

There is ever greater need for foresight of the future of IT, where shifts in the economic and social structures as well as technological advancements have significantly changed the industry and its structure. At NTT DATA, we believe providing such foresight will promote continuous growth and business innovations of our customers. Since three years ago, we have launched the NTT DATA Technology Foresight, which is our initiative to understand future changes. In this paper, we will give an overview of our efforts and an outline of the NTT DATA Technology Foresight.

### What is NTT DATA Technology Foresight?

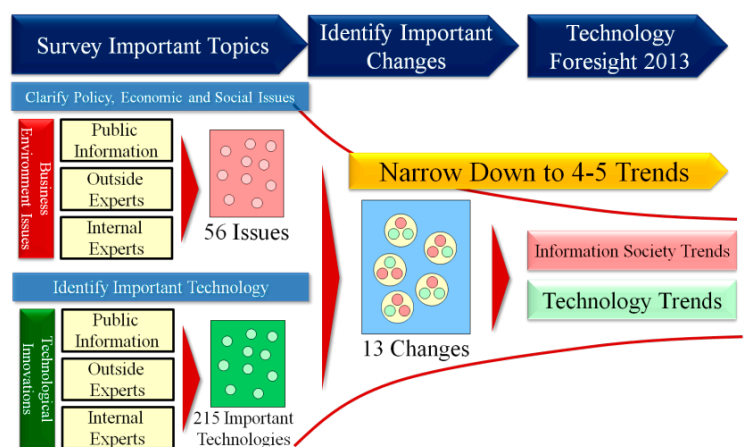
The world we live on is approaching a new global era, in which the physical earth is being fused with a digital network that encompasses it. In light of this, the future of business management will be required to keenly perceive medium- to long-term changes in policy, economic and social structure, and technology trends.

NTT DATA Technology Foresight systematically organizes two trends from our customers' perspective: 1. Trends in information society that grasp the changes in information society that could have a significant impact on business in the medium to long term; and, 2. Trends in technology that grasps the important technologies and services.

### Development Process of Trends

NTT DATA Technology Foresight 2013 analyzes trends in the so-called PEST (Politics, Economics, Social, Technology), based on publicly available information. In addition, we conduct discussions and collection of wide-ranging information, by interviewing NTT DATA Group both in Japan and overseas (North America, EMEA, APAC, etc.), NTT R&D, and outside experts in a variety of fields. Then, we organize the information into 56 major issues in politics, economics, and society, as well as 215 innovative technologies. Generally, there are various types of changes in society—such as human understanding, large-scale data utilization, and adaptation to change. However, we have summarized these into 13 future changes and, finally, we have derived four trends

in information society and five trends in technology. (Figure 1)



**Figure 1: Technology Foresight 2013 Development Process**

### Trends in Information Society

Trends in information society are derived from the perspective of information society based on an outlook of trends in the near future that are expected to significantly impact the future of business and society. These trends are derived by observing the evolutionary direction of business and society in each area of PEST.

As a result, we identified four trends in information society: 1. Source of competitiveness shifting towards application of knowledge and information; 2. From a mass-oriented society to a society that focuses on individuals; 3. Increasing demand for real-time response to ever-changing environment and needs; and, 4. More accessible and user-friendly IT that can be used by anyone. (Figure 2)

Below is an overview of information society trends.

**1. Source of competitiveness shifting towards application of knowledge and information**

The advancement of information disclosure and sharing, through latest technologies such as Open Data and Big Data, has realized the immediate sharing of innovative technologies and ideas. In addition, knowledge consolidation and data analysis are increasingly becoming sophisticated. As such, the ability to foresee the future has been dramatically improved through the extraction of not just information, but knowledge and expertise. Thus, in the future, foresight will shift from calculating probability, to adapting to grasped changes, and then to continuously anticipating changes, thereby enabling companies to constantly gain competitive edge.

**2. From a mass-oriented society to a society that focuses on individuals**

The advancement of cutting-edge research such as iPS cells and DNA has developed custom medical treatment that fits the individual, while companies are facing the important challenge of moving away from the traditional mass-oriented business model to re-

sponding to the diversification of values.

In addition, sensing technology has created an environment where personal information can be collected, such as information through the five sense organs, action logs and biological information. The utilization and accurate understanding of such information has led to understanding the needs of the individual. In light of this, the focus of the age will shift towards the individual, and tailoring products and services to each customer’s desires.

