A research study on the Information Sharing/Exchange System During Construction

June 2012

Japan Construction Information Center Foundation

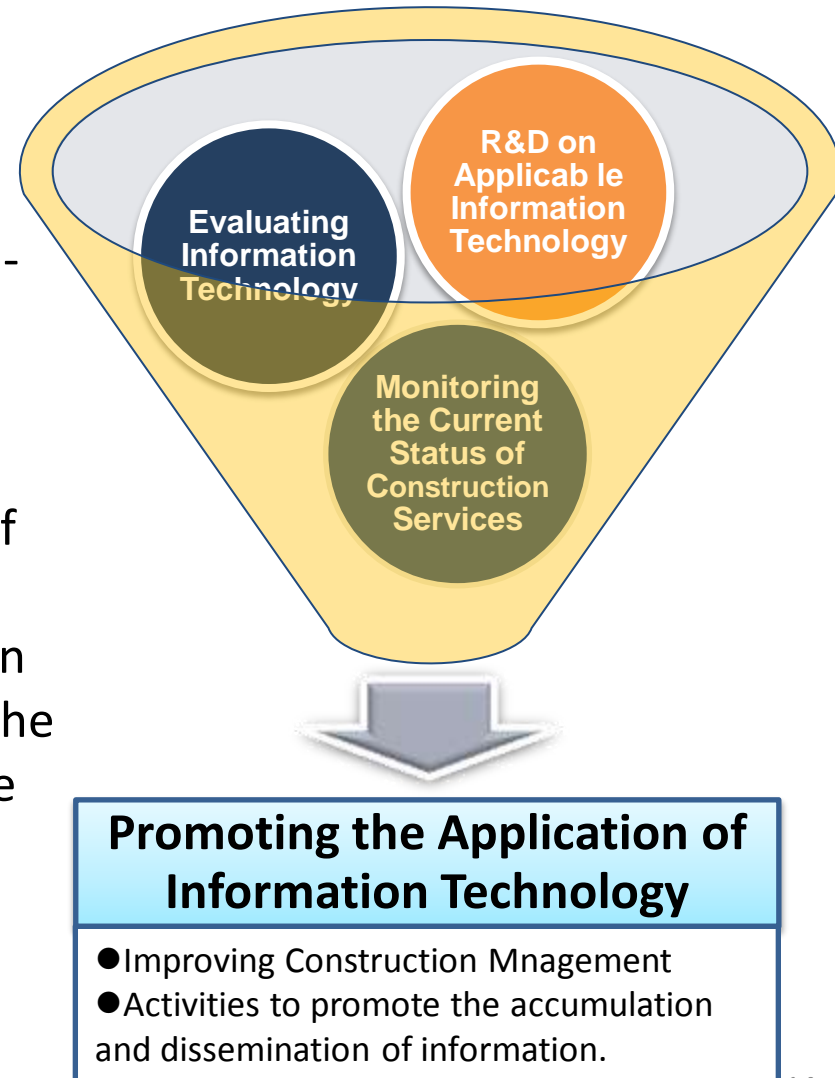## Chief Researcher

Katsunori Miyamoto

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JACIC

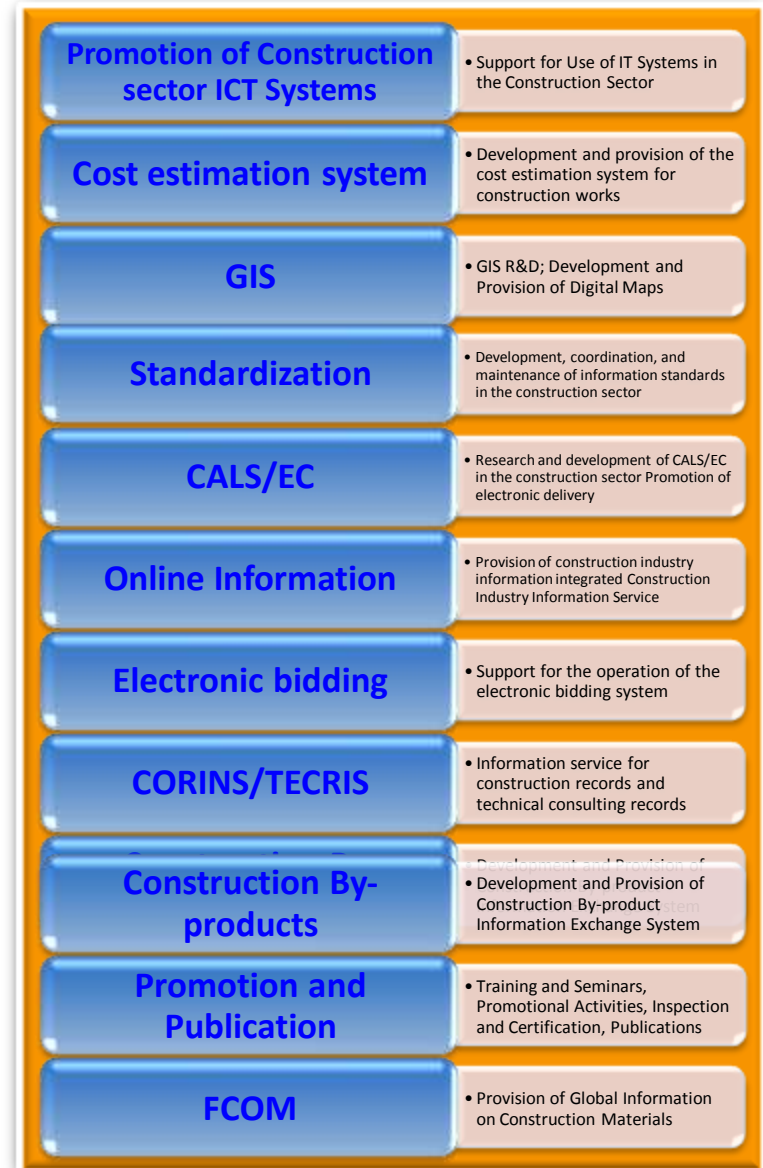# 1. Introduction - About JACIC is pronounced "jassik" -

JACIC is

◆ My organization is improving construction-related information service through information technology.

◆ Since its founding on Nov. 15, 1985,the JACIC has been conducting a wide range of activities for digitization of construction sector information so that the construction industry as a whole can be responsive to the challenges of an intelligent society and the demands.

Evaluating Information Technology

R&D on Applicab le Information Technology

Monitoring the Current Status of Construction Services

Promoting the Application of Information Technology

● Improving Construction Mnagement
● Activities to promote the accumulation and dissemination of information.

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1. Introduction - About JACIC -

JACIC is

■ Improving Construction Management

■ Collection, Processing, Storage and

■ Promotion Activities

|	
Promotion of Construction sector ICT Systems	• Support for Use of IT Systems in the Construction Sector
Cost estimation system	• Development and provision of the cost estimation system for construction works
GIS	• GIS R&D; Development and Provision of Digital Maps
Standardization	• Development, coordination, and maintenance of information standards in the construction sector
CALS/EC	• Research and development of CALS/EC in the construction sector Promotion of electronic delivery
Online Information	• Provision of construction industry information integrated Construction Industry Information Service
Electronic bidding	• Support for the operation of the electronic bidding system
CORINS/TECRIS	• Information service for construction records and technical consulting records
Construction By-products	• Development and Provision of Construction By-product Information Exchange System
Promotion and Publication	• Training and Seminars, Promotional Activities, Inspection and Certification, Publications
FCOM	• Provision of Global Information on Construction Materials

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2. Past Process and Background

