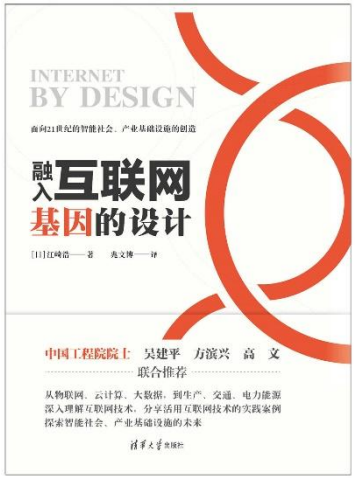
How our class goes ?

1. In April 9, 16, 30, May 7) : Presentation by Esaki
   - ✓ Based on check of your attendance at the classes via ITC-LMS , the schedule of presentations after May 28 by students will be planned.
2. **Presentation by students from May 28, 2024**
   - ✓ **About 20 min. (plus Q&A 10 min.) per person**
   - ✓ **Check attendees at every class using ITC-LMS.**
   - ✓ **Pick some topic related with the Internet (technology, business, policy, governance)**
3. Reports
   - i. Mini report at April 9th via ITC-LMS (April 16, 7:00AM)
   - ii. Topic, that you presented in the class

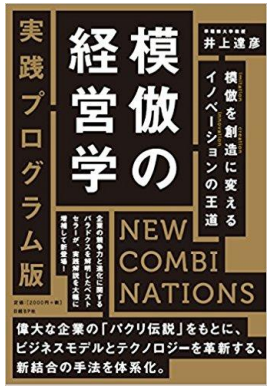
Internet-by-Design

1. Global
2. Unique system on the Earth
3. Provision of Alternatives
4. Respects running system
5. Best effort
6. Transparency and end-to-end principle
7. Social eco-system
8. Independency, autonomous and distributed



Innovation comes out by copying, neutrality is important

By Prof. T.Inoue of Waseda Univ.



- There are **horizontal** copy and **vertical** copy
  - Horizontal : Improvement
  - Vertical : Innovation

  (*) **flying up (= abstraction) and swoop down (=apply) at different site.**

  Higher altitude corresponds to higher abstraction and looks obvious at the end.
  Lower altitude goes to near site, where a lot of competitors (i.e., **Red-Ocean**).

- Process of business or research {is **"also" copying**}
  1. Anti-theses of conventional works
  2. Find out a difference/uniqueness, based on conventional works
  3. Propose new idea/knowledge through the combination(=copying) of some legacy works.

Internet by Design

1. **Global** ➔ **Nation/Government is a stakeholder**
2. Unique system on the Earth
3. Provision of Alternatives
4. Respects running system
5. Best effort
6. Transparency and end-to-end principle
7. Social eco-system
8. Independency, autonomous and distributed

