

2017 NTT Data Business Briefing
(Technology and Innovation General Headquarters)
- Technological strategy for Global 3rd Stage -
December 4, 2017
NTT DATA Corporation
Director and Executive Vice President
Head of Technology and Innovation General Headquarters
Tsuyoshi Kitani

I am Tsuyoshi Kitani from the Technology and Innovation General Headquarters. Thank you for your attendance. I would like to introduce you technology and innovation we have been working on.

I would like to explain about it in two parts. The first part is about Digital Transformation. I would like to take a keyword, Digital, to talk how we have been working on it and how the business keeps changing. The second part is about utilization of such technologies as AI, IoT, Blockchain, Security, etc.

Global 3rd Stage

3 Global 3rd Stage
Trusted Global Innovator
Aspire to Global Top 5 Status

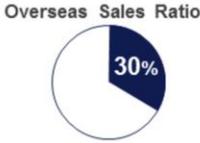


2 Global 2nd Stage
Recognized Global Brand

NTT DATA: ASCEND
Rise and grow our global brand
FY2016 → 2018



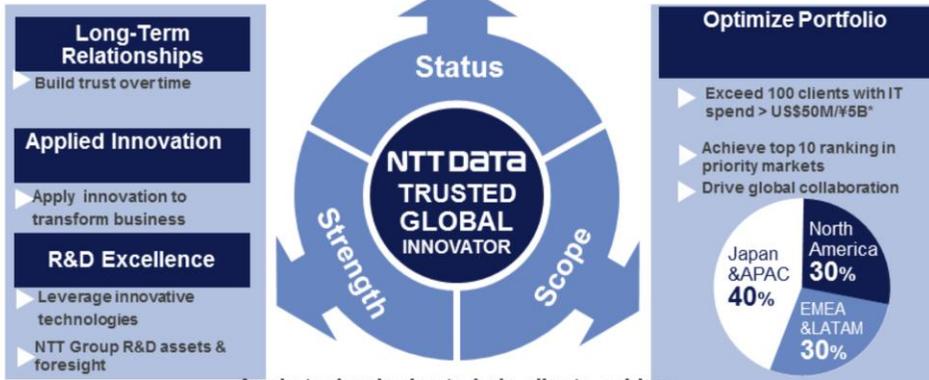
1 Global 1st Stage
Increased Global Coverage



(Description Abbreviated)

Trusted Global Innovator

Global Top 5



Apply technologies to help clients achieve their business outcomes as their partner

* Clients with annual sales of ¥5.0 billion or more (Japan) or US\$50 million or more (outside Japan)

(Description Abbreviated)

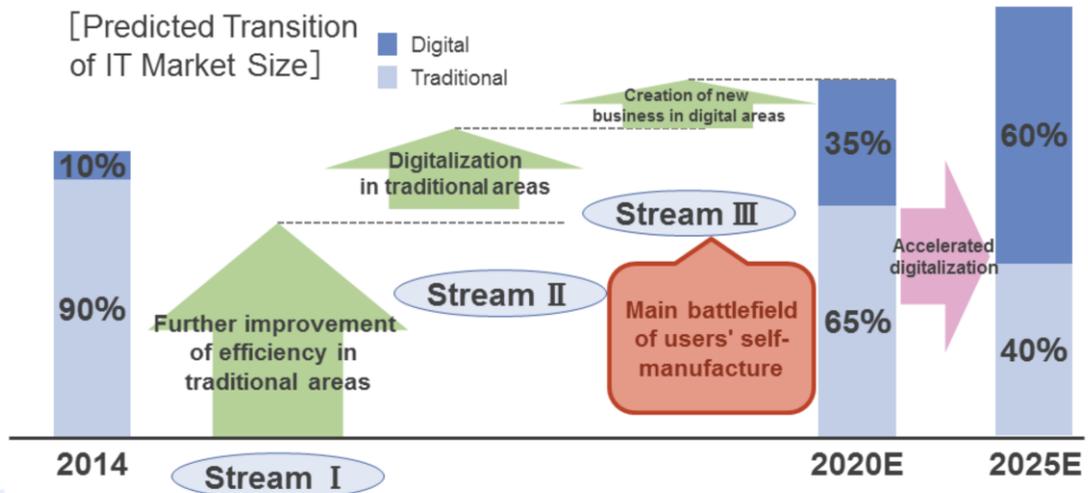
Initiatives for Digital Transformation

Now I would explain how we have been working on the first part, Digital Transformation.

DX: Digital Transformation

SI trend has changed, and DX is advancing As an Sler, there are three streams we must follow

[Predicted Transition
of IT Market Size]



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NTT DATA

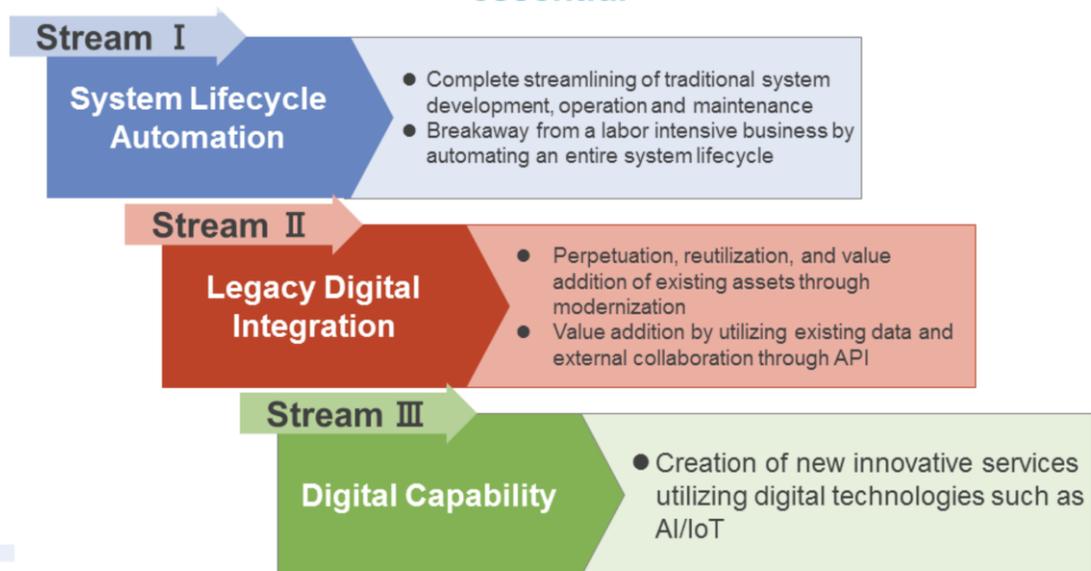
This figure shows materials summarized by a research company somewhat deformed and how the SI (System Integration) trend is changing. The graph does not show our business volume but an analysis of the general IT market. Approx. 90% of the current business among SI is not digitalized and is called a traditional SI/IT services. A stage where the traditional SI will be optimized is called Stream I. And a process where the traditional area is getting digitalized over time is called Stream II and a process where new destructive business is created digitally is called Stream III.

