growth & challenges
-  Search for mature society models
-  Power and influence of individuals
-  Deconcentration of power
-  Diversified threats, need for safety and security

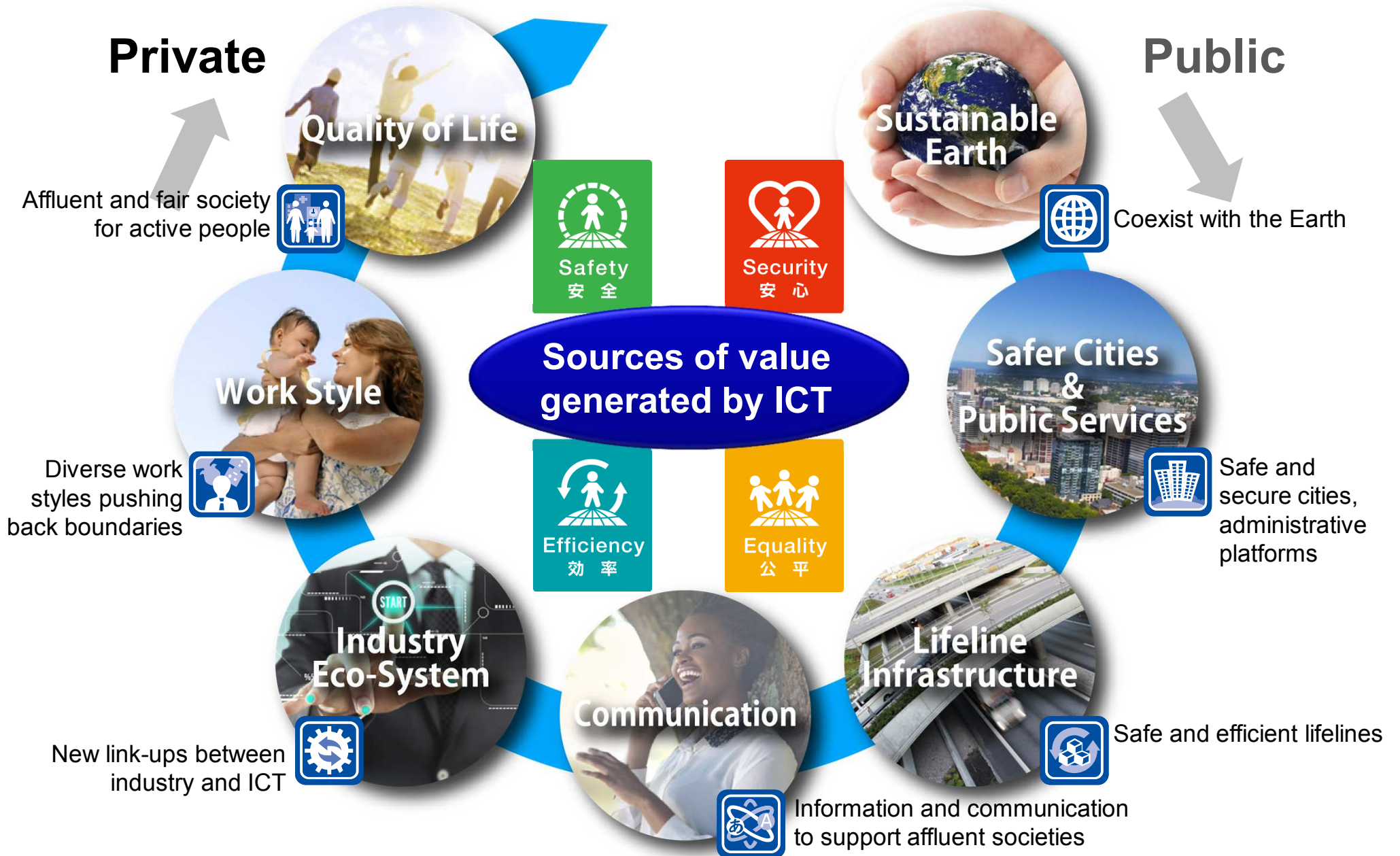
## Future Technology Trends



## Seven Themes for Social Value Innovation



# Seven Themes for Social Value Innovation

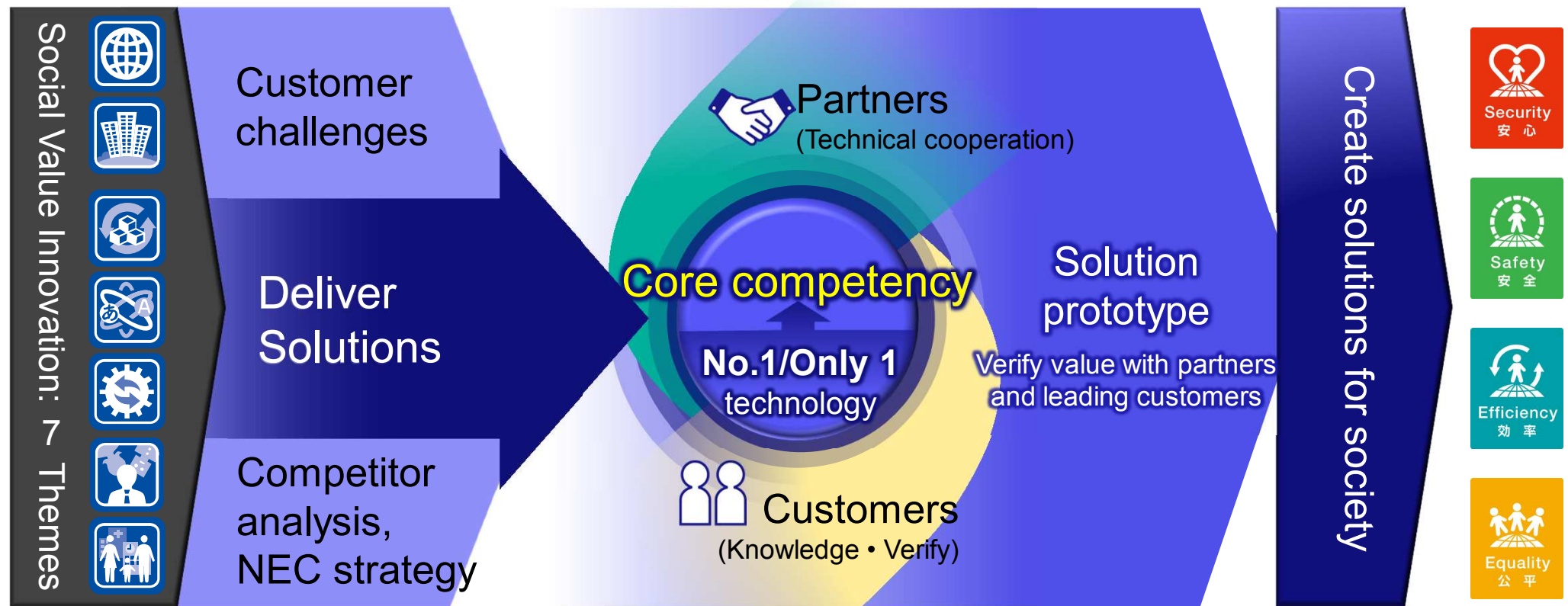


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# 2-1-1. R&D Strategies

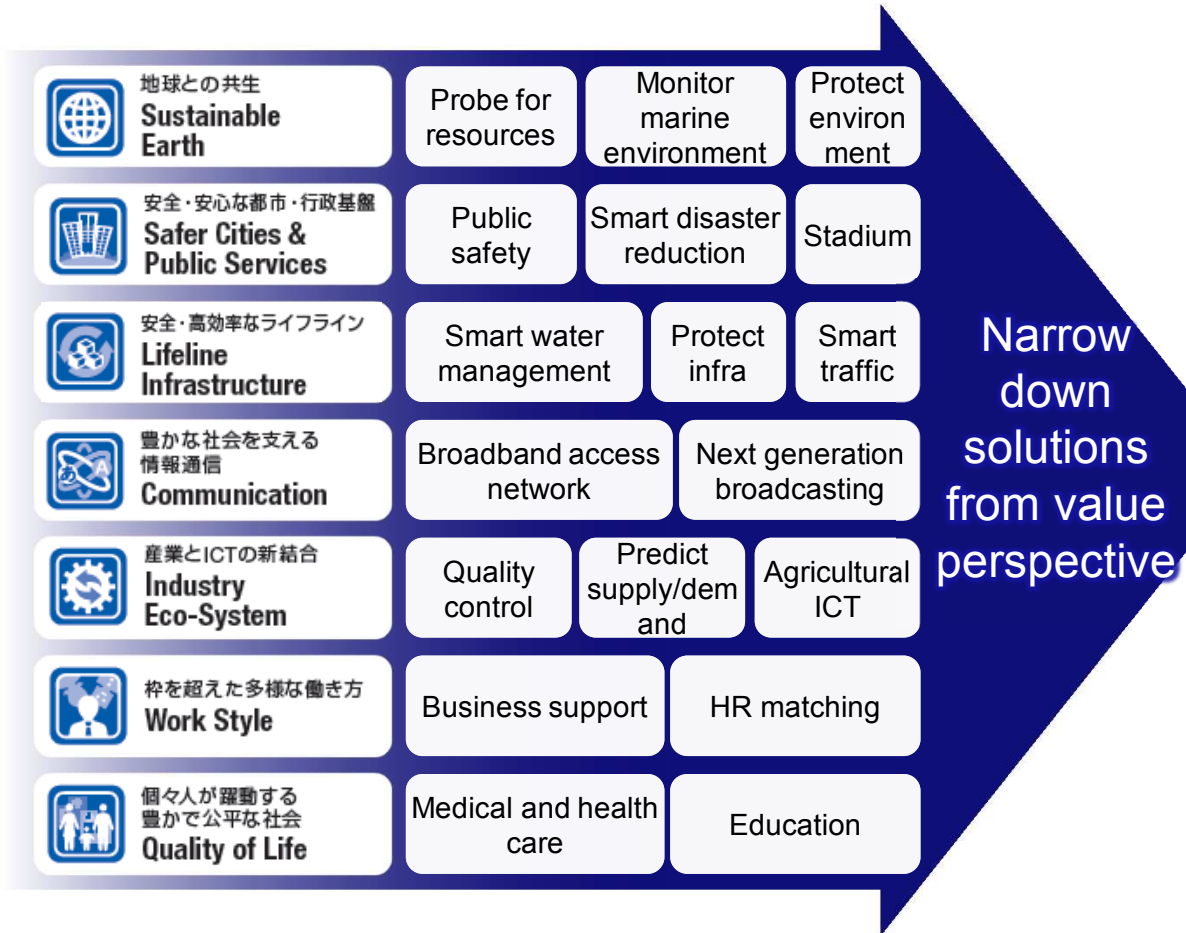
- (1) Concentrate and deliver high value in our strong areas
- (2) Deliver core competency with strong technologies
- (3) Co-create strong solutions with our partners and customers