What CALS/EC?
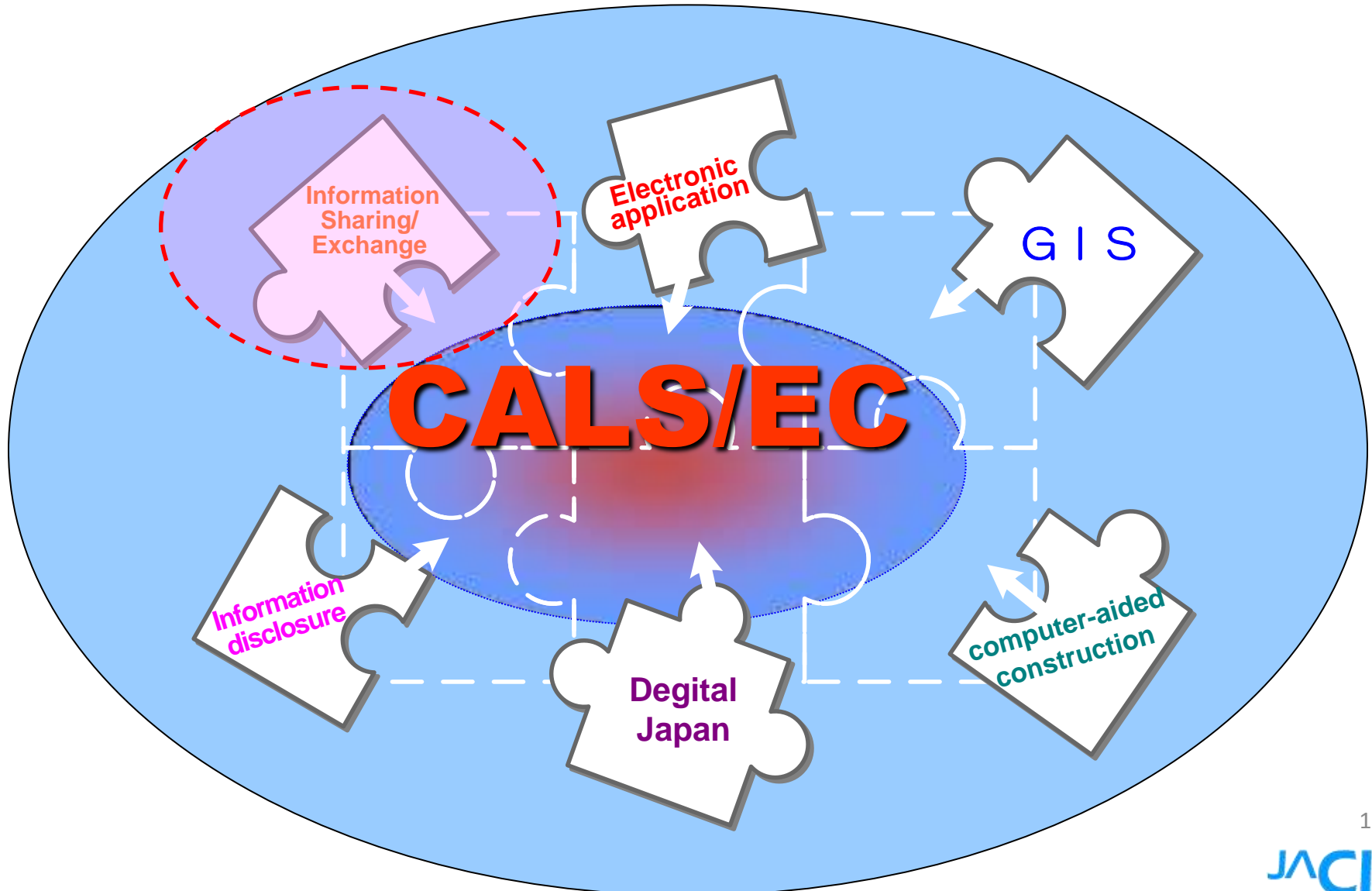
2. Past Process and Background(About CALS/EC)
Yearly Targets for Local Promotion

Targets for Yearly Plan Ministry of Land, Infrastructure and Transport's Targets for Supporting CALS/EC Introduction

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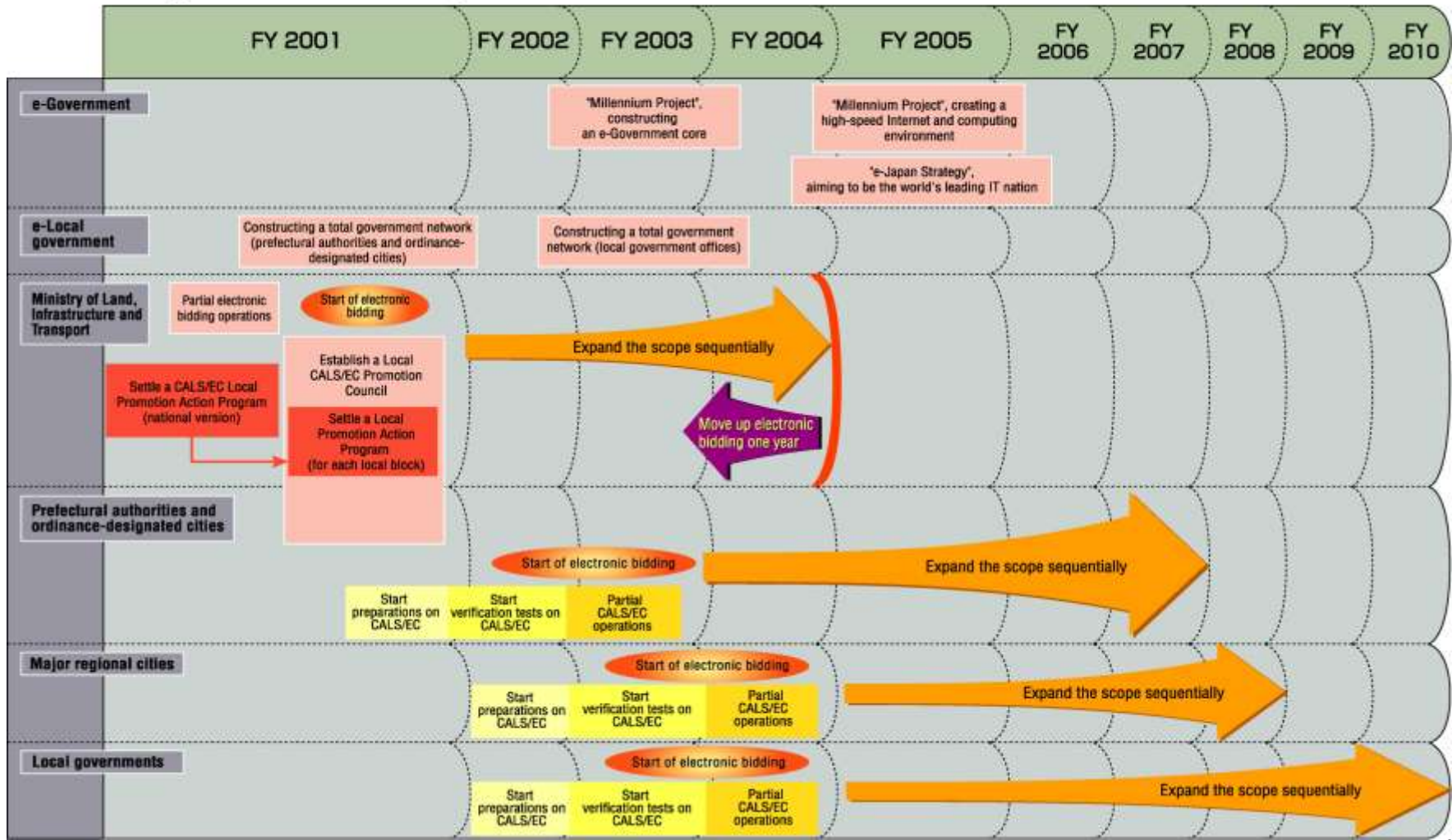
2. Past Process and Background
Innovation of construction works system！

In CALS/EC which Ministry of Land, Infrastructure and Transport promotes,
Concept ⇒ Planning in 1996 :
- Electronic use of information through standardization
- Exchange and sharing electronic information
- Use of ICT

Purpose of CALS/EC:
◆ MLIT :Ensuring quality, lowering construction costs, and speeding up project implementation
◆ Contractor :Improving work process at construction site
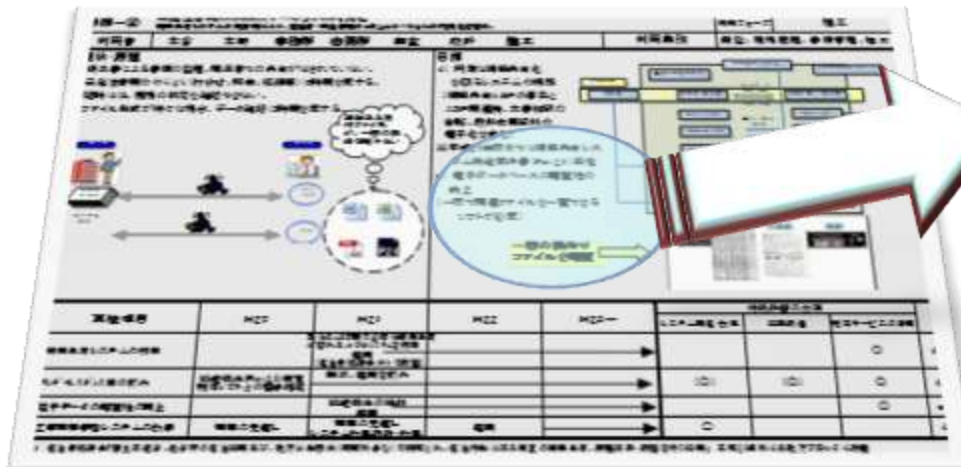
d) build of system planning smooth information communication (including the spread of information sharing system ASP and interchange between ASP, omit sealing, elecrtonic documentation of the design change document)

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3. Works to be Exchange/Sharing Model
Breeding of "Place of Creative Knowledge"

The way of thinking is "SECI Model of Knowledge Management "
  Tacit Knowledge considered to be it expresses **S**ocialization as form Explicit Knowledge and **E**xternalization and is **C**ombination and does **I**nternalization.