**3. Increasing demand for real-time response to ever-changing environment and needs**

Real-time response to changes in a variety of fields is made possible by the optimized feedback process through sensing technology and IT capabilities. This trend is expected to help optimize energy use, which is one of the most pressing issues after the Great East Japan Earthquake on March 11, 2011. It is also expected to help respond to unexpected natural disasters and infrastructure crises. In addition to early detection of changes through detailed sensing of environmental conditions and people’s situations steady feedbacks of such changes are returned in real time.



**Source of competitiveness shifting towards application of knowledge and information**



**From a mass-oriented society to a society that focuses on individuals**



**Increasing demand for real-time response to ever-changing environment and needs**



**More accessible and user-friendly IT that can be used by anyone**

**Figure 2: Trends and Evolutionary Direction of Information Society**

#### 4. More accessible and user-friendly IT that can be used by anyone

The Japanese population is increasingly moving towards an aging society. Thus, in the future, there will be a growing demand for IT to overcome the challenge of reduced bodily functions and performance. In addition, a user interface (UI) that is appropriate for the elderly and improving accessibility for the handicapped will become critical elements. IT will soon become an infrastructure or environment that can be used by anyone (just like water or electricity), while a natural interface that can be operated naturally and intuitively will spread. Ultimately, an ambient IT age will arrive, where we will be able to use IT unconsciously.

#### Trends in Technology

Trends in technology are derived based on our observations of advanced technologies and services that are latent or already actualized in society, and are thought to spread in the future. We have derived trends by observing the changes in information society and the course of progress in technology. (Figure 3)

We observed the following five trends in technology: 1. Human-centered IT that recognizes individuals; 2. Strategic data collection and analysis; 3. Cyber-physical computing; 4. Resilient IT infrastructure that adapts to environmental changes; and, 5. Extremely rapid application development for prompt delivery.

Below is an overview of technological trends.

#### 1. Human-centered IT that recognizes individuals

Passing through an age of mass production, age of function and quality, and an age of experienced value that focuses on consumer type, the next age will be one that focuses on individual consumers. In this age of the individual, a human-centered IT that facilitates a change in people's feelings as well as customized products and services for those individuals will be sought, and the values of increased individual satisfaction and increased creativity and productivity will be realized.