# 2-1-2. Narrow Down Solutions

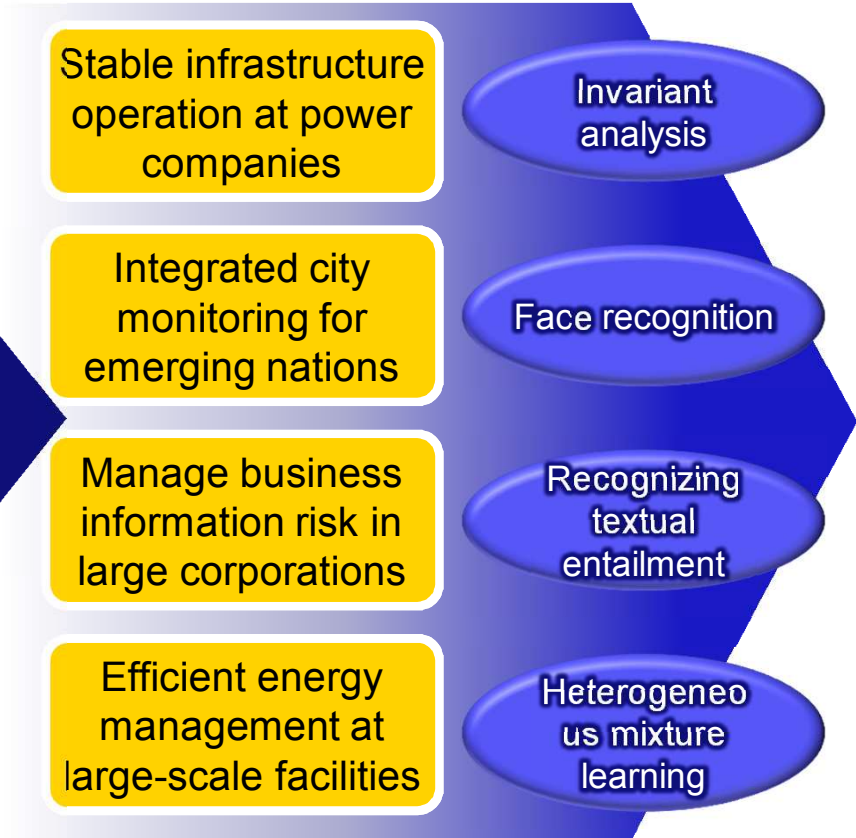
Focus on solutions for society that deliver high value

## Seven Themes for Social Value Innovation



Potential solution

No.1/Only 1 Technology



⋮

Continued to deliver competitive solutions for society.  
Worked to refine our propriety technologies.

**City monitoring**  
Singapore National Project

Case study



**Predictive plant failure monitoring**  
for The Chugoku Electric Power Co., Inc.



**Solutions to information governance**  
at Sumitomo Mitsui Banking Corporation

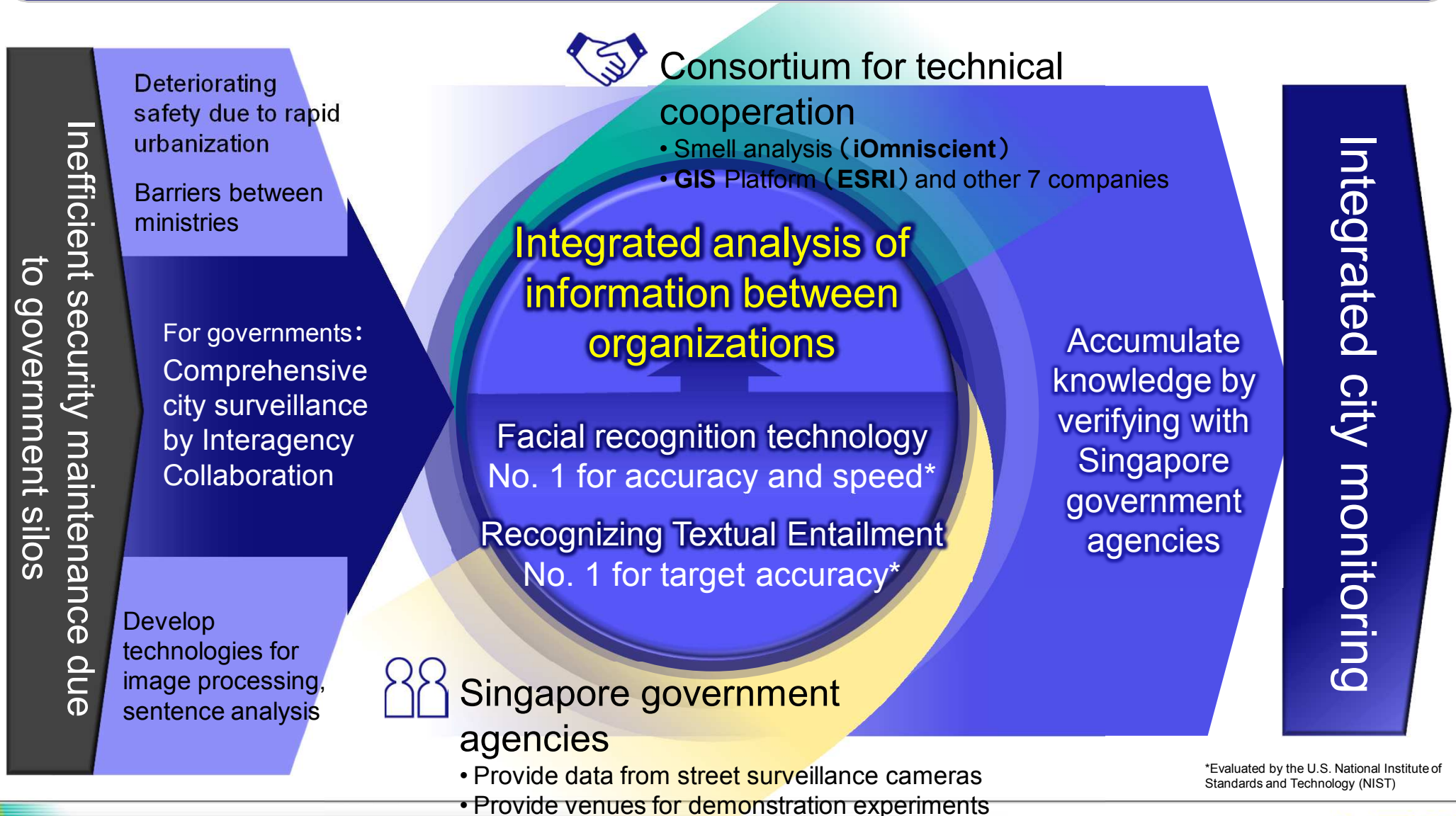


**Solution to predict power demand**  
at Obayashi Corporation









# 2-2-1. Case Study: Integrated City Monitoring

Integrated analysis of data from surveillance cameras and SNS using the world's best engines. Verify efficient monitoring systems for government interagency use



# 2-2-2. No.1/Only 1 Technologies: Business Contributions

(2013-2014)

Seven Themes for Social Value Innovation	Contributions to the Business	No.1/Only 1 Technologies
 <p>地球との共生 <b>Sustainable Earth</b></p>	<ul style="list-style-type: none"> <li>Reduced power consumed by air conditioning by 30% at NEC Kanagawa Data Center</li> <li>Increased battery life for wireless sensors by 10 times</li> </ul>	<ul style="list-style-type: none"> <li>Phase change cooling</li> <li>Spintronics circuit</li> </ul>
 <p>安全・安心な都市・行政基盤 <b>Safer Cities &amp; Public Services</b></p>	<ul style="list-style-type: none"> <li>Introduced street surveillance in Tigre</li> <li>Introduced system at Lemon Tree Hotels in India</li> <li>Participated as a leading enterprise in the Singapore Safe City Project</li> </ul>	<ul style="list-style-type: none"> <li>Facial recognition</li> <li>Crowd behavior analysis</li> </ul>
 <p>安全・高効率なライフライン <b>Lifeline Infrastructure</b></p>	<ul style="list-style-type: none"> <li>Predictive monitoring for nuclear plant failures at The Chugoku Electric Power Co., Inc.</li> <li>Set up cyber security solution systems</li> </ul>	<ul style="list-style-type: none"> <li>Invariant analysis</li> <li>Lightweight encryption</li> </ul>
 <p>豊かな社会を支える情報通信 <b>Communication</b></p>	<ul style="list-style-type: none"> <li>Provided TMS applications</li> <li>Delivered over 200 SDN<sup>*2</sup> solutions to corporations and organizations worldwide</li> </ul>	<ul style="list-style-type: none"> <li>Bandwidth prediction</li> <li>SDN</li> </ul>
 <p>産業とICTの新結合 <b>Industry Eco-System</b></p>	<ul style="list-style-type: none"> <li>Verified product demand prediction at major retailers</li> <li>Provided to major advertising agencies a service that link print medium ads with smartphones</li> </ul>	<ul style="list-style-type: none"> <li>Heterogeneous mixture learning</li> <li>Image recognition</li> </ul>
 <p>枠を超えた多様な働き方 <b>Work Style</b></p>	<ul style="list-style-type: none"> <li>Provided HR matching solutions</li> </ul>	<ul style="list-style-type: none"> <li>RAPID machine learning</li> </ul>
<p>個々人が躍動する豊かで公平な社会 <b>Quality of Life</b></p>	<ul style="list-style-type: none"> <li>Built 4K broadcasting system/ test broadcasting</li> </ul>	<ul style="list-style-type: none"> <li>Real-time processing</li> </ul>