Tacit Knowledge

Tacit Knowledge

Socialization

Externalization

Explicit Knowledge

Internalization

Combination

Explicit Knowledge

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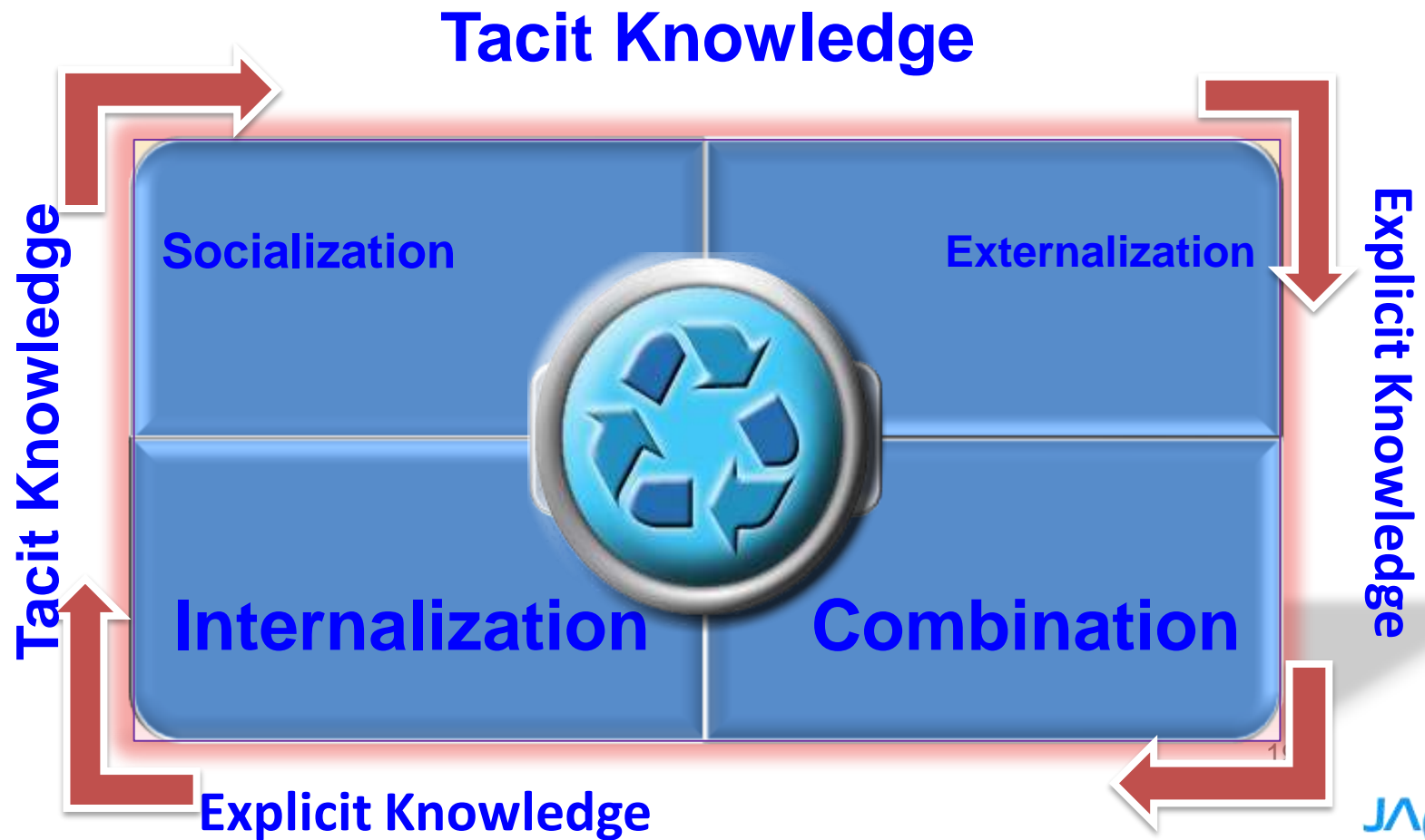
Necessity : Why?

The Information Exchange/Sharing/+Interchange System

Need of Common Data Coordination tool.

◆ The trial the Information Exchange/Sharing System more than about 13,000 carried out.
◆ On the other hand, ASP is used in the construction of local public entity and contractors ordering .
◆ Both actions that expanded the range together are pushed forward and are expected as the efficiency of duties to rise and a tool to improve.
◆ In the ASP company, service is provided now system and solution system, various types of industry including the company pro- construction, the company of the scale.

gathered by the next opinion from both Contractor and Orderer.

◆ It allows ASP which Orderer contracted to Data Coordination with ASP using in a company(Contractor)
◆ If ASP is different , the use by plural construction is difficult. They want unified ASP to Data Coordination (Orderer)
◆ They want to continue the data which I used in ASP in front even if ASP which I contracted changes and want to use it (both Contractor and Orderer)
◆ They want to do it equally in different ASP to be control same by different types of cars (both Contractor and Orderer)

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The Information Exchange/Sharing/+Interchange System

Verification the effectiveness of Data Coordination methods

The examination at the place of the construction information sharing Network and proof experiment
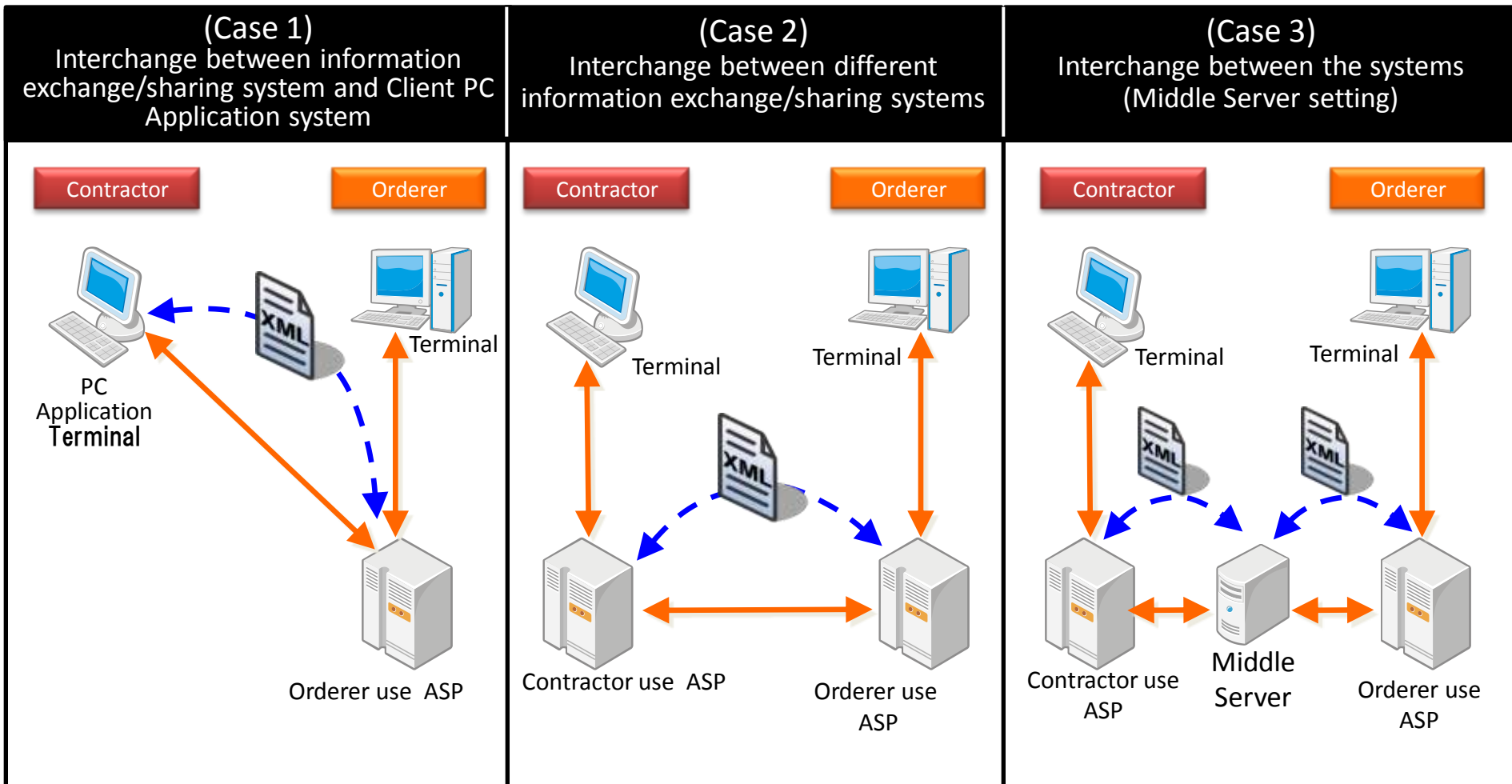
⬇

Extraction of Data Coordination Method

■Case1: Data Coordination method between the client PC application

■Case2: Data Coordination method between different Information Sharing/Exchange System

■Case3: Data Coordination (middle server) method between the system

⬇

By collaboration with ASP vendors , we carried out a proof experiment of the cooperation between ASP system about two methods (case1, case 2).