A bar graph on the right side indicates that approx. 60% will be digitalized by the end of 2025, but this is a prediction by the research company. I am not yet sure if the actual IT market could be digitalized like this.

Now I would like to explain about Stream I, II, and III and our initiatives.

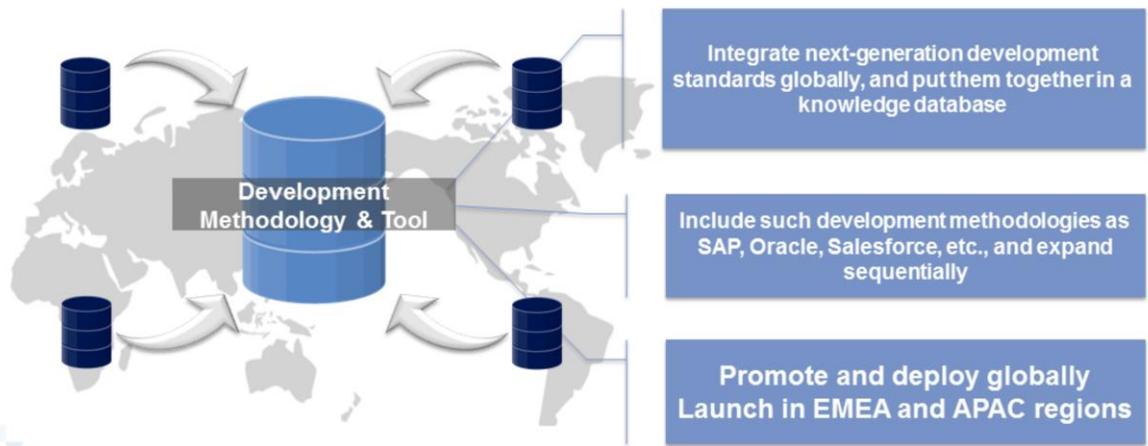
Characteristics of the Streams

Particularly in Stream II , collaboration with various partners is essential



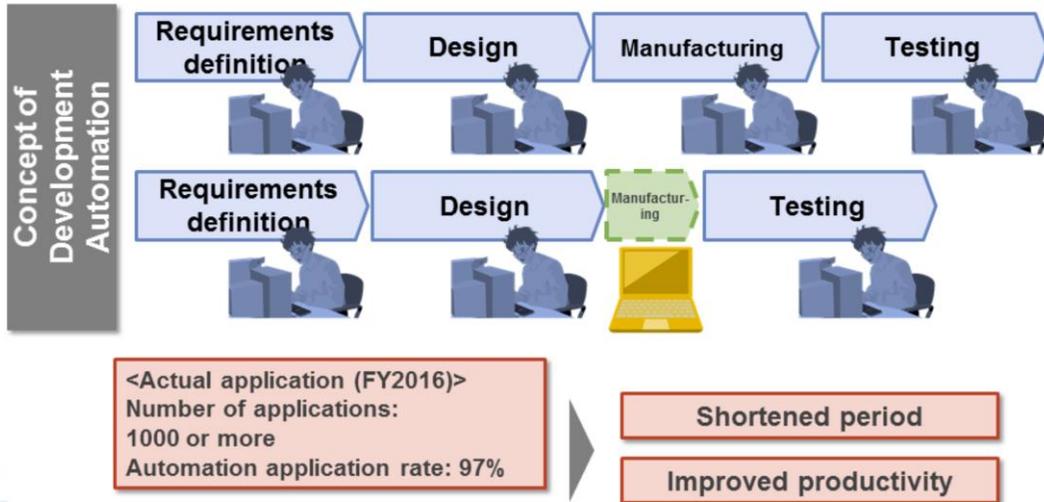
First of all, automation greatly contributes to Stream I from an optimization point of view. Stream II is related to Legacy Modernization by which the legacy system is reformed safely and securely. With the Legacy Modernization continuing to advance, how the data should be treated is one concern. I will introduce it later. In addition, a stage where currently a quite advanced API (Application Programming Interface) mechanism is getting ready is Stream II. Stream III is a stage where utilizing new technologies including AI and IoT to create completely new services can produce a brand new business model which changes the ecosystem.

Global integration of next-generation development standards. In addition, consolidation of tools to prepare for production technologies which help to provide high-quality services worldwide



I would like to introduce our technical initiatives for Stream I. The first initiative is called NTT DATA Core Methodology, which integrates development processes. So far, we have acquired a number of companies including overseas companies, and a Japanese development methodology called TERASOLUNA and development methodologies from the U.S., and Spain, etc. are integrated as one. We have been not only adapting these to a pure application development but serially preparing development procedures including SAP, Oracle, and Salesforce, etc. Especially when more than one overseas group company develops collaboratively, hopefully using this method, optimization of the development and quality improvements can be expected.

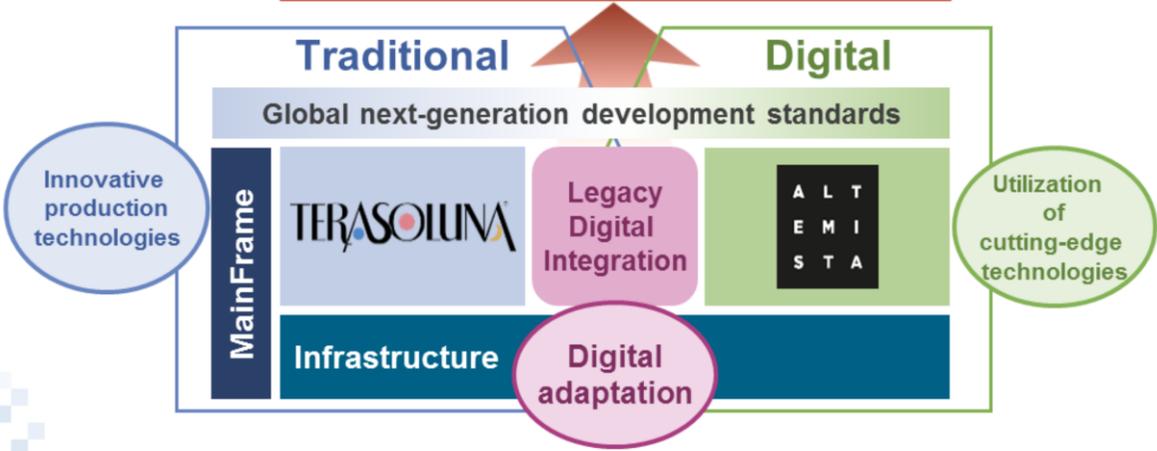
Promote development automation initiatives throughout processes
Shorten development periods and improve productivity