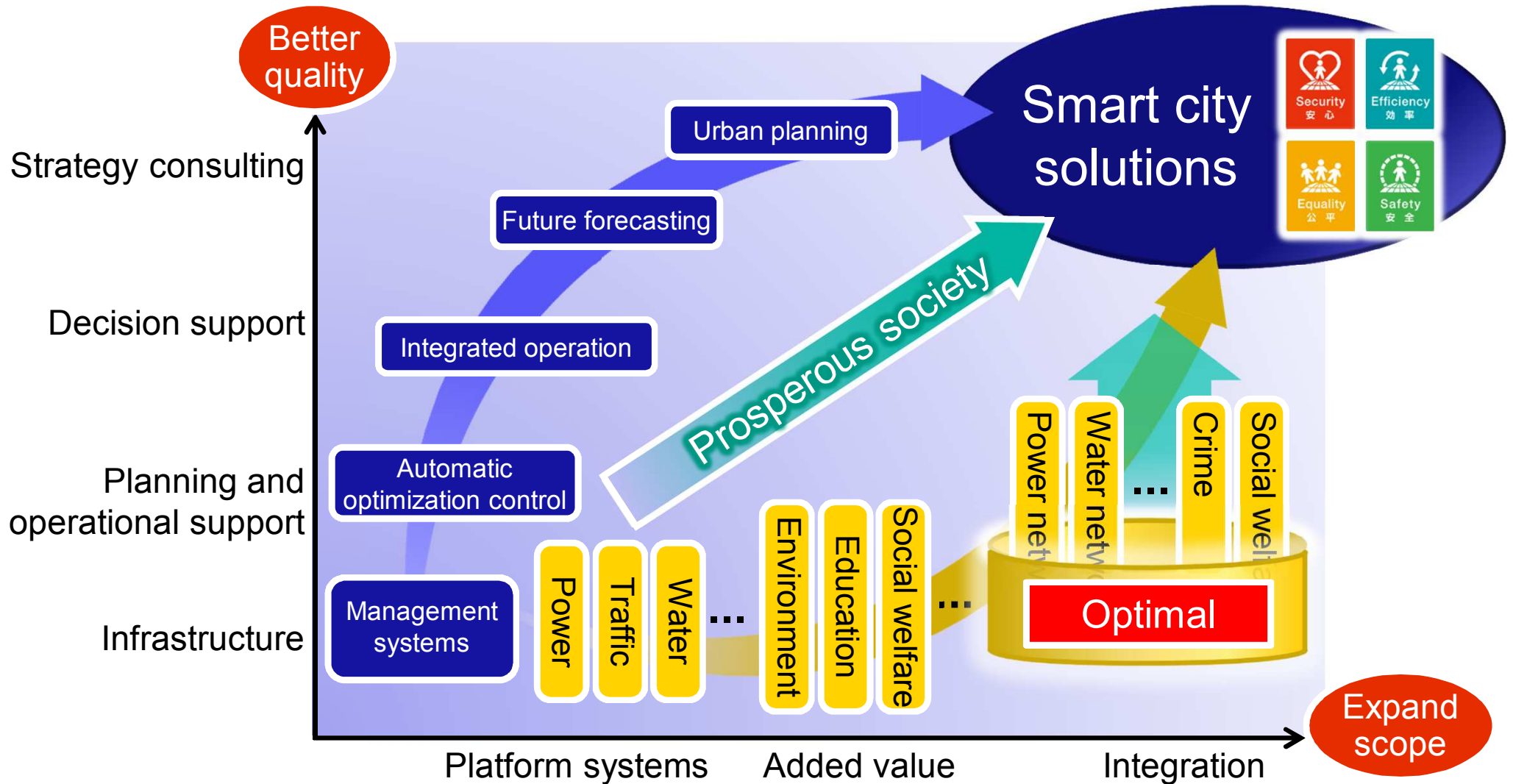
\*1: Traffic Management Solution

\*2: Software-Defined Networking

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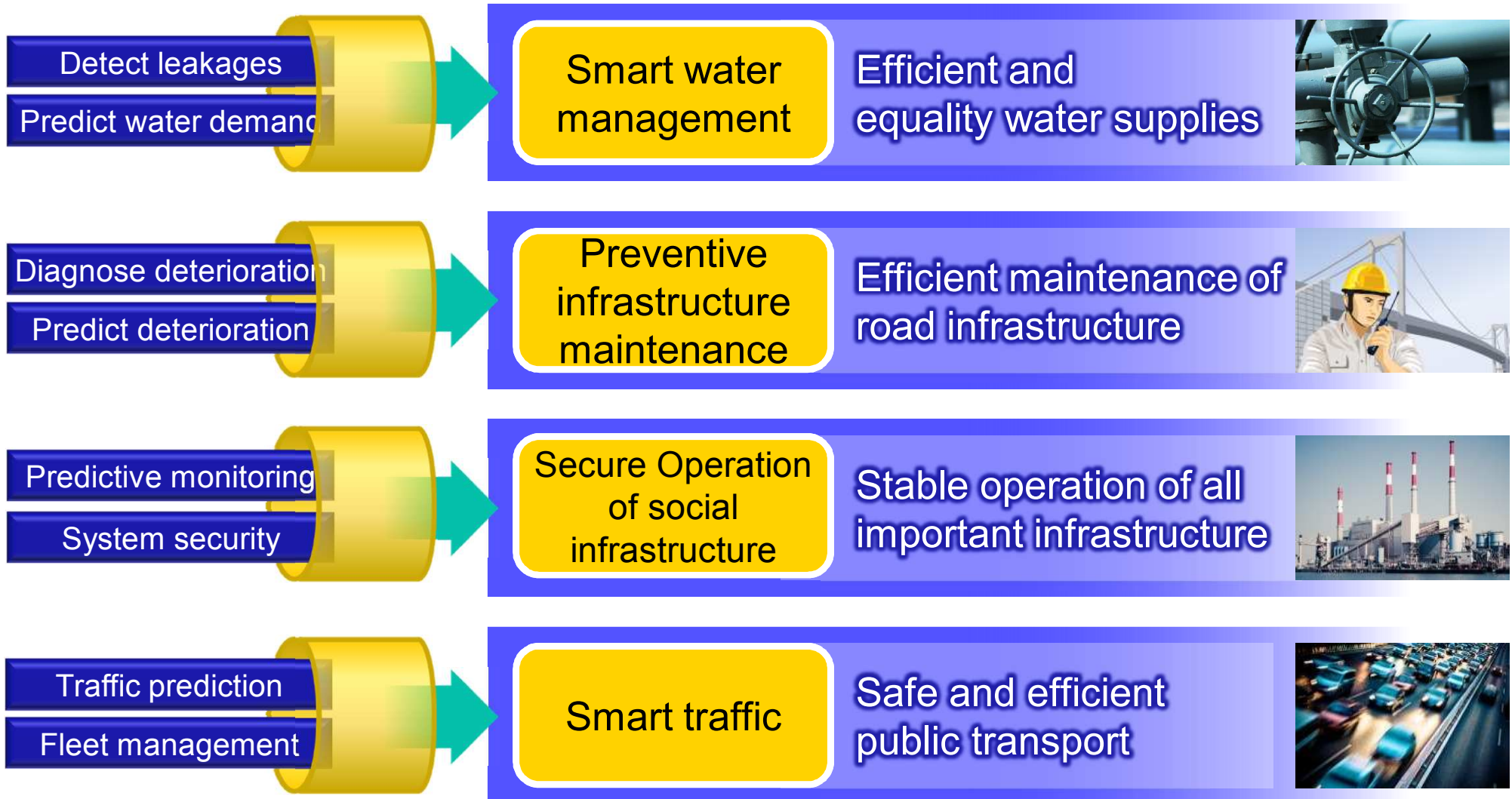
# 3-1-1. Changes in Solutions for Society

Provide high value-added solutions for society by upgrading services and optimizing entire systems



## 3-1-2. Provide Integrated Solutions for Society

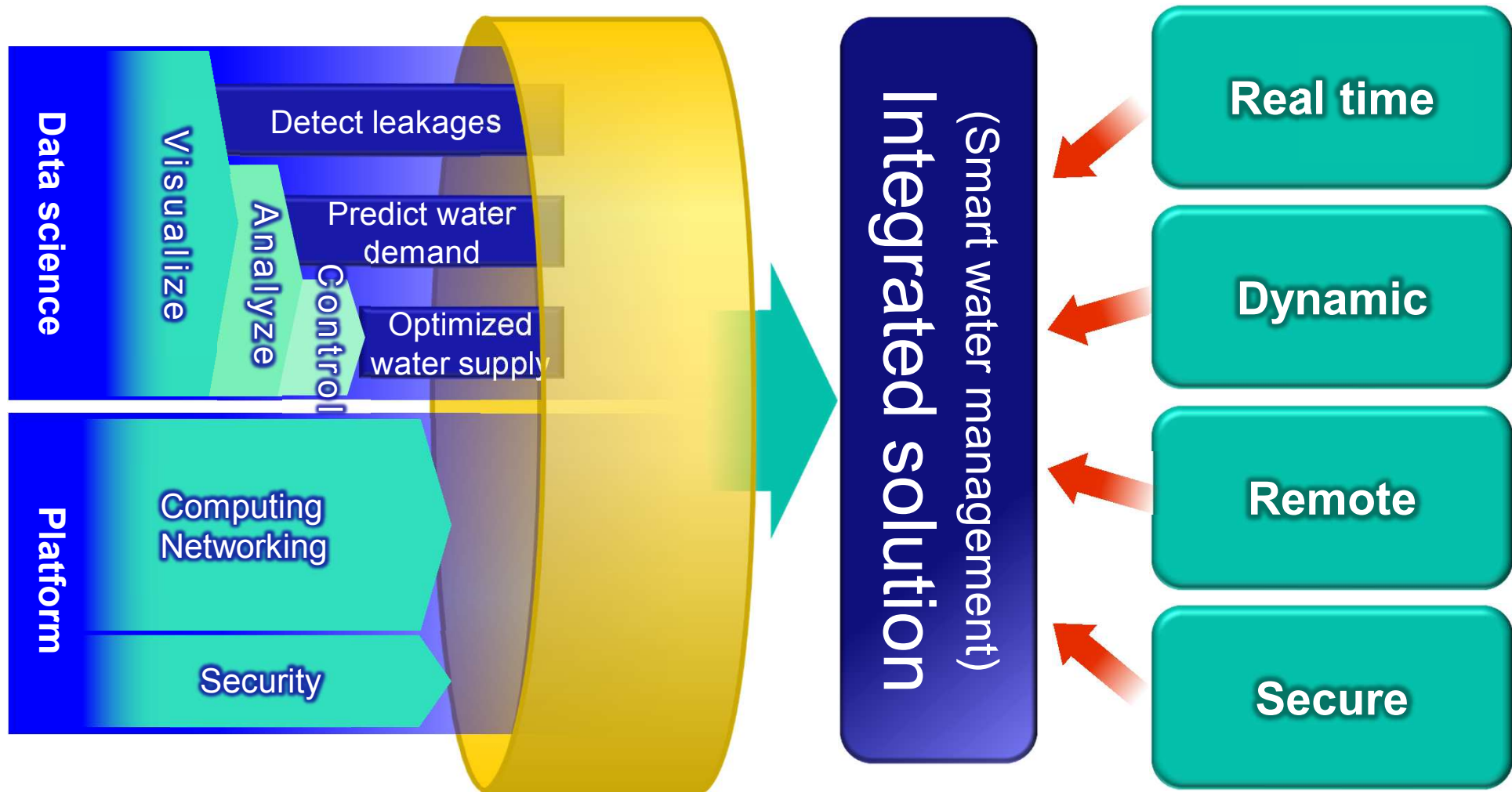
Provide for customers with efficient and secure businesses by integrating our strong competencies