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The data Interchange method between the information exchange/sharing systems
3 Cases：Extraction of the data Interchange method

(Case 1) Interchange between information exchange/sharing system and Client PC Application system	(Case 2) Interchange between different information exchange/sharing systems	(Case 3) Interchange between the systems (Middle Server setting)

Case 1

Contractor — Orderer

PC Application Terminal

XML

Terminal

Orderer use ASP

Case 2

Contractor — Orderer

Terminal — Terminal

XML

Contractor use ASP — Orderer use ASP

Case 3

Contractor — Orderer

Terminal — Terminal

XML   XML

Contractor use ASP — Middle Server — Orderer use ASP

The data Interchange method between the information exchange/sharing systems

3 Cases：Extraction of the data Interchange method

■**Case 1:** **Interchange between information system and Client PC Application system**

When an on-site communications infrastructure thinks about the use at the low speed, this case is a method chosen among a point of view to allow to use it in offline.

■**Case 2:** **Interchange between different information systems**

Exchange agreement is necessary for the combinatorial number to take r unit out of a thing of n unit varying in different ASP in the case of n unit is $nCr = n!/(n-r)! \, r!$. For example, when 10 different ASP is objects; $10C2 = 10!/(10-2)!$ An exchange agreement of $= 45$

■**Case 3:** **Interchange between the system(Middle Server setting)**

Compatibility (Interoperability) rises by locating "Middle Server" to mediate between different systems seamlessly, and relief, security can wipe out the problems such as original-related guarantees to modify exchanges cooperation with problem of ,case 1,2 and one to one because it is possible for the exchanges that cooperated.
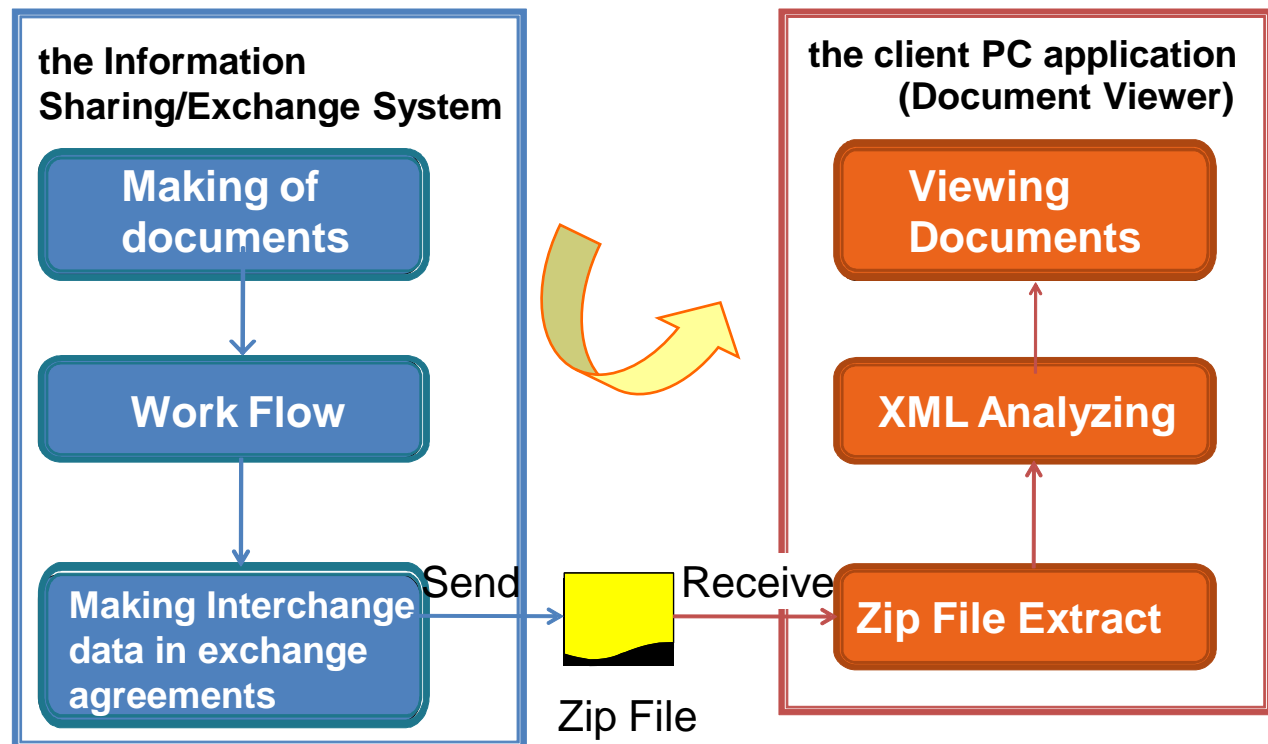
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4. Experiment , analysis and result

Case1: Proof experiment of the client PC application Data Coordination

Enforcement and inspection

① Purpose of the experiment
② Experiment contents

Processing Flow >>

the Information Sharing/Exchange System

Making of documents

↓

Work Flow

↓

Making Interchange data in exchange agreements

Send → Zip File → Receive

Zip File

the client PC application (Document Viewer)

Viewing Documents

↑

XML Analyzing

↑

Zip File Extract

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4. Experiment , analysis and result

Case1: Proof experiment of the client PC application Data Coordination

③ **Experiment finding**
Five standards documents all was able to reappear.

④ **Problem**
● Standardization of Interchange data to include such as system and process information.

the Information Sharing/Exchange System

the client PC application (Document Viewer)

Results >>

Zip File

Work flow meta data is lack

Call attached file

XML Analyzing + Viewing Documents

Case2: Proof experiment of the cooperation between the different Systems

Enforcement and inspection

① Purpose of the experiment
② Experiment contents

Processing
Flow >>

(A) the Information Sharing/Exchange System

- ✓Schedule
- ✓Meeting book

Making Interchange data in exchange agreements

Zip File archive

Exchange File

Send → Zip → Receive

(A) the Information Sharing/Exchange System

Viewing Documents

Receive CSV

Zip File Extract

Viewing Documents

Receive CSV

Zip File Extract

Receive ← Zip → Send

Exchange File

- ➢Schedule
- ➢Meeting book

Making Interchange data in exchange agreements

Zip File archive

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4. Experiment , Analysis and Result

Case2: Proof experiment of the cooperation between the different Systems

③ Experiment finding

I was able to reproduce "construction number , user number" precisely at the data item "planned title" "place , contents" "start number , end time" of the schedule.