The second is development automation we have been fully working on for five years. Developments without source codes written are increasing, and creating design specifications and automatically generating source codes help to skip a part of a unit testing. This contributes to a shorter development period and quality improvements. We have been working on automation of testing in addition to developments in which no source codes are written. Applications can count 1,000 cases or more and the automation application rate is 97%, which shows automation applied in a significant number of projects.

Three actions to support our client business innovation

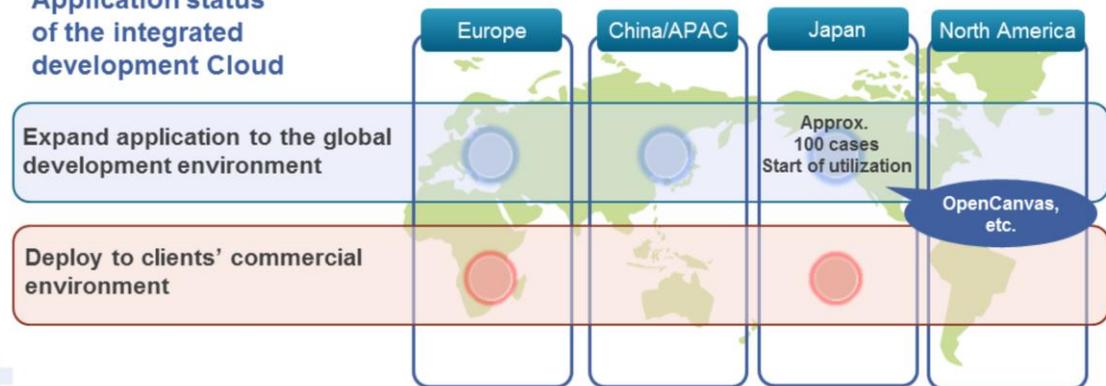
Optimized Utilization of New/Old IT Resources



(Description Abbreviated)

Continue efforts to improve business agility and reduce costs by deploying the Integrated Development Cloud inside/outside Japan aggressively

Application status of the integrated development Cloud

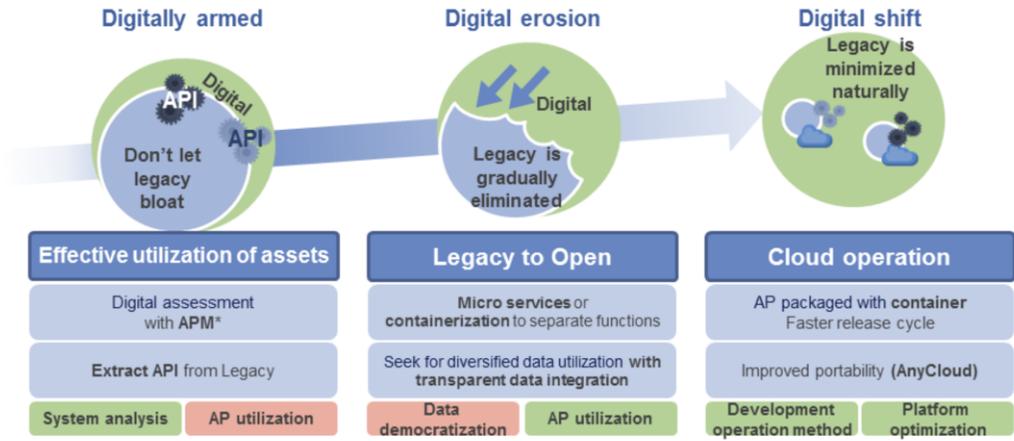


What we have been promoting actively since FY2016 is an initiative for a Cloud-based development. Conventionally, development machines were purchased at each project and a development environment was built there, which is still our main stream. We have been promoting an initiative to make it on Cloud promptly. This helps to get a complete development environment ready on Cloud, and setting resources for development allows for a prompt development, leading to a shorter development period. In addition, it has an advantage of skipping a purchase of a range of development environments.

The main stream of the development is a waterfall model in which it goes from upstream to downstream linearly, but a method called Agile development is getting increased. This is a method of development by which critical functions are selected among those to be developed in a sequential development manner. A development environment which can realize this is available on Cloud.

This integrated development Cloud has been being deployed not only domestically but globally. China adopts this method in offshore development for Japan, and everis in Spain started to use this. We are not only utilizing this for development of our products but have started to market this to our customers as a commercial environment.

Step-by-step digitalization support using existing systems



*Application Portfolio Management

I talked about Stream I until now, and now I will talk about a bit technical stuff of Stream II. Recently, a digitalized system has been added to the existing system. First of all these should implement an Application Portfolio Management which analyzes customers' existing IT system assets. And, such a mechanism as API used to combine the legacy system with external services will emerge. I will explain this later. Next, once a digitalized area has expanded, I assume promotion of data utilization is getting required with functional breakdown data democratization with a container or micro services. I will explain this also later.

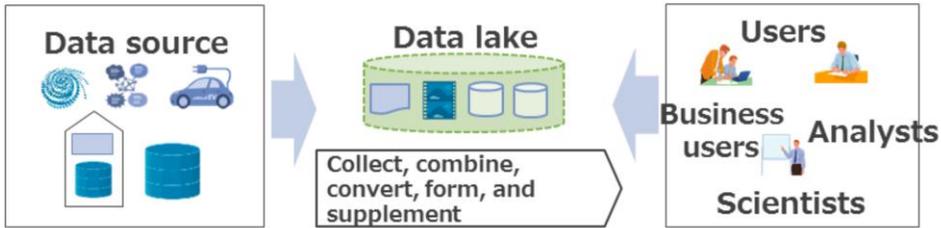
When it comes to the final Digital shift phase, such a mechanism as AnyCloud is getting popular, in which information system can be operational on any Cloud.