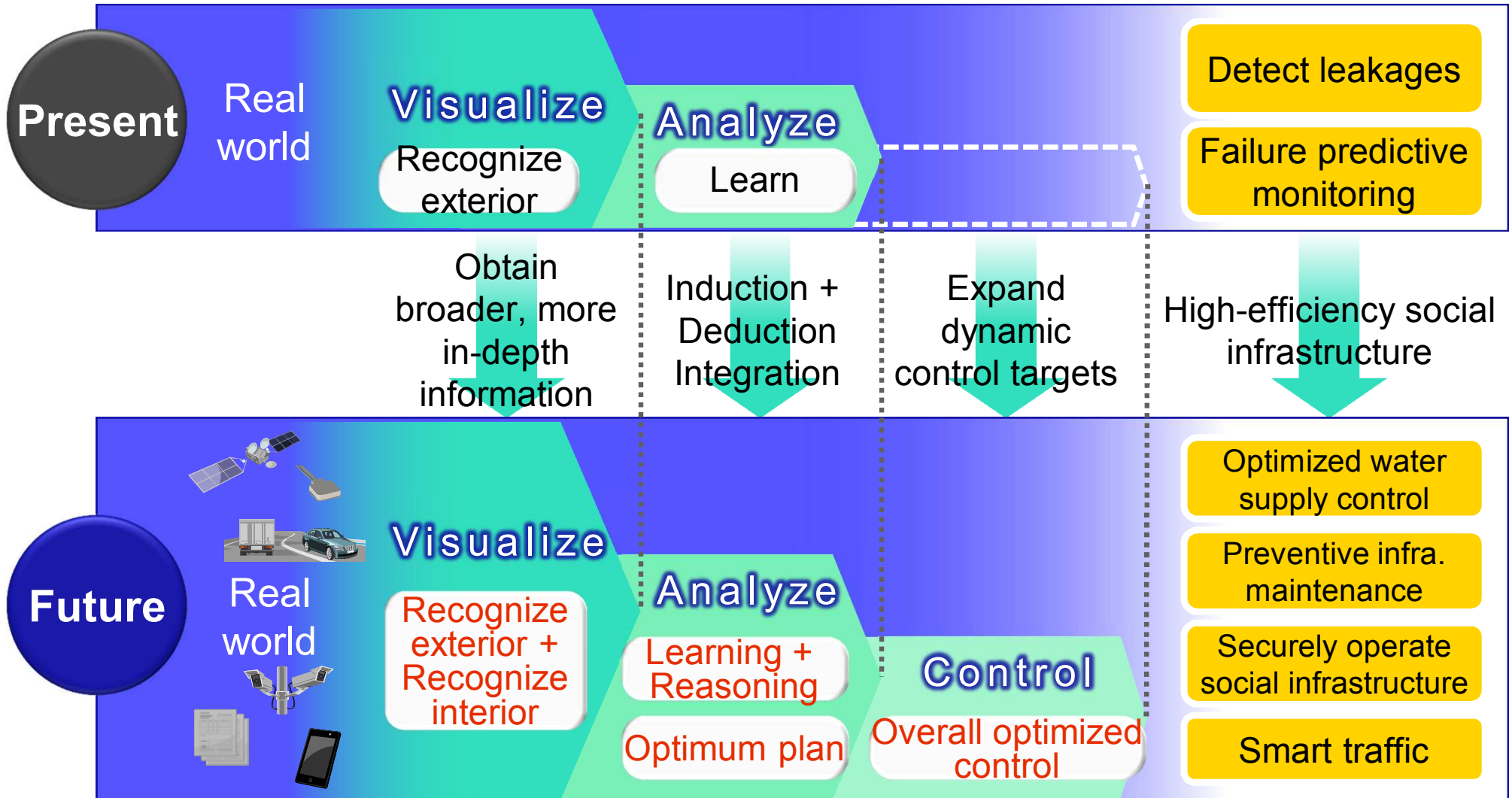
### 3-1-3. Added Value and Integrated Solutions for Society

Focus on core technologies to add value to solutions and refine No. 1/Only 1 competency



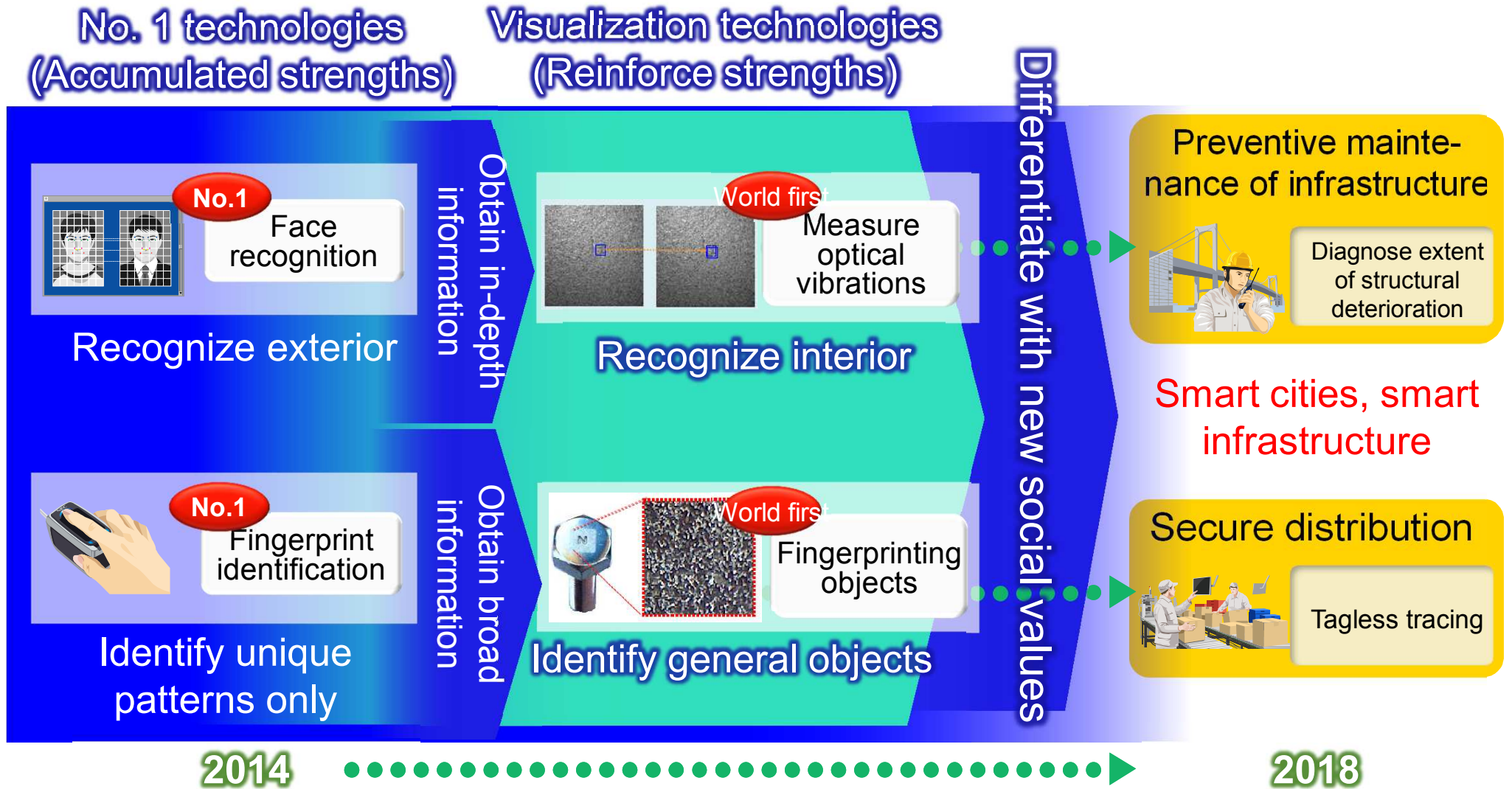
# 3-2-1. Changes in Data Science Technologies

By leveraging our strength in visualization and analysis, enhance accuracy of prediction and broaden subjects of surveillance



# 3-2-2. Reinforcement of Data Science (1) Visualization

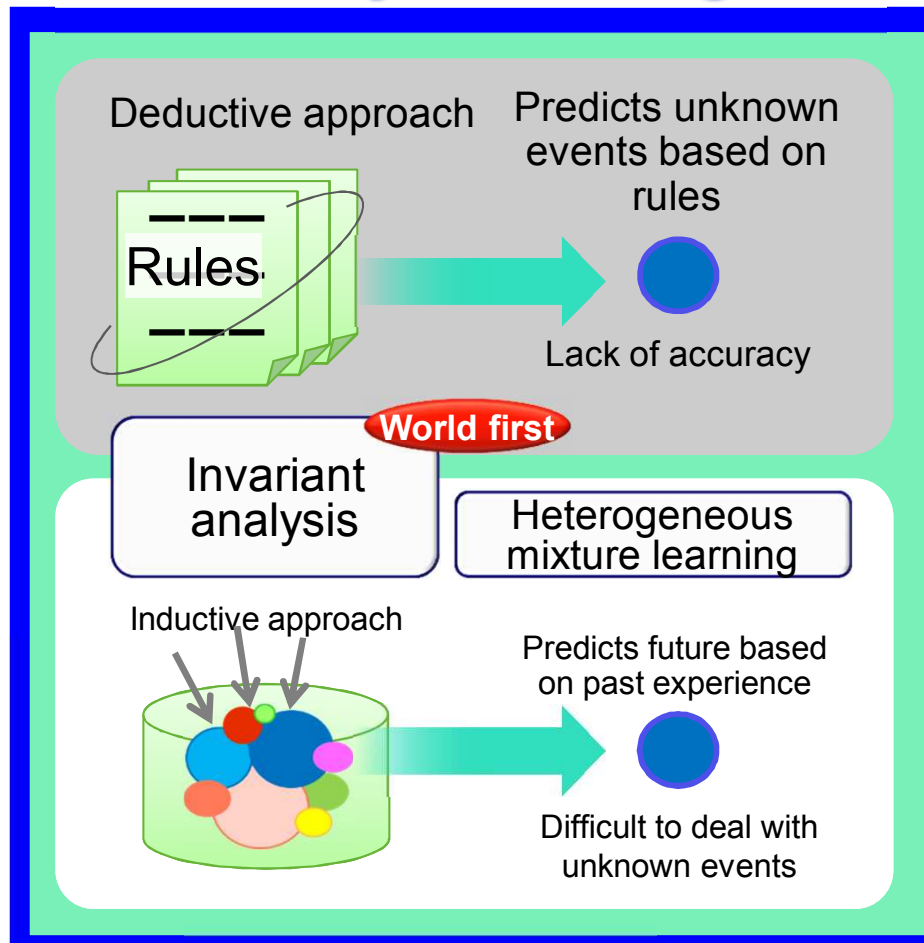
Provide unique solutions by obtaining broader, more in-depth information