④ Problem

● The choice of the library (archive) form of the file suitable for Data Coordination

■Schedule Infomation

Results >>

■Meeting book

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4. Experiment , analysis and result

Case3: Proof experiment of Middle Server between the systems

The experiment by Middle Server Method in new module and experiment environment for proof is expensive, I assumed it an experiment at the on
• Middle Server by the third party with reliable system
• Common infrastructure to provide open API according to Data Coordination Agreement

① Purpose of the experiment

Prospective assumption effect by Middle Server Method to give next –

② Experiment contents(Inspection contents of the assumption)

[*Scene I*] when Contractor proposes it, and Orderer receives it
a. Making documents by Contractor System ⇒b. In Contractor transmission folder of Middle Server documents transmission (Push Method) ⇒c. Orderer system takes it in Contractor system and carries it out (Pull method)

[*Scene II*] When Orderer proposes it, and Contactor receives it (approved and return)
a. Making documents by Orderer system ⇒b. To Orderer transmission folder of Middle Server documents transmission (Push Method) ⇒c. Contractor System takes it in a Orderer system and carries it out (Pull Method)

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The data Interchange method between the information exchange/sharing systems

Method of enforcement and the inspection of the data Interchange experiment

■ Proof experiment of the data Intechange (Middle Server) between the system

I carry out the inspection (plan) of the middle server Data Interchange method that assumed a scenario scene on the desk
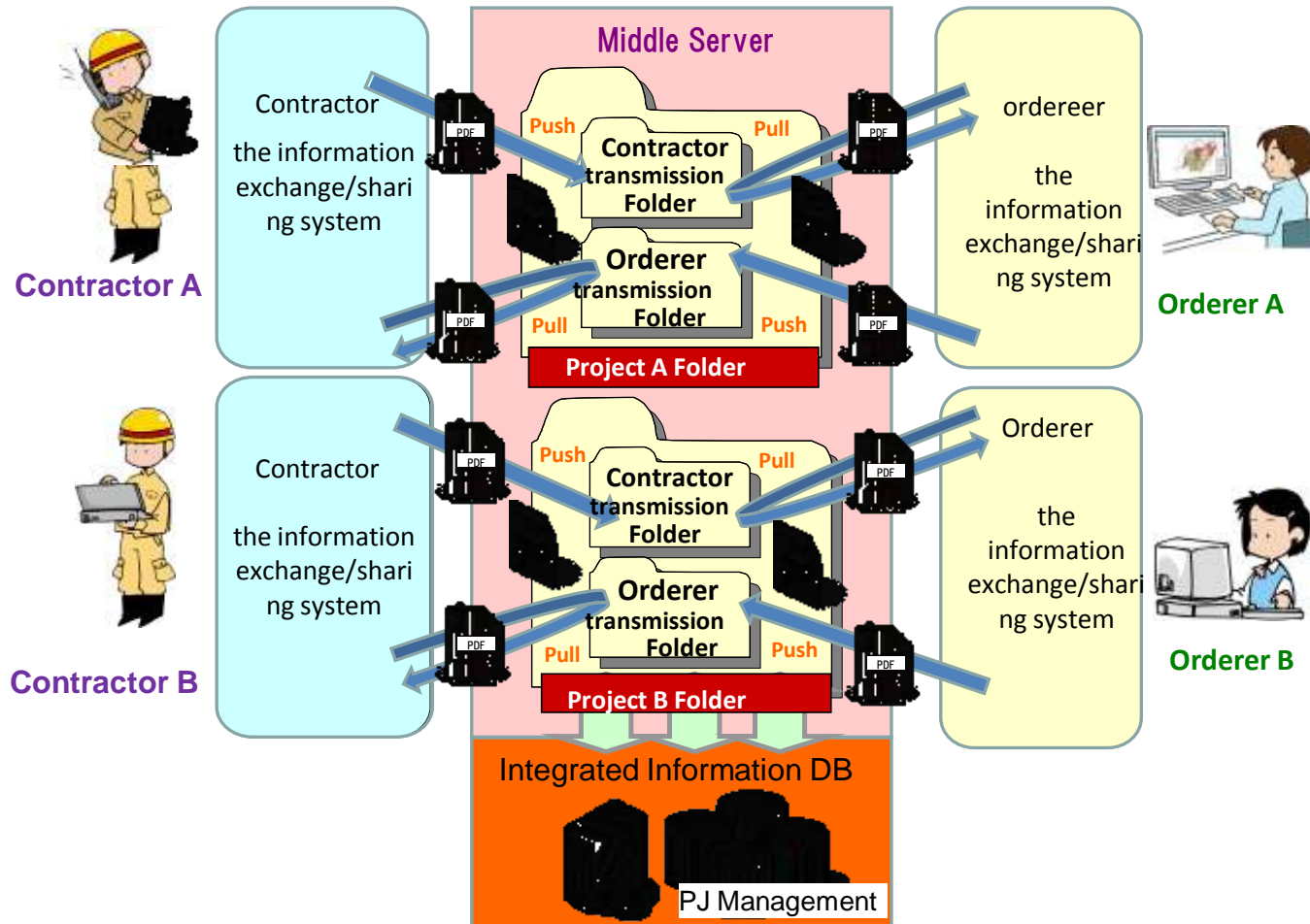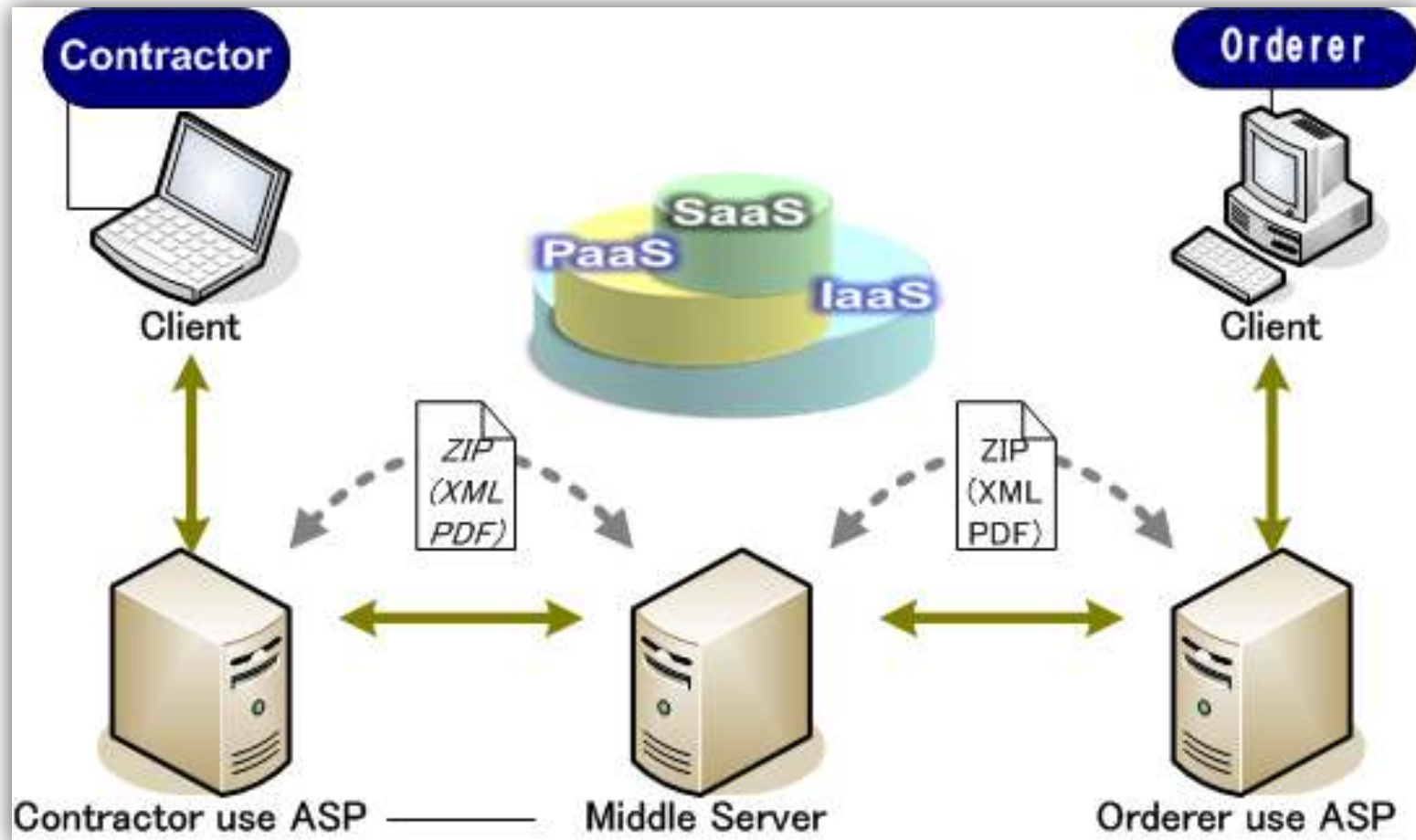
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4. Experiment , analysis and result