Disclose enterprise systems for use in a range of new services



First of all I will explain about an API. For example, we create a path called an API by which external services are linked in our account management system called AnserBizSOL serviced to enterprises. Such a FinTech enterprise as Money Forward can easily have an access to an account of a financial institution through this AnserBizSOL and provide enterprises with a household account function.

Make data always available from both "data itself" and "utilized platform" aiming towards data democratization

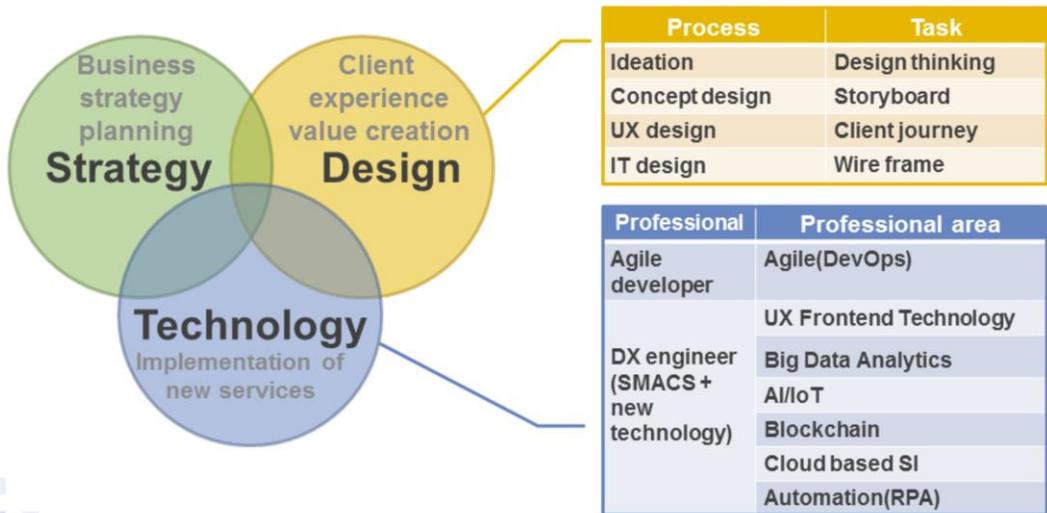


| Data itself | | | Utilized platform | | |
|---|------------------|-------------------------------|--|------------------------------------|---|
| Effective utilization of unstructured data | Informati-zation | Sensitive information secured | Data hub supporting bucket brigade | Scalable and integrated data store | Processing platform tolerating diversified data utilization |
| Maintain freshness and purity of diversified data throughout data lifecycle | | | Respond to the ever-changing demands of diversified business users | | |

In addition, big businesses have a lot of information systems, which are independently created. Currently it is quite difficult to bond and utilize these systems organically. To solve this situation, there arises a stream that data lake, more simply, data warehouse is created, the data is fetched from the current information system and given a meaning for its, then analyzed and utilized. As this business called Data Democratization has been growing significantly, I guess supports are required. Now I have explained Stream II.



Build a DX delivery framework with Agile + Digital capabilities for "business strategy x UX design"



Stream III is a phase in which new business is created. Let me talk about our initiatives for realization of innovative business, including Uber and Airbnb, which destroy existing industries.

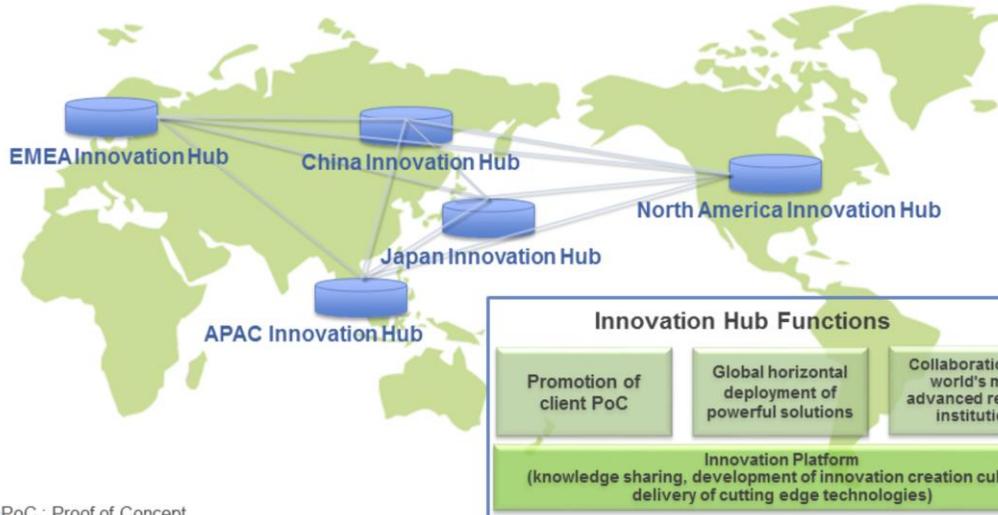
A wording, User Experience, is often used, which means increase of customer values. For that purpose, power to design services is demanded. Adoption of IT for current services does not mean creating a new service as services already exist. In order to such a new mechanism as Uber, we have to think up new services and there are three factors to make it happen; strategy, design, and technology.

Strategy is an area in which business consultants who understand know-how on customers' industries start to think up materials for non-conventional new services.

Design is an area in which non-conventional services are planned. Methodologies, including Design Thinking, Storyboard, and Customer Journey are used there to plan a service for which customers or customers' end users find values.

Technology is a development of conventional information system but technologies used are different. Not to speak of AI, IoT, and Blockchain, etc., development on Cloud has been realized, and engineers who are familiar with development methods including Agile and DevOps are needed.

Build up a structure for creating global innovation through PoC (*) with clients, horizontal deployment of solutions, and collaboration with research institutions



(*) PoC : Proof of Concept

We have been building up a structure to implement the innovation globally. The Technology and Innovation General Headquarters along with overseas group companies launched a virtual organization called Innovation Hub. We are working on activities to make new proposals to our customers there.