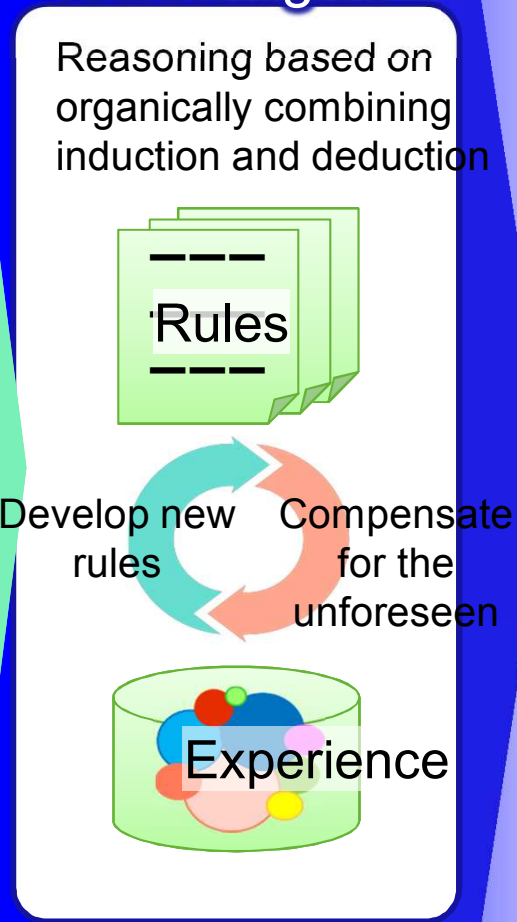
# 3-2-3. Reinforcement of Data Science (2) Analysis

Optimize future prediction for more complex and uncertain social systems by joining inductive prediction (experience) with deductive prediction (rules)

## No.1/Only 1 Technologies



## Analytical Technologies



### Smart Traffic



Optimum deployment for public transport incidents  
 Supports incidents

Supports more complex and uncertain systems

### Optimum water infrastructure



Supports a city-wide incidents

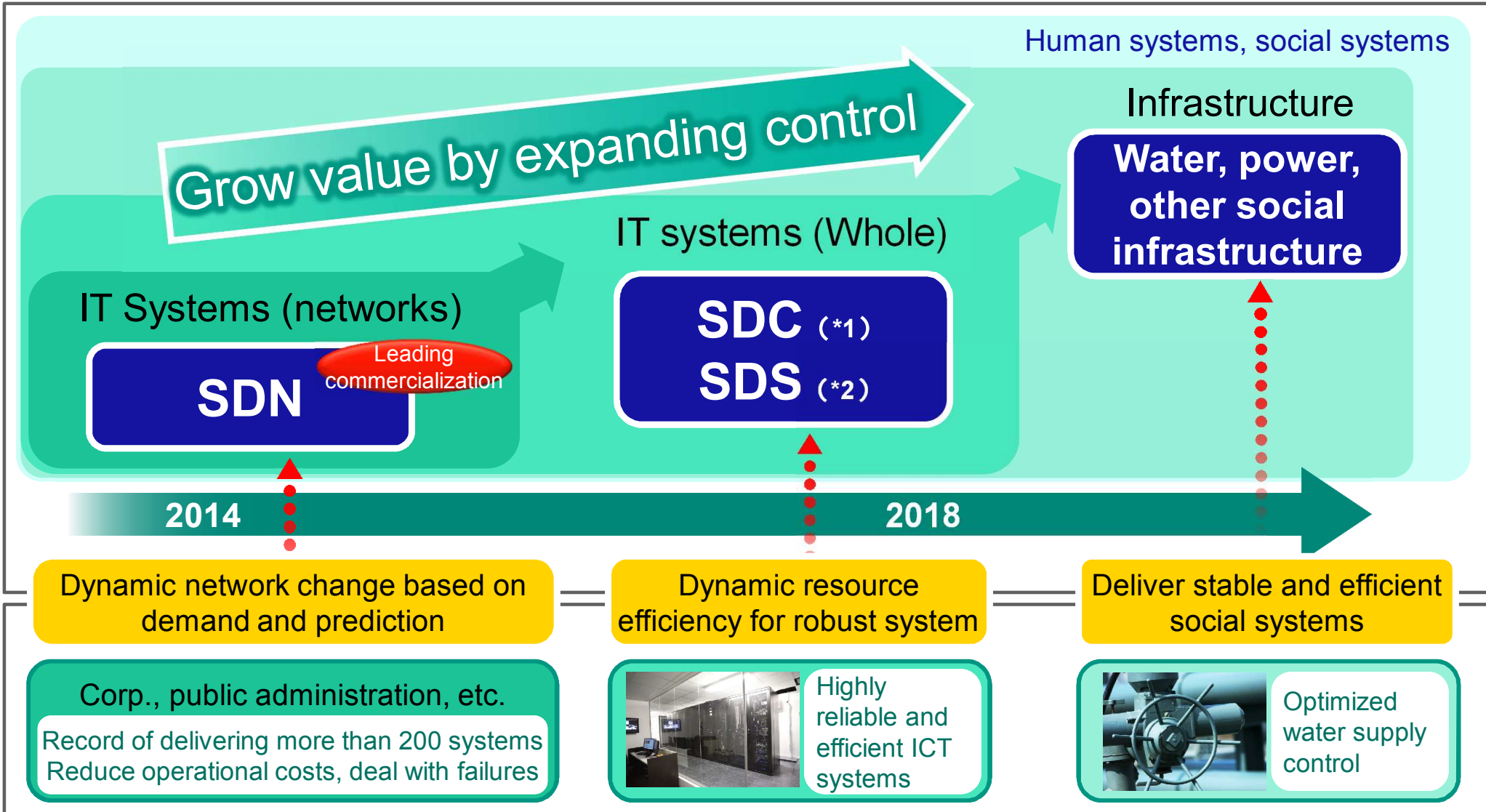
2014



2018

# 3-2-4. Reinforcement of Data Science (3) Control

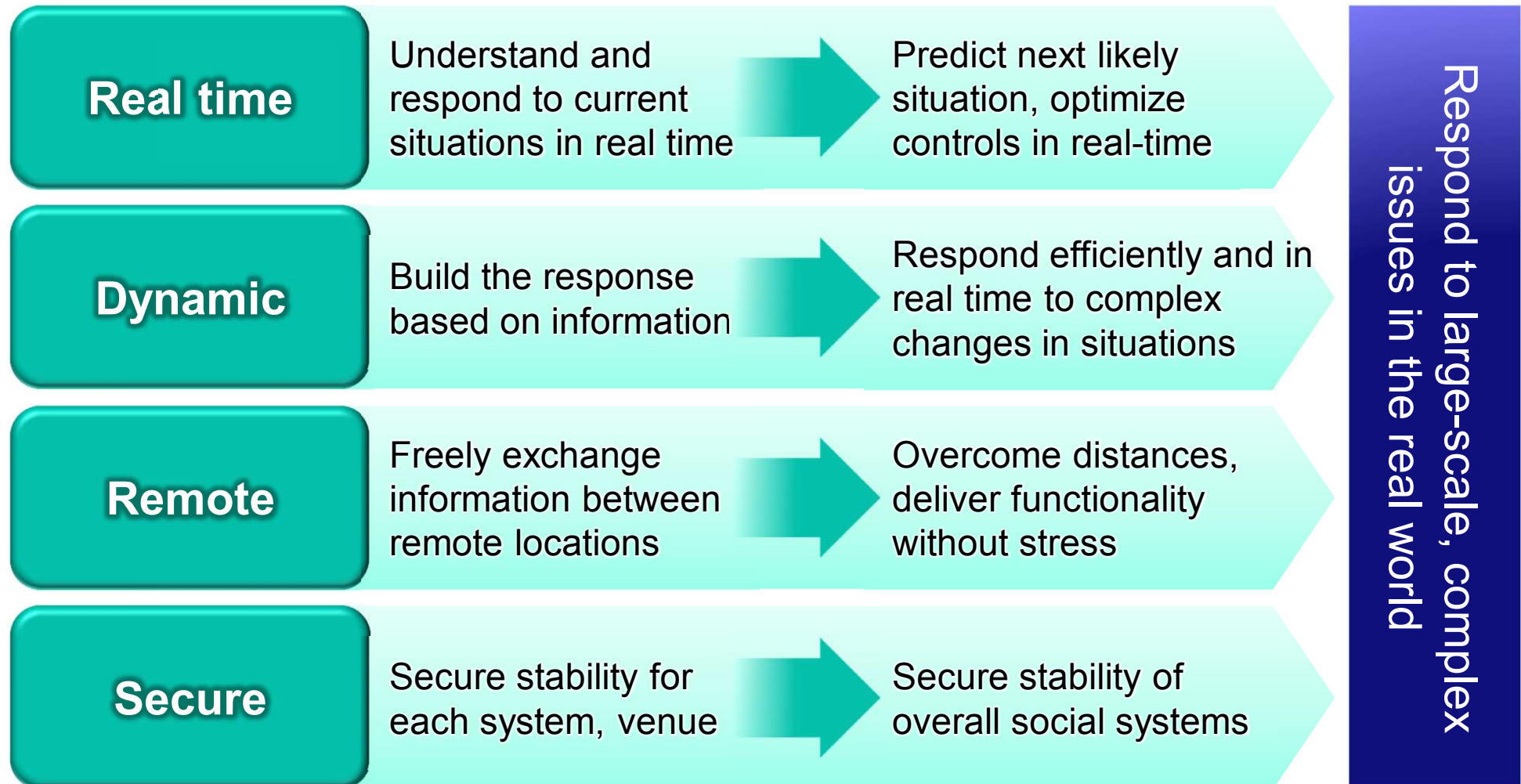
Expand objects of control to deliver dynamic and optimized controls for the entire social system