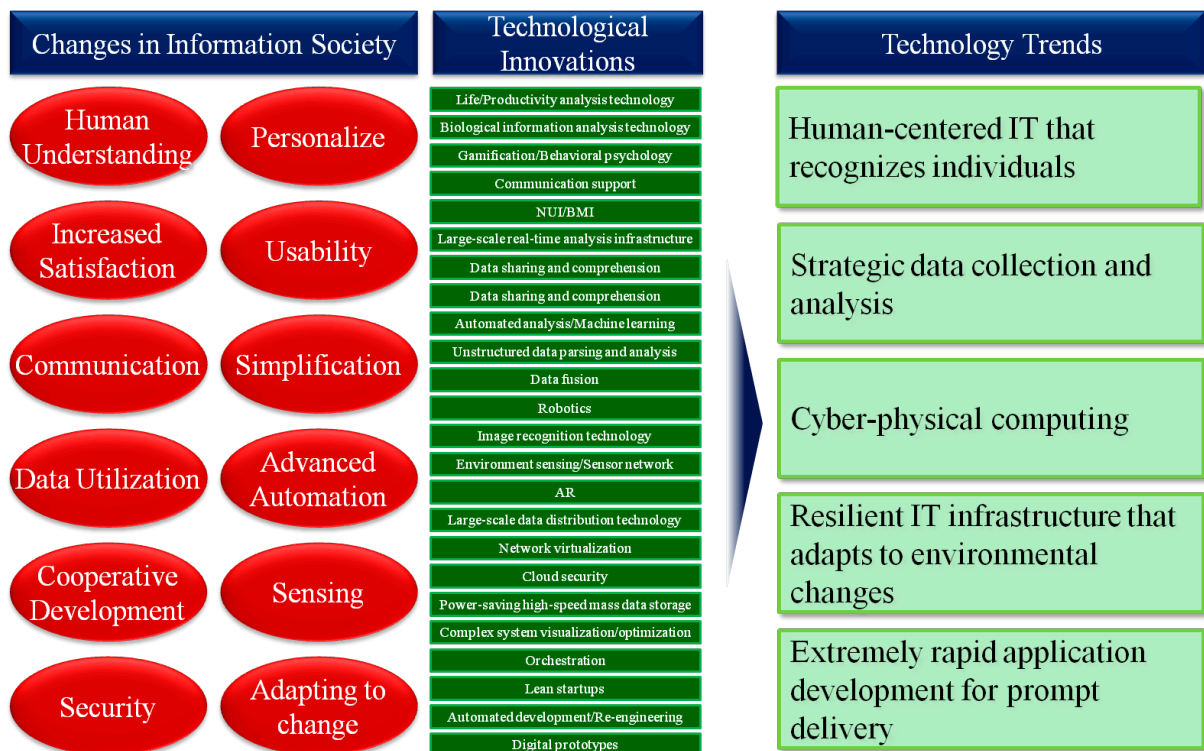


Figure 3: Changes in information society, Technological Innovations, and technology trend

<Direction of evolution & related technology and services>

- Diverse UIs and Advancement of Communication

-> NUI, BMI, communication support technology

- Understanding the Individual

-> Lifelog/worklog analysis, behavioral analysis, biological information analysis

- Customization of Products and Services

-> Personalization, 3D printing

- Raise Motivation, Optimize Human Behavior

-> Gamification, behavioral psychology

## 2. Strategic data collection and analysis

Strategic data collection and analysis realizes a shortened time for collection of various data and analysis cycle through the sophistication of big data analytics and a dramatic improvement in computer power, thereby producing new values. In order to advance data analysis beyond its current level, data collection and analysis technology are becoming increasingly important. The sophistication of data collection and analysis has led to the actualization of creating business opportunities and holistic decision-making based on the foreseeable future.

<Direction of evolution & related technology and services>

- Shortening analysis cycle

-> Large-scale real-time analysis infrastructure, automation of analysis, and machine learning.

- Utilizing a wide variety of data

-> Data sharing and comprehension, parsing and analysis of unstructured data, and data fusion.

\* The two evolutions mentioned above realize a holistic decision-making.

## 3. Cyber-physical computing

IT implementation has expanded from within enterprises to end-users. And in the future, application to social infrastructure will be critical, so that it can respond and adapt immediately to changing environments and needs. Progress in cyber-physical computing will make it possible to control the real-world in real time and support human behaviors through enhanced re-

al-world experience. Through this, the optimization of society and freedom from physical constraints will proceed even further.

<Direction of evolution & related technology and services>

- Sophistication of Sensing and Control Technology

-> Environment sensing, sensor network, object recognition from images

- Real-time control of the real-world

-> Robotics, autonomous cruise control

- Support human behaviors through enhanced real-world experience

-> 3D production, 3D video, AR

## 4. Resilient IT infrastructure that adapts to environmental changes

IT infrastructure has passed the age of centralized processing and distributed processing, and is now approaching an age of autonomous processing, where IT is integrated as part of the social infrastructure. IT infrastructures, which assume the core of social infrastructure, are required to have an autonomous optimization that adjusts to meet changing circumstances and a resilience to stand up against threats, and will achieve flexibility and resilience.

<Realized value: Example technology and services>

- Autonomous optimization that adjusts to meet changing circumstances

-> Orchestration, automated scale out, virtualization

- Improved resilience against disaster and attacks

-> Widely distributed technology, dependable technology, cloud security

## 5. Extremely rapid application development for prompt delivery

The capabilities required of development technologies are changing according to the shifts in the roles played by IT systems.

The role of IT systems will change from tools to streamline business, to tools that create innovation. At the same time, the capabilities required of development

technologies will shift to responding to diversity, in order to ensure success in business innovation, as well as ensure speed and high quality that accurately and rapidly develops systems. In the future, a development infrastructure will be realized that is capable of continuously creating IT systems that respond to diverse needs with speed and high quality. Having such infrastructure will significantly impact whether one will have competitive edge.

<Direction of evolution & related technology and services>

- Response to changing needs
- > Agile, Scrum, DevOps, Lean Startup, A/B Test
- Balance of development speed and quality
- > Reengineering, automated program generation, design simulation, cloud-based development

## Summary

NTT DATA Technology Foresight aims to show the direction of business transformations in the medium to long term, in order to construct a continuous partnership with customers.

With NTT DATA Technology Foresight as the material, NTT DATA will examine hypotheses and scenarios of future business transformations together with customers, and by integrating in-house technology with technology of other companies in an optimal way, we will achieve success in PoC (Proof of Concept), thereby realizing innovation in our customers' businesses. In addition, we will promote our R&D activities by utilizing feedback we receive from customers and knowledge gained from the NTT DATA Technology Foresight.

April 2013 version