Collaboration with universities and venture businesses helps to promote creation and development of innovation

Boston Exponential Hub



MIT media lab
Planned a collaboration project with prospective startups




Autonomous Coaching Robot

Global Hackathon



Final (Barcelona) Nov. 20, 2017

264 teams applied from all over the world
14 teams competed in the final

Participants
UK, Germany, Italy, Romania, everis, NDBS/intelligence, Services(NA&India), Japan

The Open Innovation Business Contest



Final (Tokyo) Mar. 22, 2018

Contests held at 15 cities

Previous highest award winner
A proposal for social problem resolutions by analyzing citizens' opinions with AI or using a payment system with Blockchain (Spain)

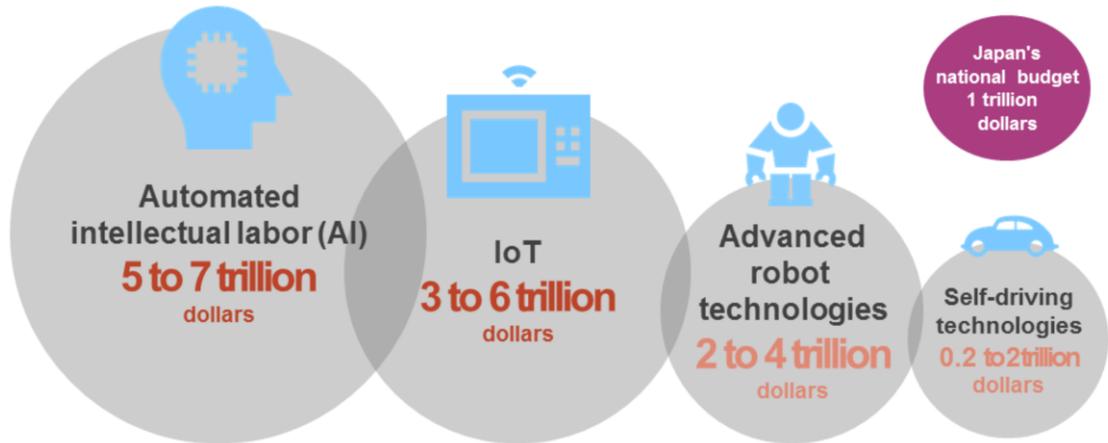
Also, we launched another initiative for Boston Exponential Hub in collaboration with MIT media lab (which is located within the campus of MIT). In addition, Global Hackathon was held for group companies, and a selected team from each region gathers on November 20, 2017 for the final match in Barcelona, Spain. The Open Innovation Business Contest was also held for the purpose of collaboration with startups.

Utilization of cutting-edge technologies - AI/IoT/Blockchain/Security -

Now I think I will finish introducing our activities on the first part, Digital Transformation. The second part is about utilization of such up-to-date technologies as AI, IoT, Blockchain, Security, etc.

Economical Impact of Main Technologies

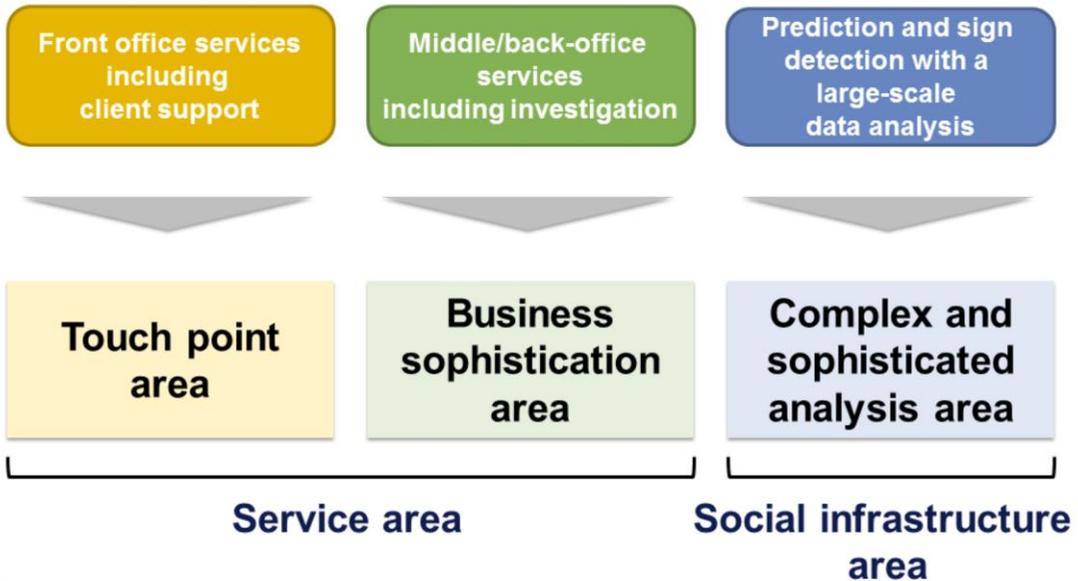
In 2025, economical impact of AI and IoT technologies will exceed the national budget of Japan



Disruptive technologies: advances that will transform life, business, and the global economy
<http://www.mckinsey.com/business-functions/business-technology/our-insights/disruptive-technologies>

This page shows data from the research company. Automation of intellectual labor in which AI takes over human beings has gotten a lot of attention recently. IoT consists of numerous number of devices and the IoT market scale has been expanding.

AI Focus Areas

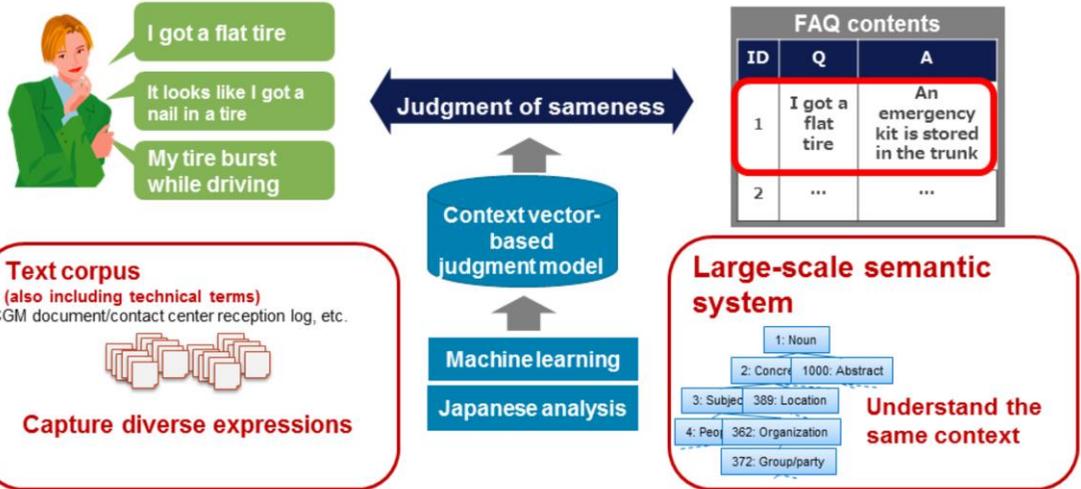


We consider there are three major focus areas in the AI segment. The first one is a customer contact area and front office services including customer support are getting sophisticated there.