\*1: Software-Defined Computing      \*2: Software-Defined Storage

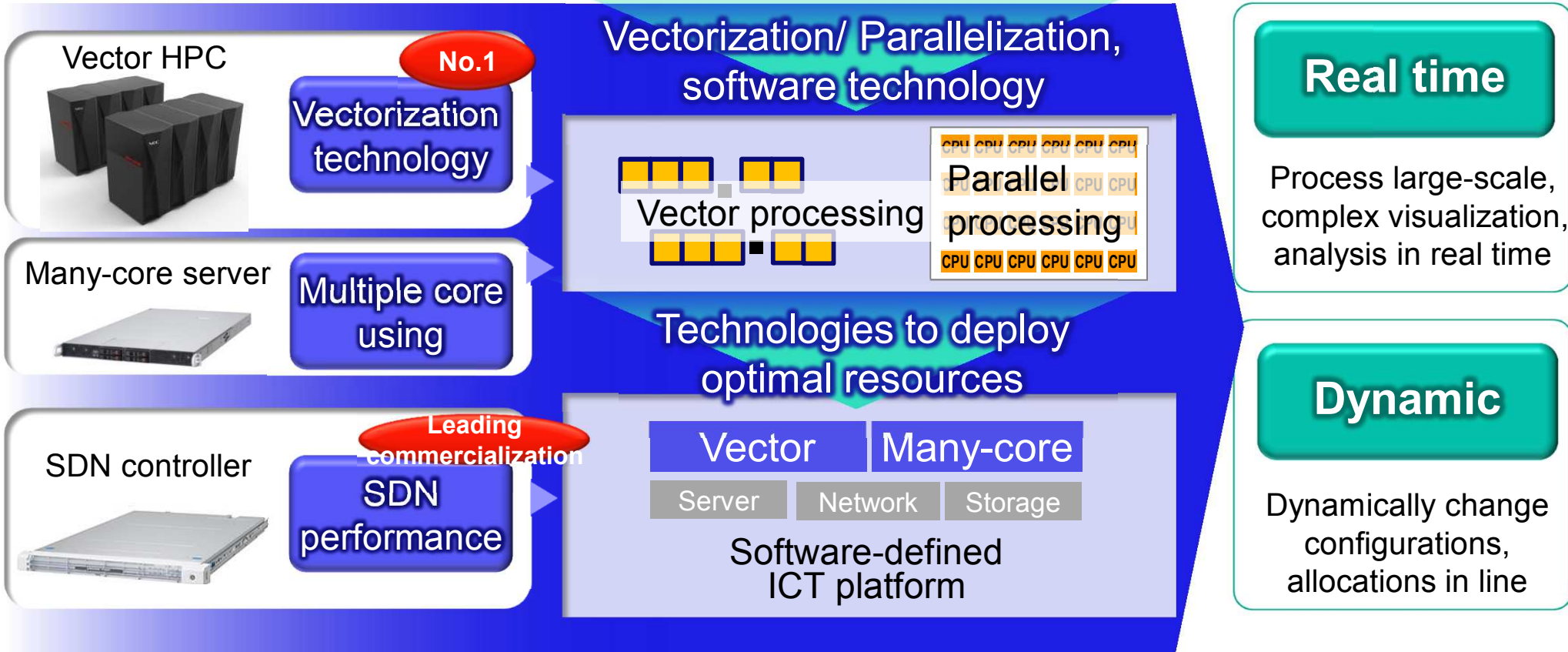
## 3-2-5. Aims of Platform Technologies

**Respond to large-scale, complex issues in the real world**  
by developing the sources of ICT value:  
**Real-time, Dynamic, Remote, Secure**



# 3-2-6. Strong Platform (1) Computing

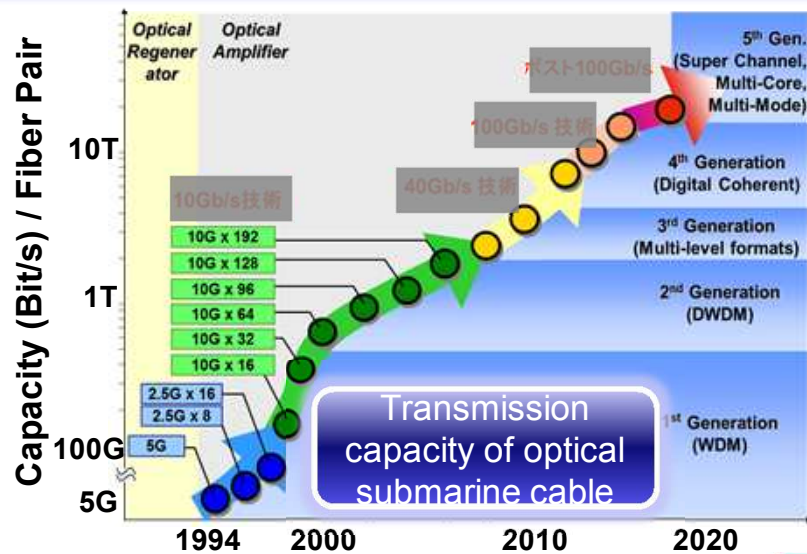
Deliver real-time operation and cost-efficient manner by dynamic combination of vector/parallel processing technologies



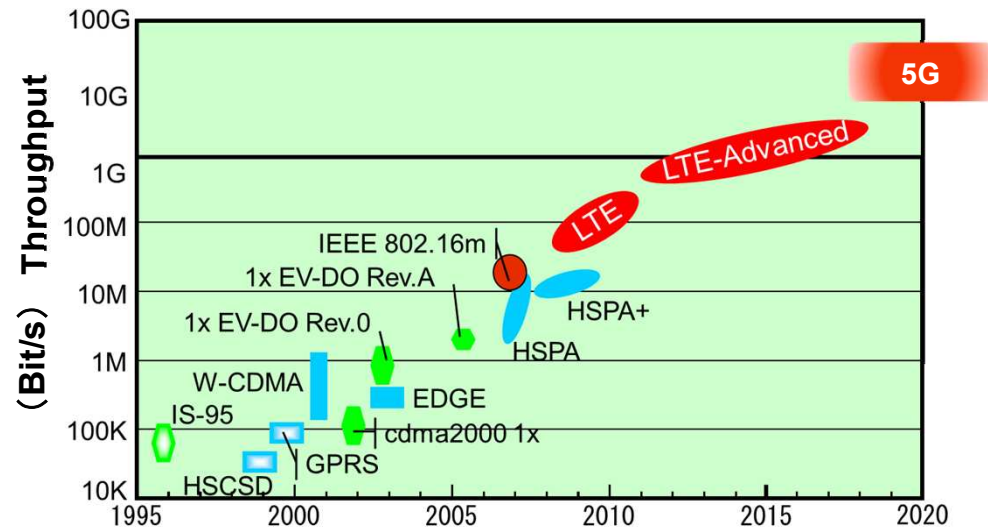
# 3-2-7. Strong Platform (2) Networking

Deliver non-discriminative and high-quality communications platform by elevating optics and wireless connectivity