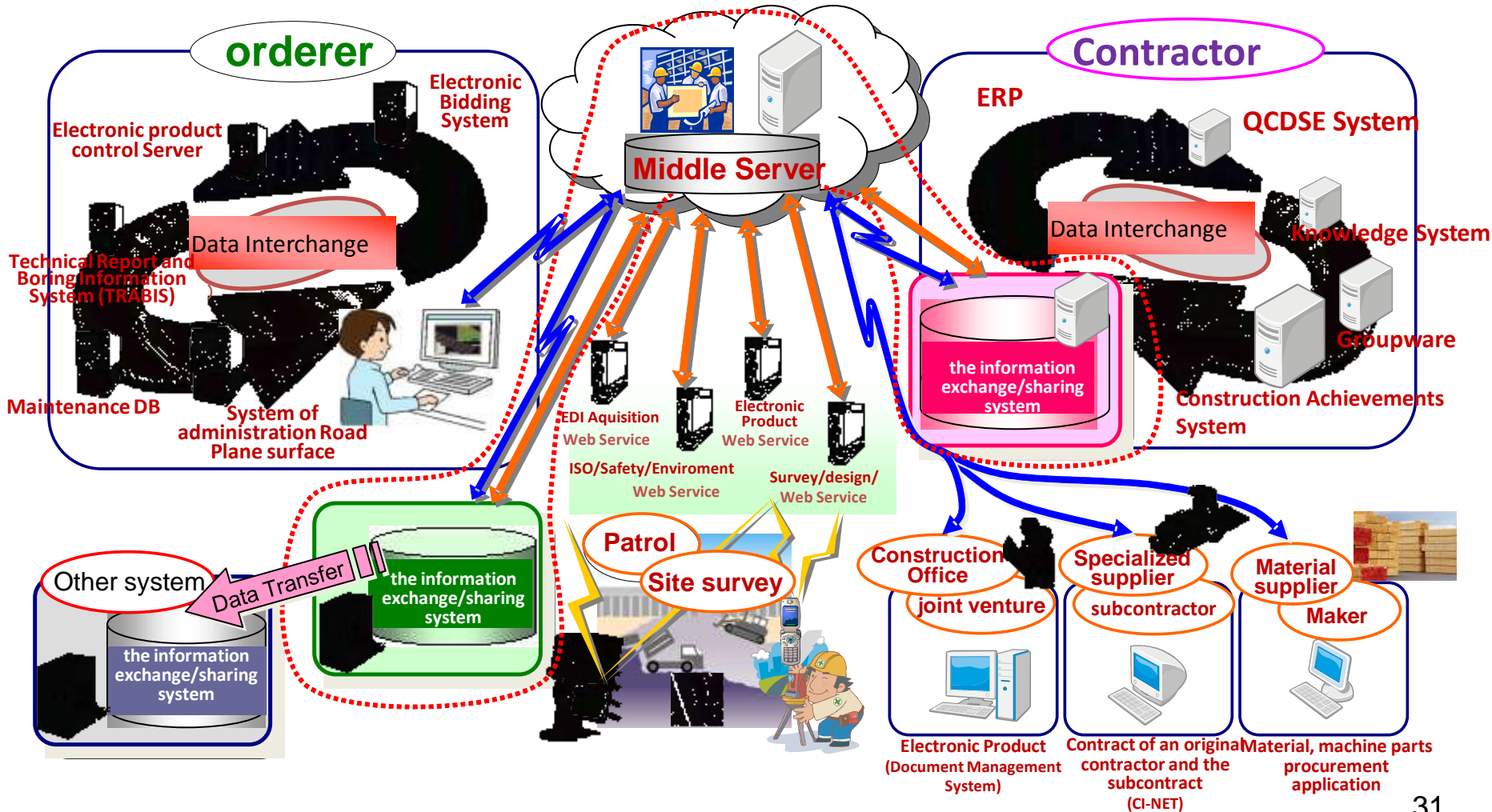## Case3: Proof experiment of Middle Server between the systems

③ The Assumption Problem
◆Confirmation processes increase in comparison with Method between the system
◆Development , Maintenance , Administration by neutral fair composition is necessary
◆the collection of use charges is difficult to assume this model a service model

The Data integration Image

About a development plan of The Data Interchange

Field of the data Interchange between different information exchange/sharing system

orderer

Contractor

Electronic Bidding System

Electronic product control Server

ERP

QCDSE System

Middle Server

Data Interchange

Data Interchange

Technical Report and Boring Information System (TRABIS)

Knowledge System

Maintenance DB

System of administration Road Plane surface

the information exchange/sharing system

Construction Achievements System

Groupware

EDI Aquisition
Web Service

Electronic Product
Web Service

ISO/Safety/Enviroment
Web Service

Survey/design/
Web Service

Other system

Data Transfer

the information exchange/sharing system

the information exchange/sharing system

Patrol

Site survey

Construction Office

joint venture

Specialized supplier

subcontractor

Material supplier

Maker

Electronic Product
(Document Management System)

Contract of an original contractor and the subcontract
(CI-NET)

Material, machine parts procurement application

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5. Framework for Service Model in JACIC Cloud

~ Perspective of the service model~

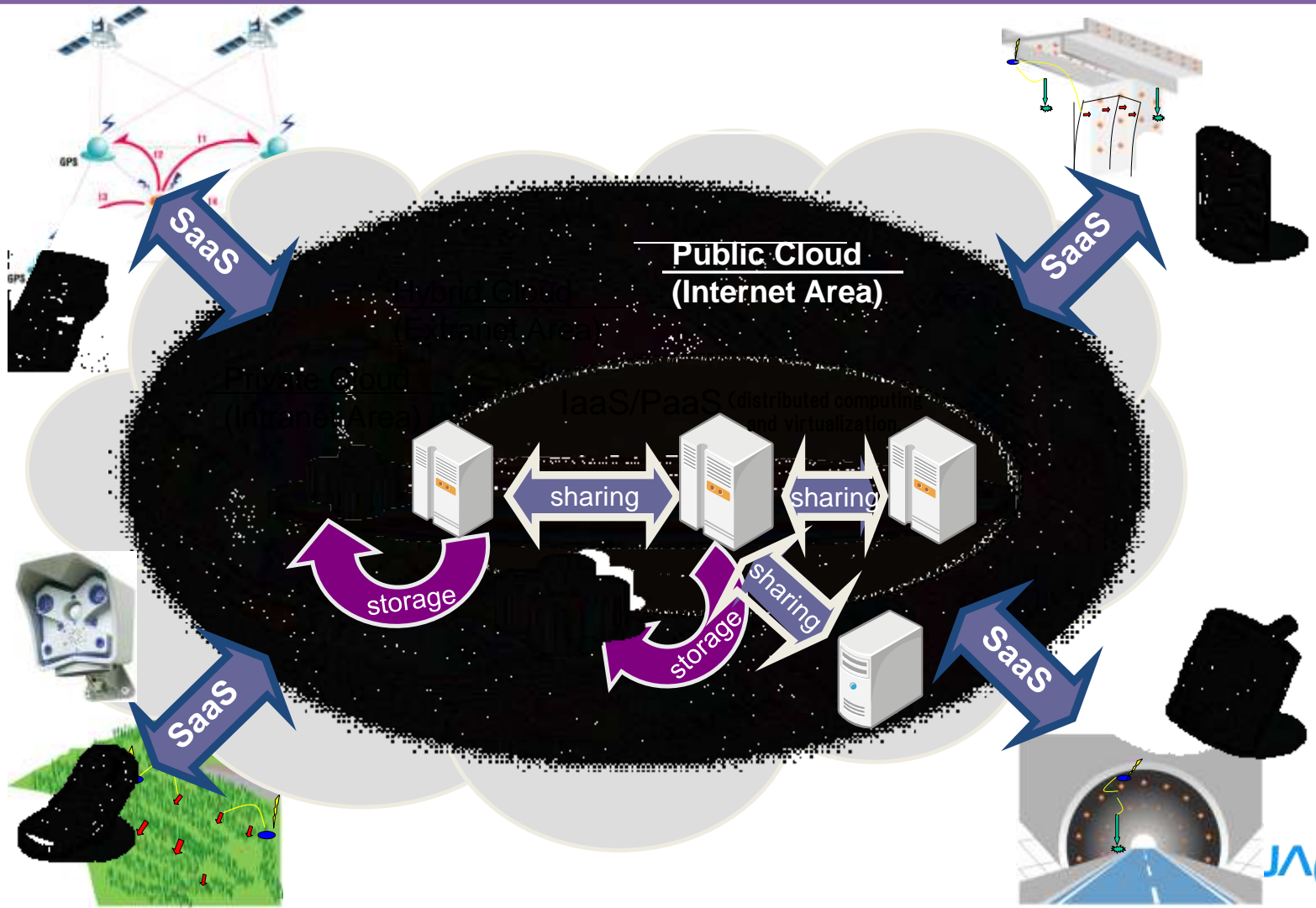A study of a new service model bundled up the representative and effective resource in construction marcket is to provide in combination by one stop possibility.