Secondly, service sophistication area is where middle- and back-office services including investigation, etc. are getting sophisticated.

Thirdly, prediction and sign detection with a large-scale data analysis. This is the area in which a range of vast data is analyzed to detect a sign, and is considered to be related to services and social infrastructure.

Understanding the intent of a user's question and assisting in providing a correct answer help implement a flexible touch point support (using NTT Group's AI technology "corevo")



Text corpus
(also including technical terms)
CGM document/contact center reception log, etc.

Capture diverse expressions

Context vector-based judgment model

Machine learning

Japanese analysis

| FAQ contents | | |
|--------------|-------------------|---|
| ID | Q | A |
| 1 | I got a flat tire | An emergency kit is stored in the trunk |
| 2 | ... | ... |

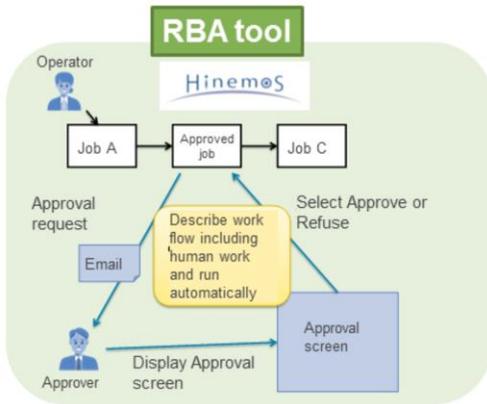
Large-scale semantic system

1: Noun
2: Concret 1000: Abstract
3: Subject 389: Location
4: Person 362: Organization
372: Group/party

Understand the same context

I would like to introduce each of those cases. First I will introduce our case related to a customer support introduced in a call center or contact center. Operators in the contact center receive diversified queries/comments, and it is quite difficult to provide services properly. Though the database stores information on answers to the past queries as FAQ, it is difficult to find a proper FAQ which can answer the relevant query because each customer says differently in his or her way. Our services utilize machine learning technologies in NTT LABORATORIES when a keyword is extracted from voice-recognized results to find an appropriate FAQ, and fuzzy search is also available.

Reduce operational tasks using RBA and RPA tools



A tool used to define, execute, and manage a regular operation process for an operator or a system using a workflow



A tool used to streamline/automate mainly operator services by utilizing a rule engine, machine learning, and AI

I would like to explain about the stuff like middle- and back-office services including investigation, etc. A word, RPA (Robotics Process Automation) has now been quite popular. Routine back office services by BPO have been automated mostly by RPA. Operator works include a lot of operations which can be automated using RPA tools, including a keyboard entry and click of a mouse, etc.

NTT Group also started business using a tool called WinActor developed by NTT LABORATORIES. However, routine services will make a circuit soon, so I guess what is important is to how non-routine services should be analyzed and standardized. We believe that those services could grow into a big business by being combined with AI and new technologies and made more sophisticated and intelligent.

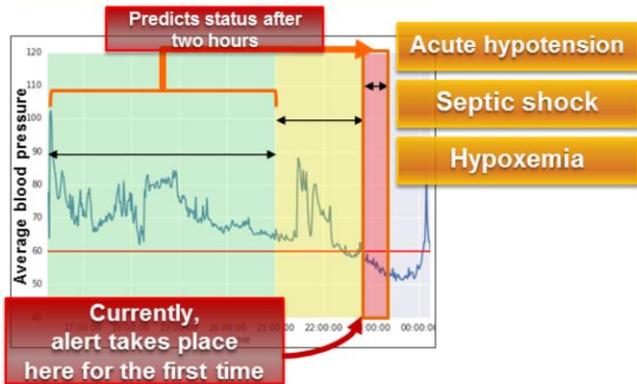
Detects a sign of a patient's deterioration in real time

Develop a predictive model indicating whether the patient might enter a critical condition after two hours or not.

Monitors vital sensor data full-time

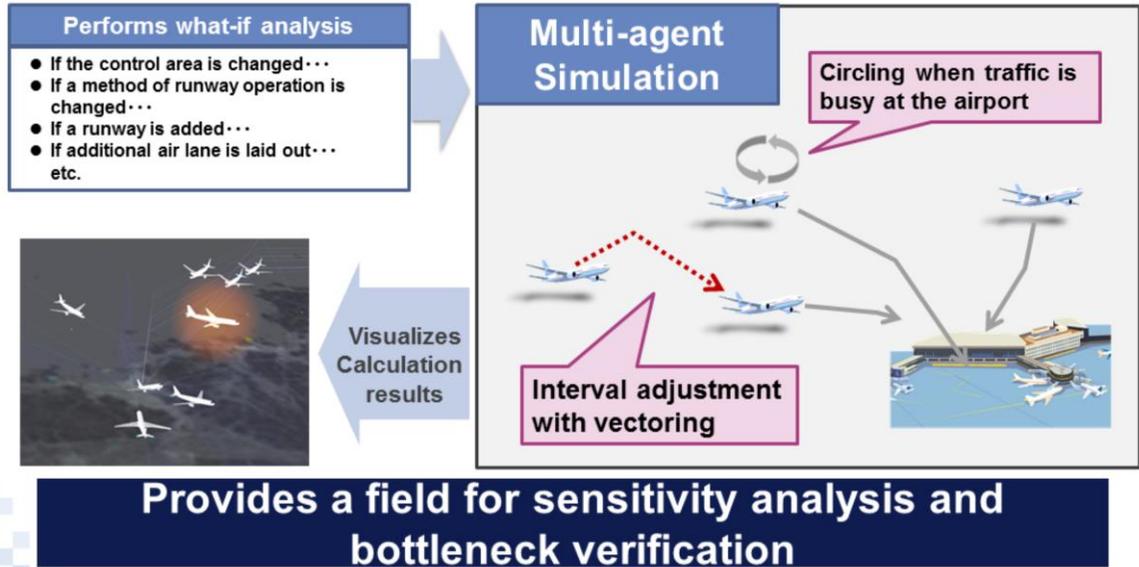


Predicts a symptom and alerts if medication or medical treatment is required.