## Network evolution



## Mobile broadband evolution



Large-capacity optical submarine cable



Across the South Atlantic

World first

400G Optical Transmission

Remote

Fair communication platform

High-efficiency signal modulation technology

Compact wireless station



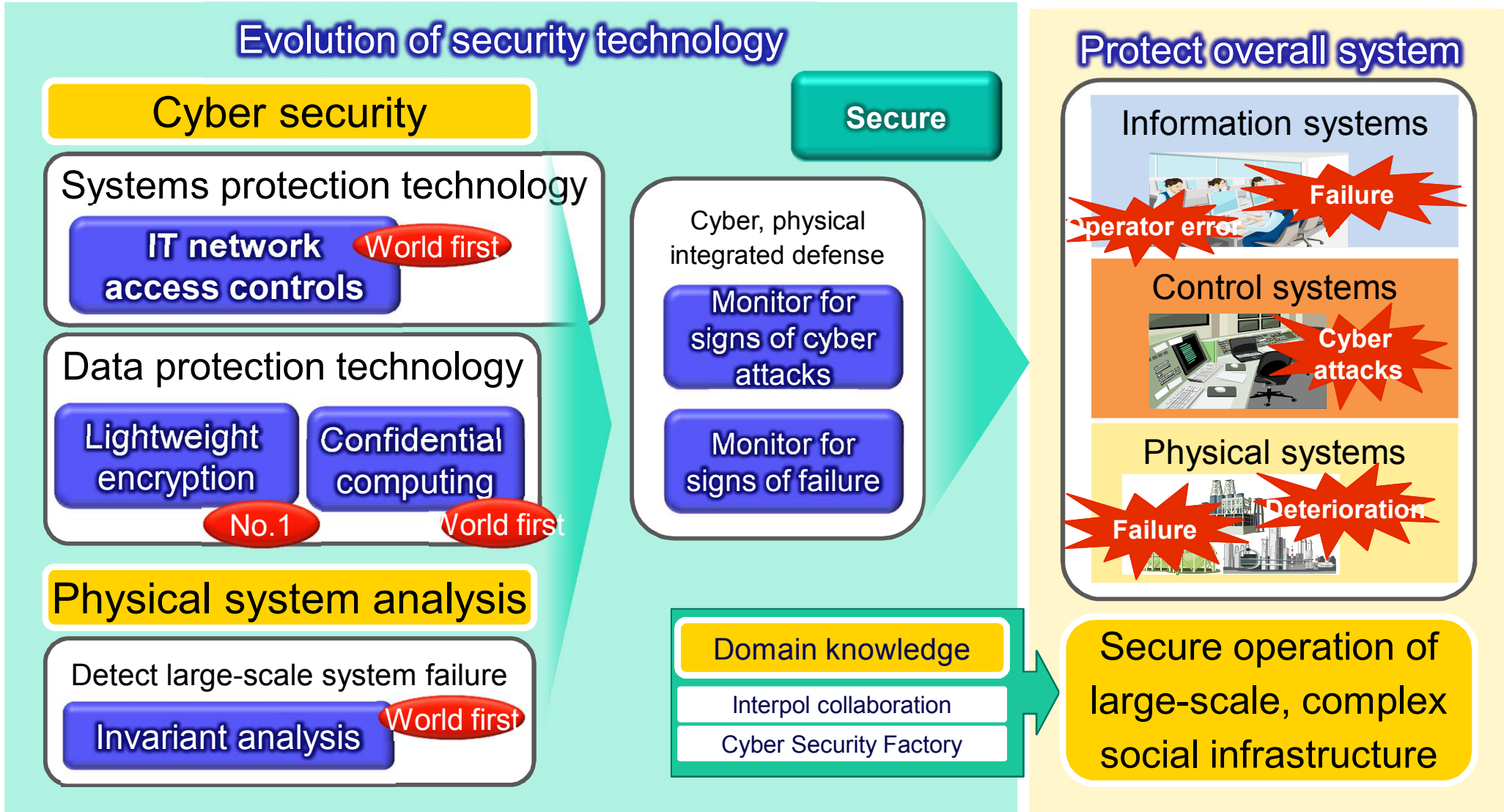
Half size

Easy to put in crowded places



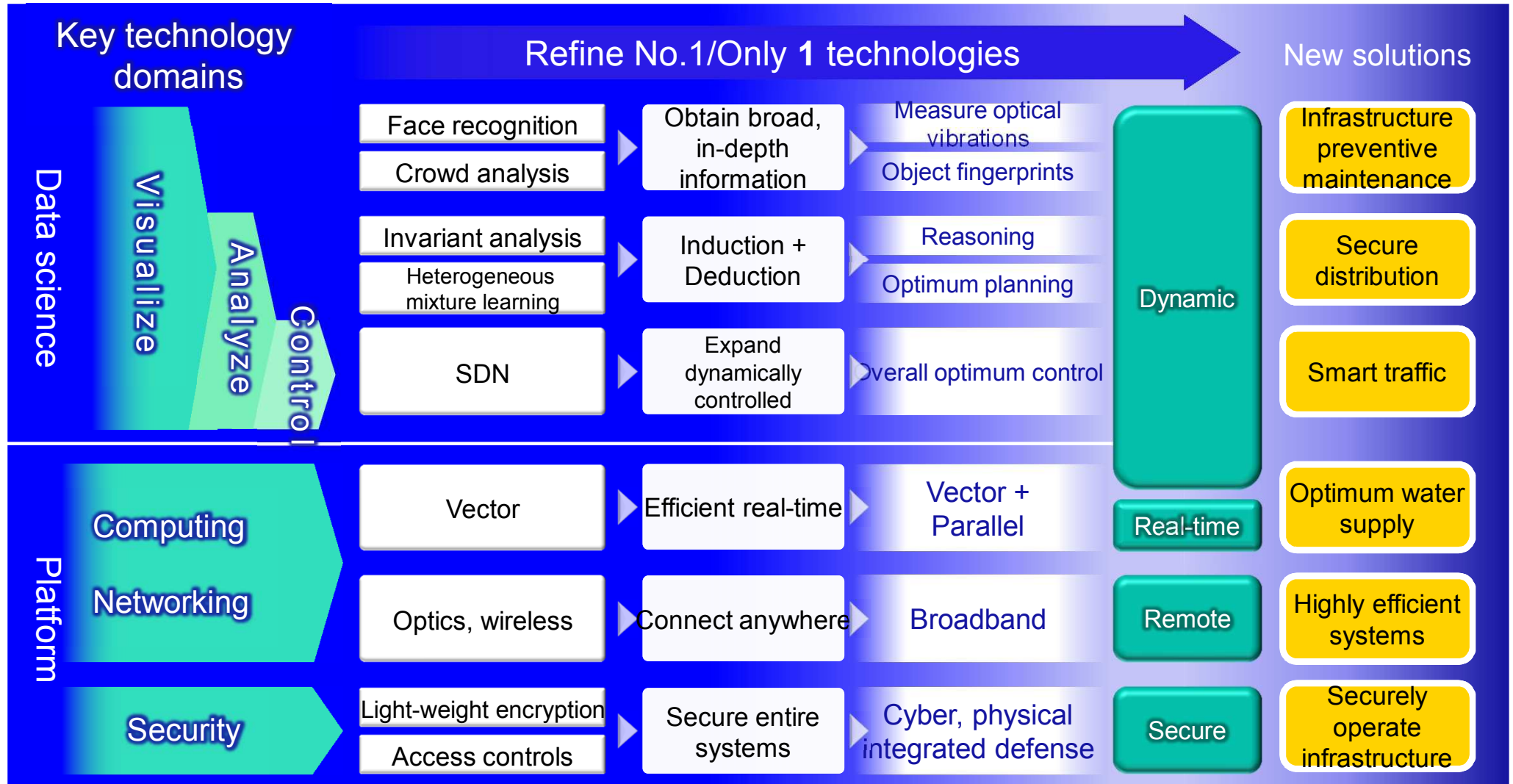
# 3-2-8. Strong Platform (3) Security

Securely operate large-scale, complex social infrastructure with integrated physical and cyber security defenses

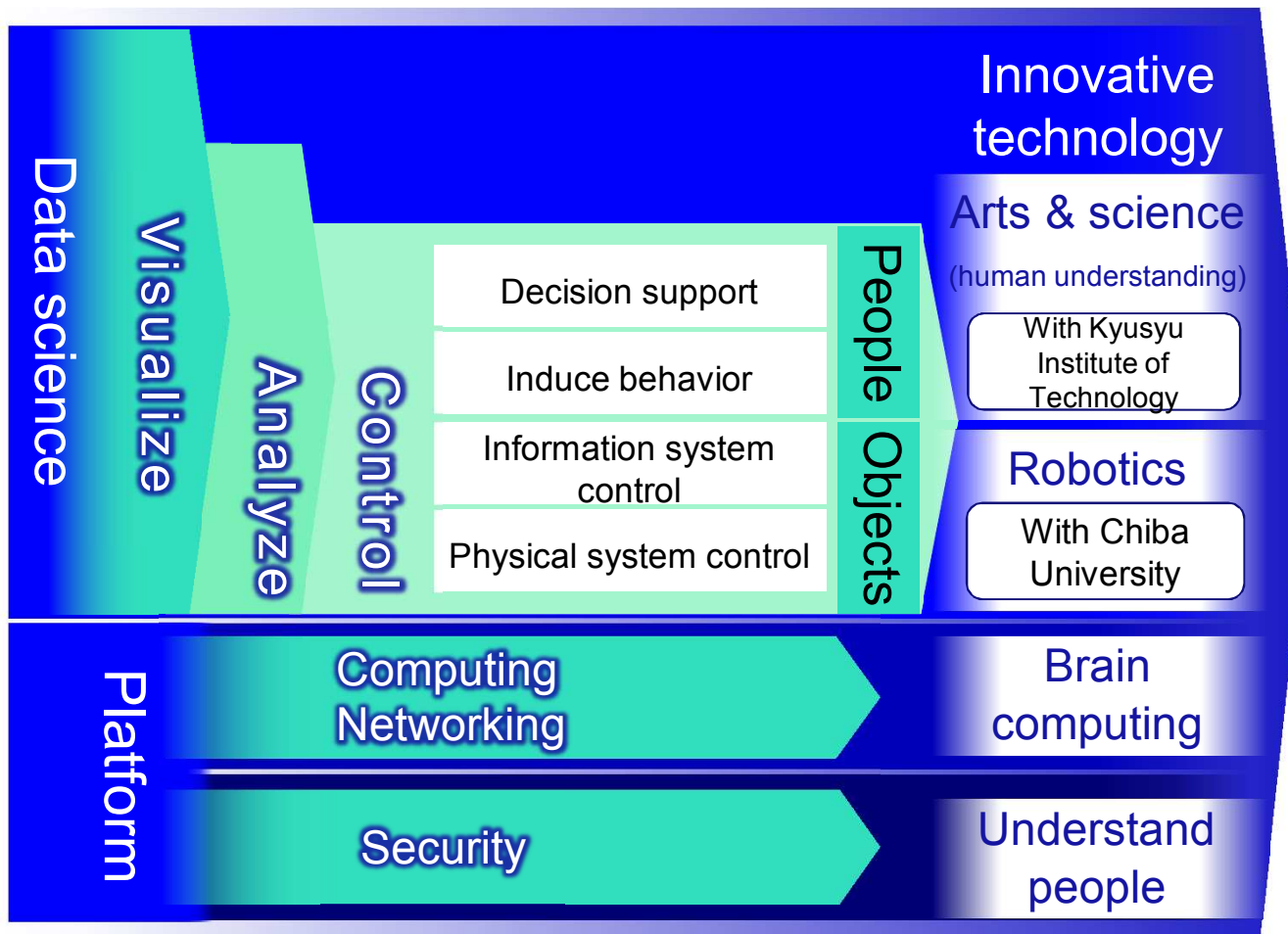


### 3-2-9. Key Technologies and Developments (Summary)

Focus on strengthening visualization, prediction and optimal control for large-scale complex systems and platforms



Innovative technologies that comprehend and influence human behavior operate efficient systems across society



## The New Society

### Control with Humanlike Thinking

- Induce user behavior
- Marketing based on understanding people

### Advanced Security

- Measures to counter inside jobs
- Measures to counter linked cyber, physical attacks

### Human-Robot Cooperation

- Automatic operation, driverless transport
- Improve production efficiency, product quality

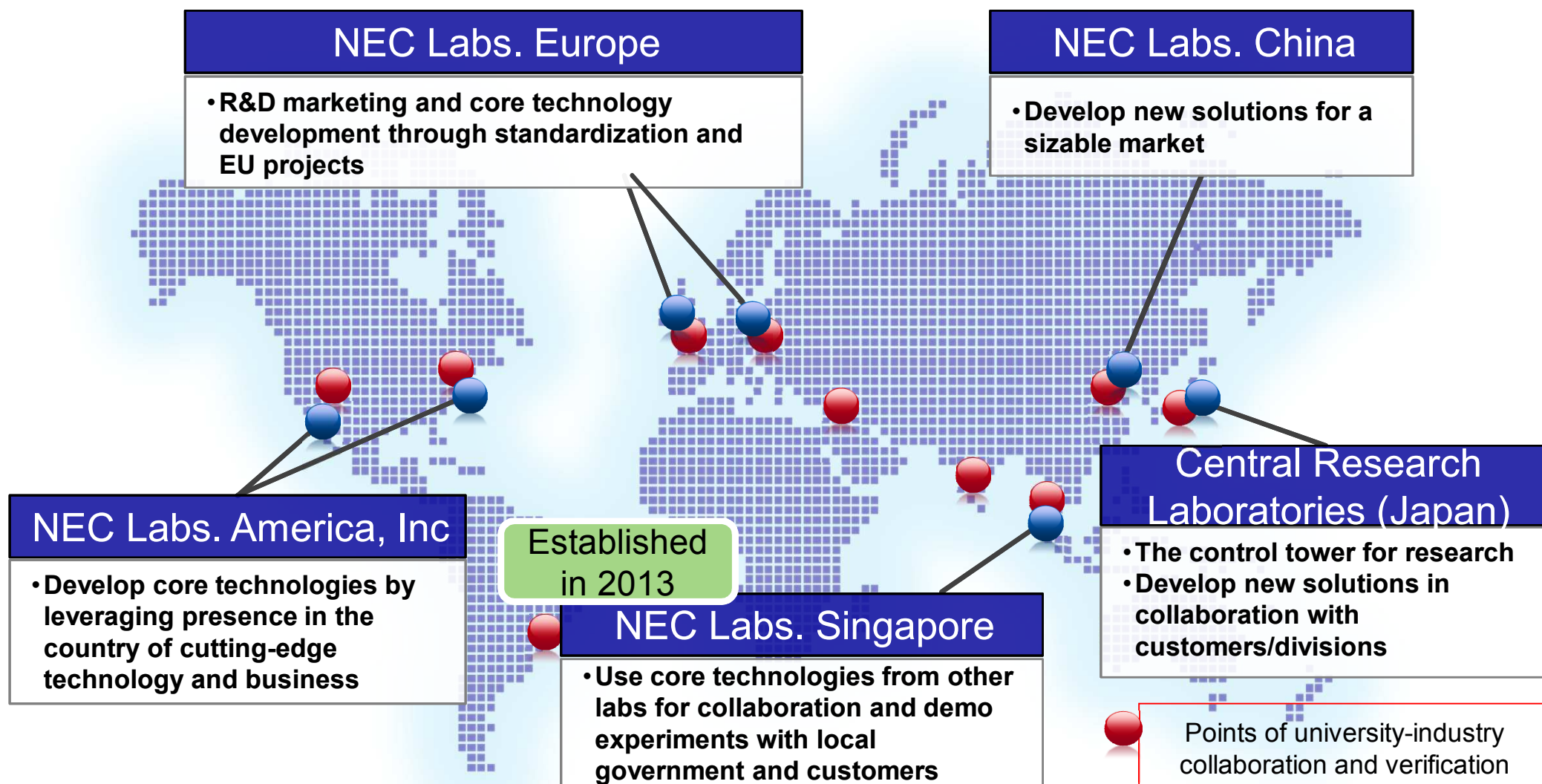
### Expand Human Ability

- Reinforce functional capacity, cognitive ability of people
- Expand memory and capacity for judgment