Resource Provider (company/group)

- Operating System/GW Vendor
- Procurement/Estimation system
- Surveying company
- Construction/CM Companies
- Maintenance/PM/FS Companies
- ASP Vendor
- CAD Vendor
- OCF (Open CAD Format Council)
- GIS Vendor

System supply

Software supply

Service supply

JACIC Coud Platform

Web Service

service user
(Procurers, construction company, construction consultancies, Citizens)

SaaS
- Procurement Management
- the Information Sharing/ Exchange System
- Cost Estimation System
- Maintenance System
- CAD/ GIS

PaaS
- Shared Integrated Database
- System Sharing/KM/ Integrated Management

IaaS
- Storage/version Management

One Stop Service

Mash up

Aggregation Service

Mining Service

Cafeteria Method (Multi-Tenant)

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# 6. Collaboration with mobile device and the cloud
~ The good use of mobile device in JACIC Cloud ~

The cloud is not almighty , so handling of the confidential information should use "Hybrid Cloud" located between public cloud and private.

SaaS

SaaS

SaaS

SaaS

Public Cloud (Internet Area)

Hybrid Cloud (Extranet Area)

Private Cloud (Intranet Area)

IaaS/PaaS (distributed computing and virtualization)

sharing

sharing

sharing

storage

storage

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Work items:Set core of tools for civil engineering works.
Cordination with Mobile and Cloud.
- Good practice of mobile device in the cloud -
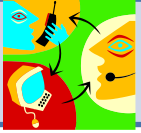
"Times of Multi-device" variety of Tablet-shaped media terminals come up, and to manage the information terminal of several kinds alone.

Smartphone, the thing such as the combination of connectibility such as the drawings which are sensible by performance enhancement and GPS position and map of the network is possible easily.

Ubiquitous environment where "Possible in anything, anytime, anywhere, anyone" and Could became feasible, because Mobile and Cloud fused.

The use as social infrastructure maintenance service such as maintenance and the disaster prevention of civil infrastructure by connecting analyzed context with the information of sensor.

"World Camera" of Mobile in grasps position, direction, behavior of the carrying with the sensors such as electronic compasses in real time and carried out free "Collective Knowledge Service" such as AR(Augmented Reality) to display meta data to picture.

Thinking to just use collected data without the second processing and arranging again. Indispensability for measurement equipment and survey equipment ,and Mobile with the system of the cloud use.

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Improvement of efficiency in disaster restoration

A plan of information management, available usage from normal time.

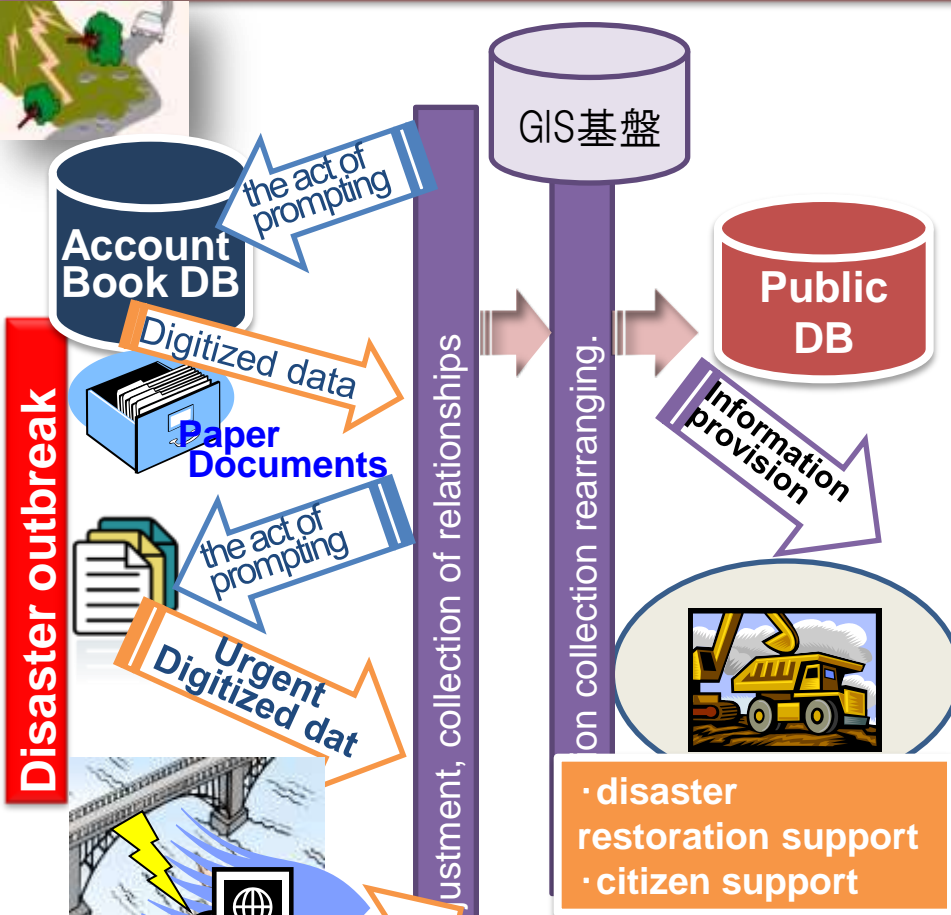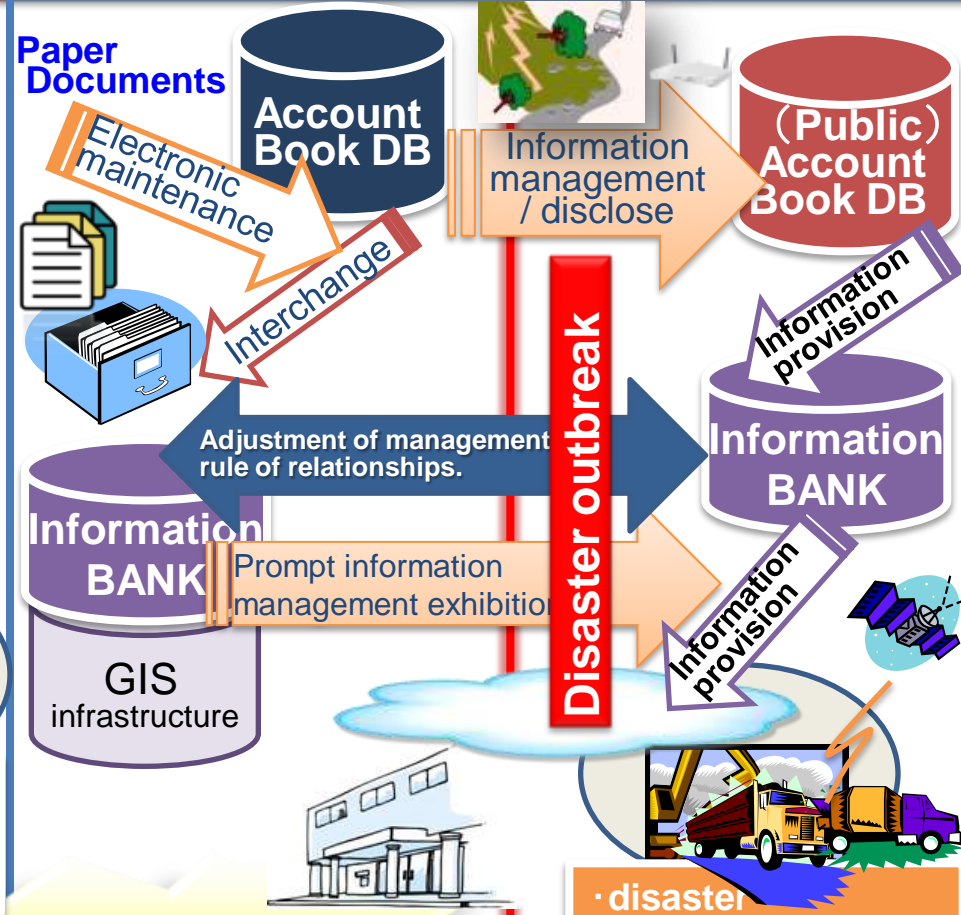| As is	To be
Problem 1: Framework of constitution ➢ The whereabouts of necessary data are unidentified at the time of disaster. ➢ There are not the resource of each organization, information sharing and interchange, a joint ownership method. ➢Not the quick use at the time of disaster for the information management of at normal time.	**Solution 1: Assemblies of the scheme From normal time** ➢ Rule of the information use at the time of disaster. ➢"Information Bank" architecture. ➢The scheme of the quick construction at the time of disaster.
Problem 1: Work items and elemental technologies ➢The available elemental technology existed, but did not lead to the quick use.	**Solution 2: The combination of elemental technology use.** ➢ MMS:Mobile Mapping System for Investigation in road traffic conditions. ➢ QZSS: Use of Quasi-Zenith Satellite System.