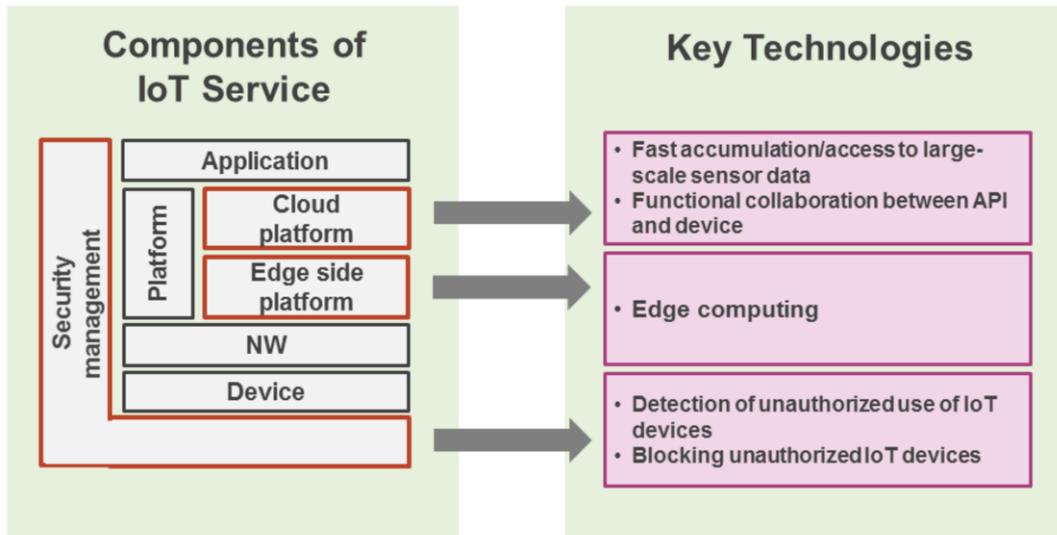
Next, I would like to explain about a case of prediction and sign detection with a large-scale data analysis. We are working on a challenge with a hospital in Spain that we will catch the condition of a critical patient in an Intensive Care Unit (ICU) two hours before he or she falls into a critical condition. A range of devices are attached to the patient in the ICU, and those devices are connected separately. Usually, if some emergency condition happens, more than one alarm will sound, which makes medical staff to rush into the ICU for check. However, catching a sign two hours prior to that condition would help them to respond with appropriate medical care at that point. This is how signals from a range of devices are detected as a sign, and machine learning is also adopted.

Reproduces a behavior of an aircraft in diversified scenarios and performs operation verification



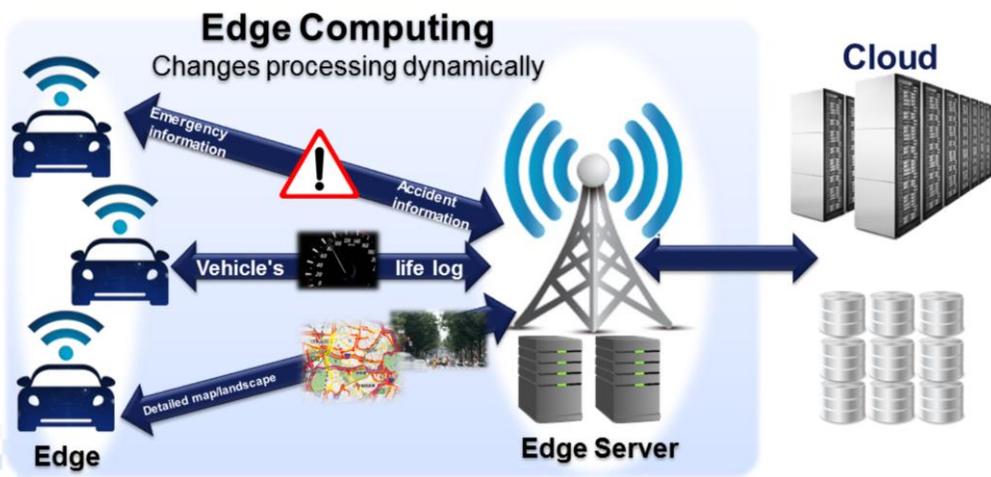
As a familiar example, we evaluate the utilization of this sign detection and complex analysis for the Air Traffic Flow Management of an aircraft. When we board an airplane, a destination airport may be busy, and we have to stand by for boarding because of that. However, if an arrival is one hour later, two hours later or more, nobody knows actually that the destination airport would be busy at the arrival time. We have been working on efforts on complex analysis of weather conditions and flight delay to minimize the standby time.

Support for large-scale data processing, edge computing, and IoT security



Next let me explain about IoT focus area. NTT DATA is not manufacturing and selling IoT devices themselves but is considering services which utilize IoT technologies. Roughly, there are three technical factors we have been working on. In the case of IoT the amount of information is vast, therefore a large volume of data must be processed/stored on a platform on Cloud and be processed in real time sometimes. A technology relevant to those is the first factor. The second factor is Edge side. The technology addresses an issue that the server side cannot catch up with processing unless the device side has to take care of processing for some amount. The third one is a technology which supports growing threats of security due to IoT.

Edge computing to realize large-scale data processing



I would like to explain about a Connected Car as an example of server-side technologies. As the edge sends car information one after another, even if 5G should be born in 2020, sending all information directly to the server side, a communication path and the server might be overloaded. After the edge side should process for some amount to reduce the amount of data, the data should be sent to the server. In this case, a car or base station is treated as an edge. Where and how the data should be processed must change dynamically depending on requirements for services and communication path traffic conditions.