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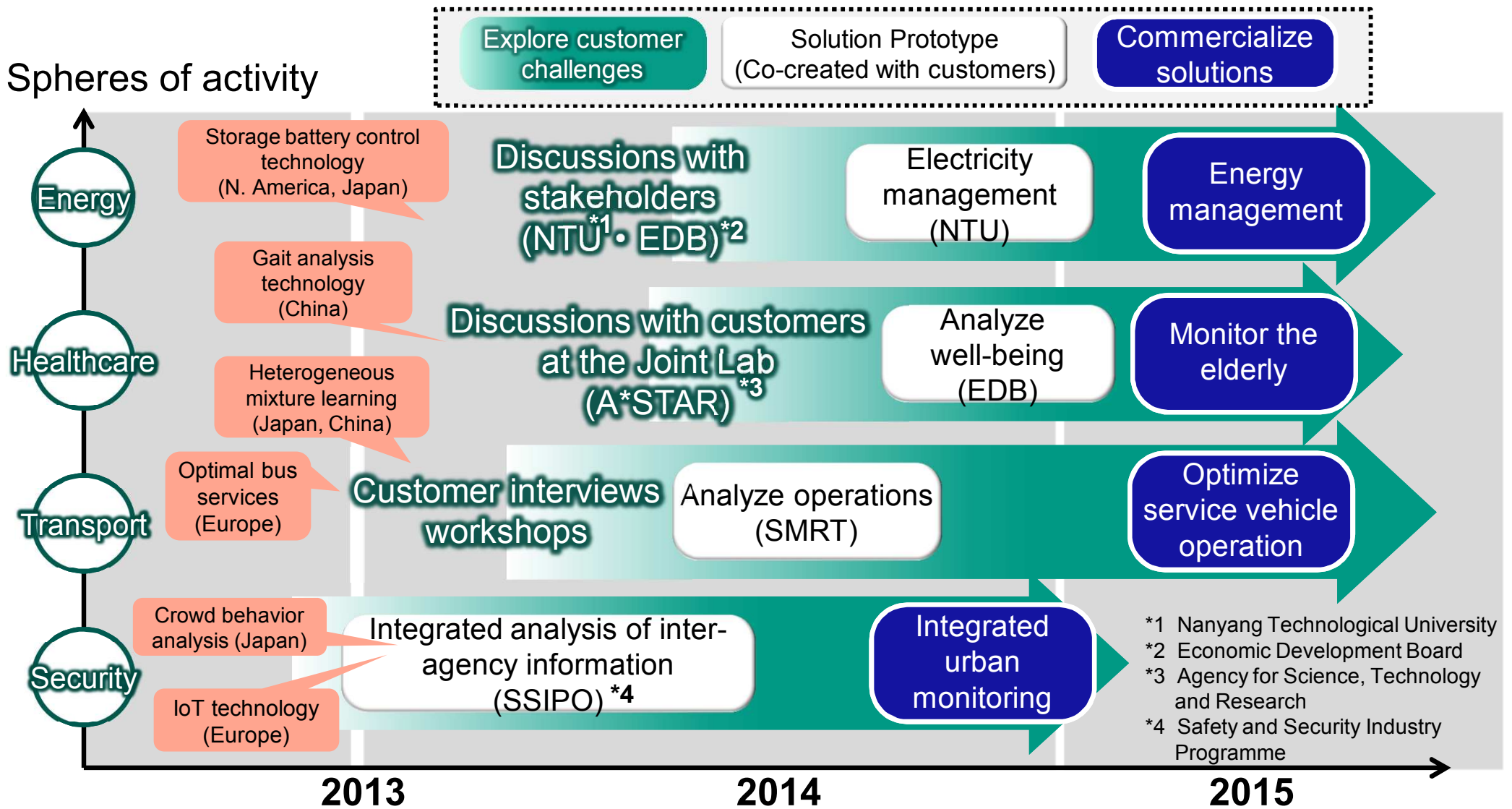
# 4-1-1. Strengthen Global R&D Activities

- (1) Leverage local advantages at five labs to create No.1/Only 1 technologies, create new business through collaboration between labs
- (2) Reinforce global open innovation to build solutions



# 4-1-2. Verify Solutions at NEC Laboratories Singapore

Expand activities to other domain following the success in the safety domain.  
Introduce competent technologies and promote open innovation



In collaboration with Imperial College and Water Utilities in UK, delivered smart water solutions by leveraging leakage detection and technologies to forecast demand



**Imperial College  
London, UK**

Water quality monitoring, water pressure sensors, water pressure remote control, monitoring and other water network control technologies

**No.1**  
Vibration sensing technology

Detect water pipe leakage

**NEC**

**World's first**  
Heterogeneous mixture learning

Predict water demand



**Water utilities, UK**

All data, fields for water pipe network



**Smart water solution**

Prevent leaking pipes

Plan, control optimum water supply



## 4-2-2. Other Open Innovation Cases

Leverage No.1/Only 1 technologies to collaborate with strong partners and knowledgeable customers

Aim	Main activities (main business partners)	Supporting No.1/Only 1 technology
Explore new ideas (Expert staff to explore external tech.)	<ul style="list-style-type: none"> <li>• Human systems (Future University Hakodate, Kyushu Institute of Technology)</li> <li>• Prevent human error (Keio Univ.)</li> <li>• Healthcare Joint Lab (Singapore, A*STAR)</li> </ul>	<ul style="list-style-type: none"> <li>• Understand human mind through approaches based on cognitive science, physiology</li> <li>• Explore security of human systems</li> <li>• Heterogeneous mixture learning</li> </ul>
Reinforce core tech. (Strengthen portfolio by teaming up with world's No.1 organizations)	<ul style="list-style-type: none"> <li>• Obtain security technologies (ETH Zurich)</li> <li>• Develop SDN related tech in USA (ON.Lab *1)</li> </ul>	<ul style="list-style-type: none"> <li>• Encryption technology</li> <li>• Distributed controller</li> </ul>
Promote commercialization (Verify value together with customers)	<ul style="list-style-type: none"> <li>• Water management (Imperial College, UK)</li> <li>• Public safety (Singapore, SSIPO)</li> <li>• Micro grids (Singapore, NTU)</li> <li>• Wireless networks to support education (SRM Univ., India)</li> </ul>	<ul style="list-style-type: none"> <li>• Leakage detection/ Heterogeneous mixture learning</li> <li>• Real server integrated monitoring</li> <li>• Storage battery integrated monitoring</li> <li>• Communication without infrastructure</li> </ul>

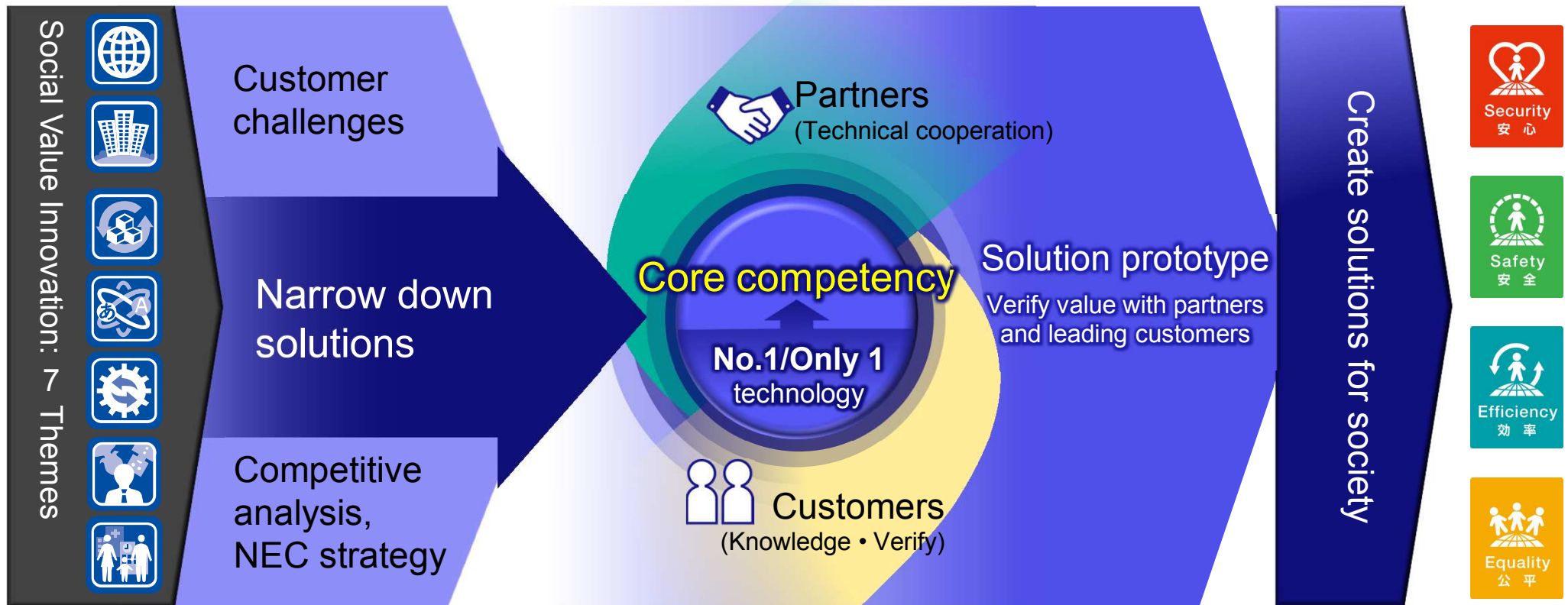
\*1 The Open Networking Lab.



# 5. Summary

Create new solutions for society through co-creation with partners and customers; differentiate through strong technologies and by narrowing down domains

- (1) Actively search for technologies and next growth market
- (2) Refine our competencies by focusing on No.1/Only 1 technologies
- (3) Create new solutions with global open innovation



# **Orchestrating** a brighter world

**NEC brings together and integrates technology and expertise to create the ICT-enabled society of tomorrow.**

**We collaborate closely with partners and customers around the world, orchestrating each project to ensure all its parts are fine-tuned to local needs.**

**Every day, our innovative solutions for society contribute to greater safety, security, efficiency and equality, and enable people to live brighter lives.**