Improvement of efficiency in disaster restoration

A plan of information management, available usage from normal time.

As is

GIS基盤

Account Book DB

the act of prompting

Digitized data

Paper Documents

the act of prompting

Urgent Digitized dat

Present situation survey data

Disaster outbreak

adjustment, collection of relationships.

on collection rearranging.

Public DB

Information provision

· disaster restoration support
· citizen support

To be

Paper Documents

Electronic maintenance

Account Book DB

Interchange

Information management / disclose

（Public） Account Book DB

Information provision

Adjustment of management rule of relationships.

Information BANK

Prompt information management exhibition

GIS infrastructure

Disaster outbreak

Information BANK

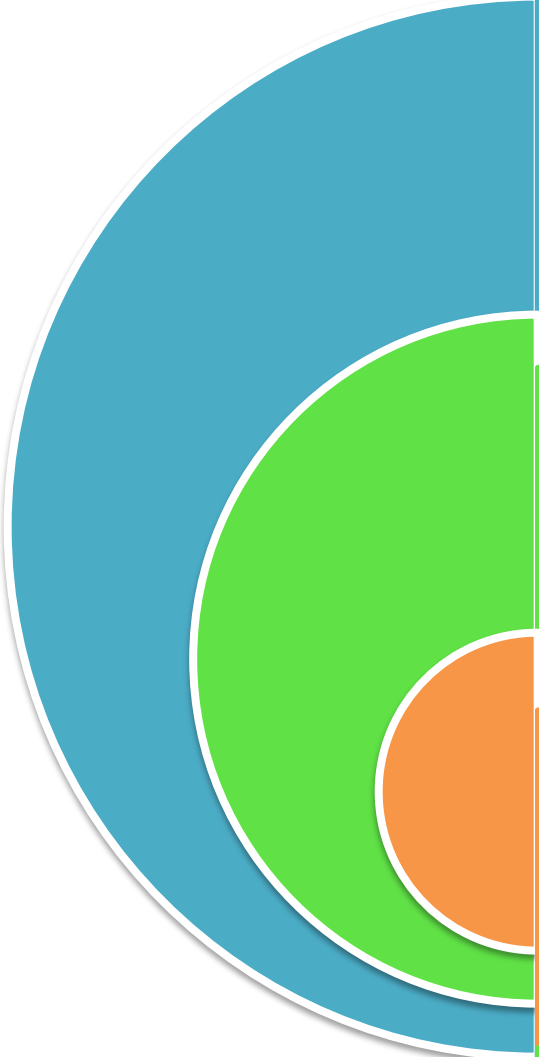Information provision

· disaster restoration support
· citizen support

To decide the management method at the time of disaster of data, and to usually push forward construction and use of the cooperation base including a "Information Bank" from normal time.

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7. Conclusions

For the realization of this service model , integrated information sharing/exchange system to carry public service is one end of "Construction Cloud" , to promote facilitation of communication , to create a new service that applied Big data to occur in a construction sector.

We want to go ahead through a construction technology of our country and fusion of the ICT advanced technology and the study for creation of the innovation by the synergy to help the international competitiveness that allied result is necessary for engineering works technology export.

Toward the suggestion of neutral fair structure "JACIC Cloud" which we made use of JACIC' strength in, we get the cooperation of the person concerned and, based on the technical institutional inspection and sophistication of this service model idea, wan to go ahead through this study.

JACIC

Thank You very much for your kind Attention .

JACIC
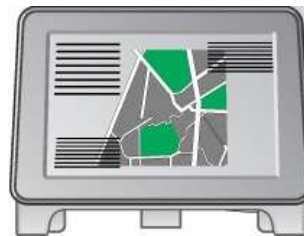
質疑応答

■ 質問事項
　研究成果の異なるシステム間連携の仕組みの検証をどのように行ったのか。また、本成果の具体的な展開方法について述べてください。

■ 回答
　検証前に、ASP利用者とサービス提供者双方にヒアリングを行い、課題分析を行った。それら結果を踏まえて具体的なプロジェクトを想定し、ユースケース・機能分析を行った後、シナリオプランニングに沿ったテストデータを作成し、一部実システムでの連携実験を行った。

　今後、これら成果を踏まえて、JACICでは受発注者間のニーズ・シーズの橋渡しを行い、建設生産システムのイノベーションを行うことを目標にクラウドを基盤とした、データベースと多様なデバイスをつなぐプル型のデータマイニング機能を持つ、サービスモデルの実現を目指している。今回の成果を連携支援モジュールとして相互接続性を高めて確立し展開を図りたい。例えば、ebXML（ebMS）連携技術による、プロジェクトの全フェーズから、プロダクトモデルへの同時アクセスを可能とし、構成するライブラリを効率よく整備、活用可能な仕組みを創出するなど、建設分野でのコンカレントエンジニアリングの実現に向けて継続した研究を行う予定である。

発表紹介

Development of the concentric reticle "Baum" for optical surveying   instruments
 「光学測距儀同心円十字線"目盛"の開発」
Kazuhide Nakaniwa
Kansai Construction Survey Co., Ltd., Japan,
Nobuyoshi Yabuki
Division of Sustainable Energy and Environmental Engineering, Osaka University, Japan
Takashi Kitayama
Nishio Rent All Co., Ltd., Japan
Tatsunori Makizumi
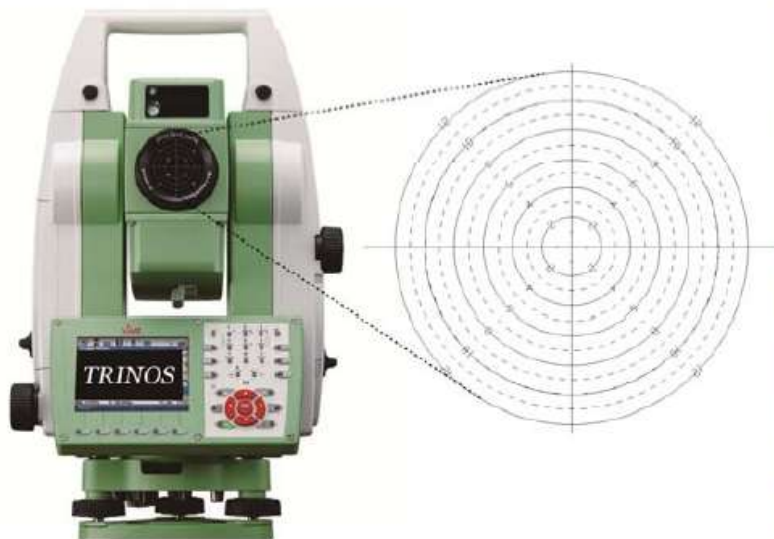*Kyushu Kyoritsu University, Japan*
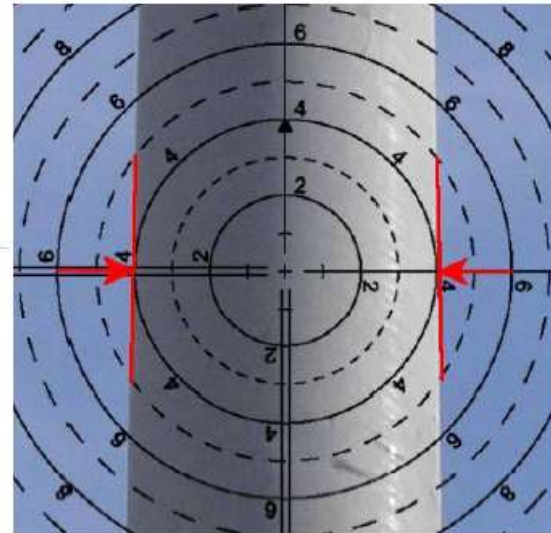
Figure 2. A TS with the Baum.

Figure 3. Measuring a cylindrical structure.

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Closing Ceremony

6月29日（水）18:00:～23:00

Conference banquet

- 矢吹先生、中庭氏

- Cathedral of Christ the Savior

- 八巻さん夫妻

- 日本からの参加者

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ICCCBEの今後の開催

- 次回2014年開催は、米国フロリダ、オーランド。

- 2016年開催は、大阪に決定。

  大阪 vs フィンランドの決選投票で12：1で勝利。矢吹先生の大阪開催プレゼンでは、開催の協力組織として、JSCEとともにJACICを紹介していただいた。

スポンサー（20社）

- 会場ではデモンストレーションとパンフレットセット

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ご静聴ありがとうございました

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