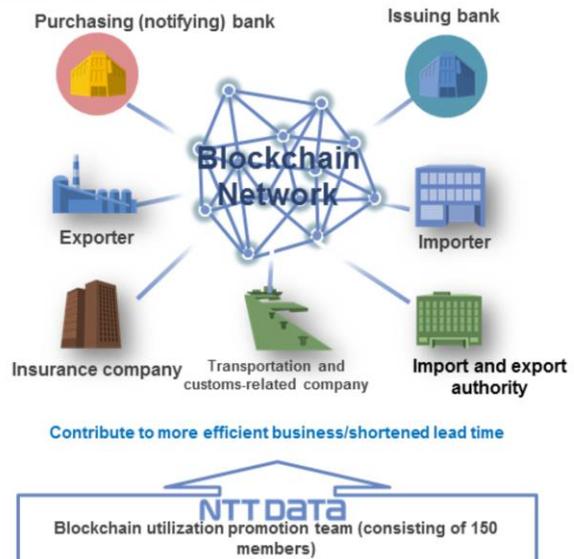
In the case of a car, it directly affects on human life, therefore, a notification may be sent to the driver in real time. For example, when the car detects that a car ahead is braking hard in 300 meters away, the situation at that time decides whether it is good to send a signal to the server, to process the signal at the server, and to notify the driver of the result or it is good to process and judge the signal at the base station on the edge side and to notify the driver of the result. The server has higher performance and can continue a variety of processing, but it should be considered dynamically depending on the situation.

Blockchain

Our operations have been reinforced to leverage blockchain technology, accelerating initiatives to co-innovate with clients and help transform business in arenas such as trade finance

Co-Innovation

- Promote PoCs (*) to which Blockchain technology is applied. 15 cases including overseas have been completed, and 20 cases are ongoing
- Consortium established with 13 companies representing each industry

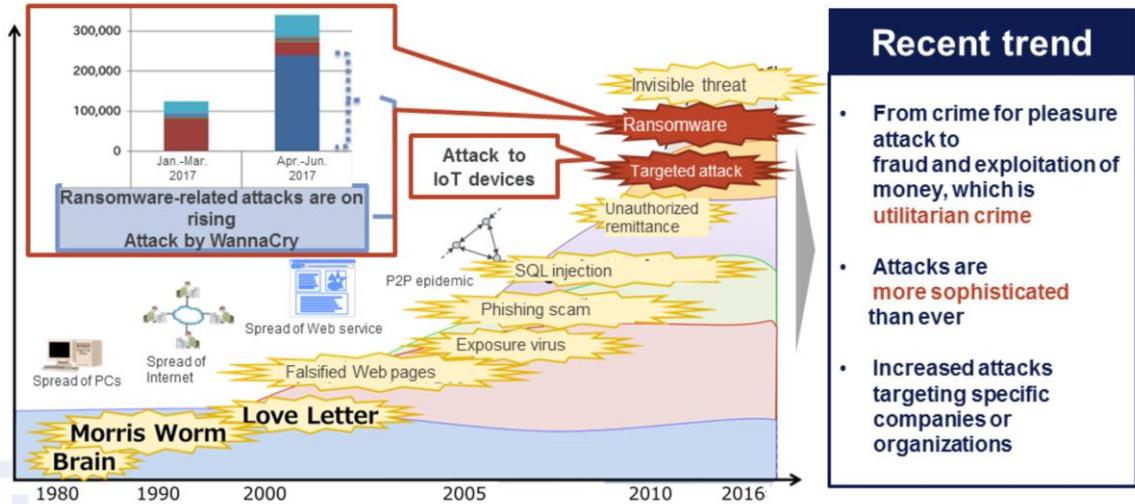


(*) Proof of Concept: Examination of a prototype system

Next is about Blockchain. As you already know, Blockchain is used as virtual currency in some cases, and there are PoC taken place in different situations. Currently, though we think it is very difficult to replace a large-scale mission critical system with Blockchain, we consider Blockchain is effective in a trade/financial area where a lot of players are involved, a system where real time responsiveness is not demanded that much, and a system where records are stored securely. We are still on the way of deciding how it should be used where.

Trend in Security Threats

Security threats are increasing and getting more sophisticated. It is important to have countermeasures in place before incidents occur.

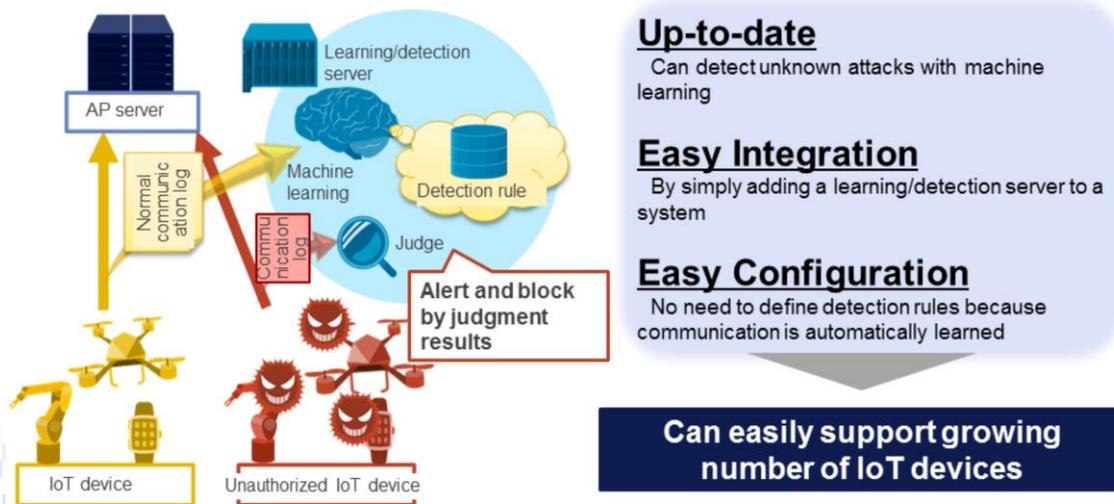


[Source] Status of reports and consultations regarding computer virus / unauthorized access [2nd Quarter (April - June) of FY2017]
 (IPA) <https://www.ipa.go.jp/security/txt/2017/q2outline.html>

(Description Abbreviated)

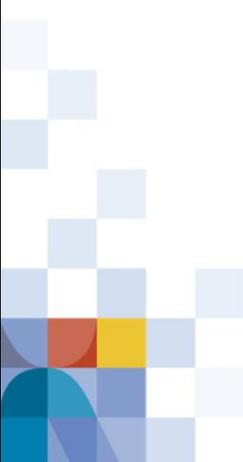
Unauthorized Device Detection / Isolation Technologies

Detect and block threats by unauthorized access or malware infection including unknown attacks to an IoT system



Finally, I would like to explain about security. An enterprise system is always threatened by security issues. IoT devices are hijacked and attacks may start there. We are using technologies from NTT LABORATORIES that communication from a suspicious communication provide will be shut down once a suspicious communication is detected at the server side.

Now I have finished briefing from the Technology and Innovation General Headquarters.



NTT Data

Global IT Innovator

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