“Economy” =Community to run financial activity

Before Internet

- Village
- City
- Nation

Economy and Regulation is identical

After Internet

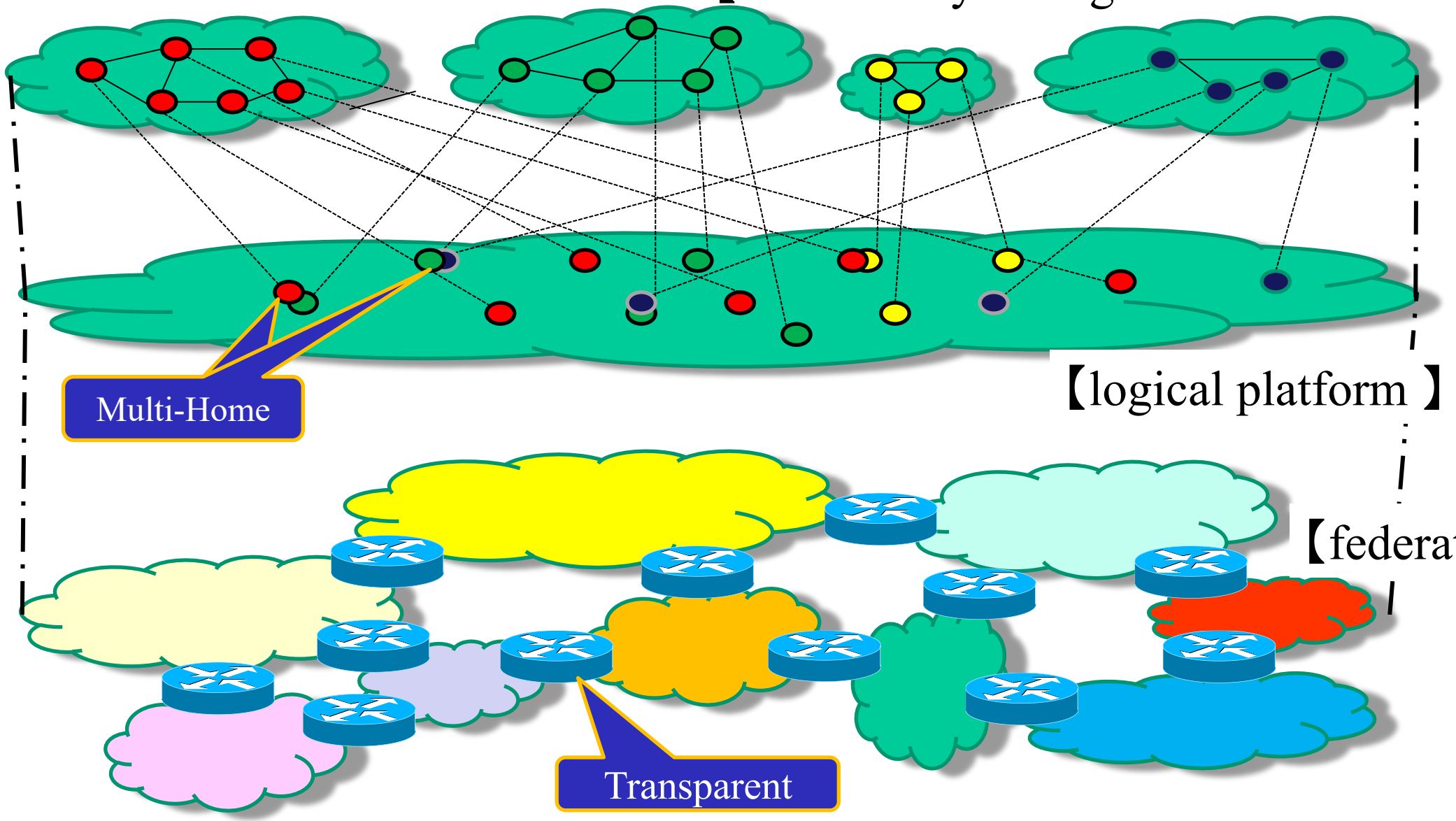
- Multi-National Compa

➔ **Global Company**

- **Global Citizen**

Economy is larger than Regulation

【Community over global infrastructure



International vs. Global

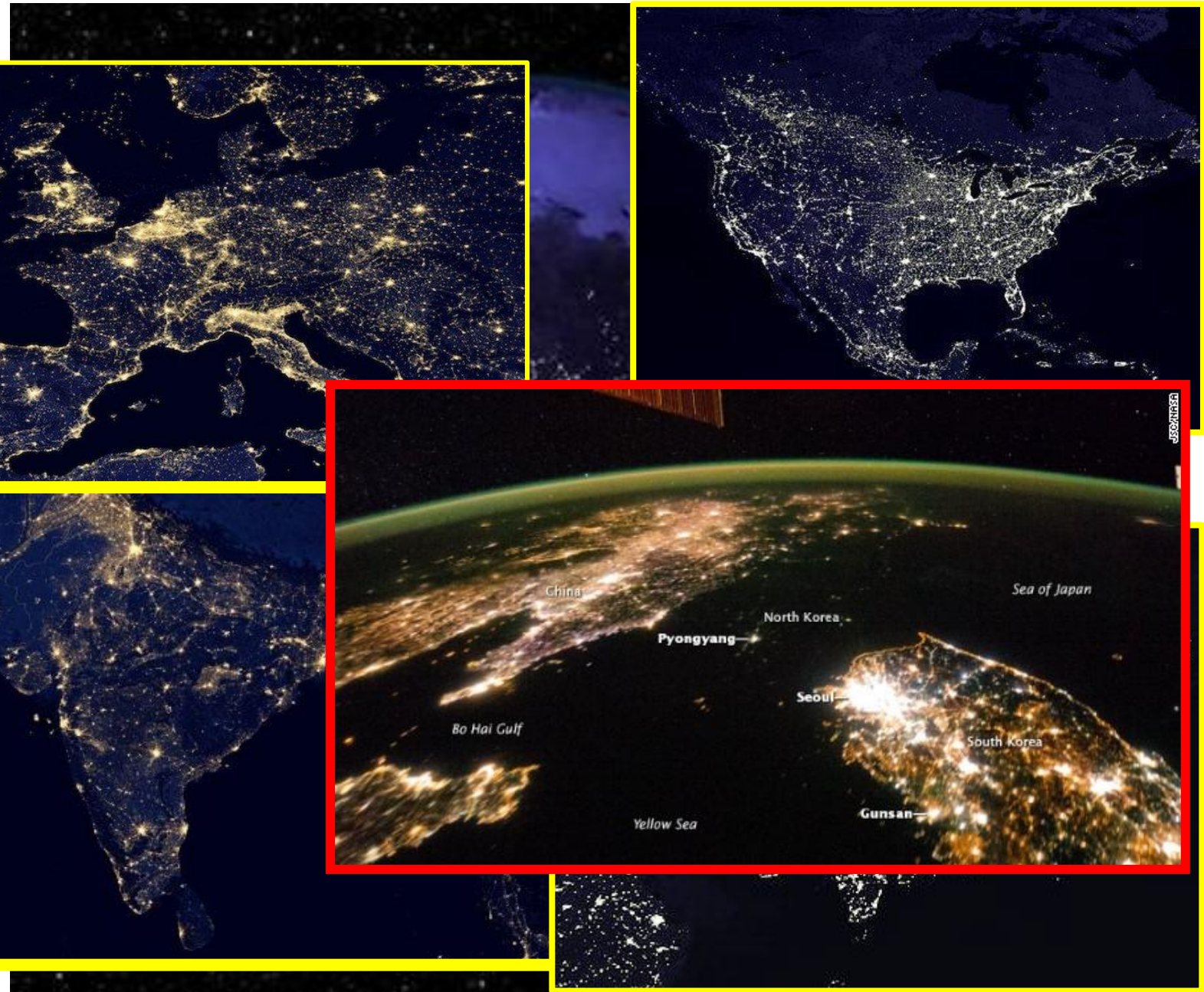
International	Global
Federated	Platform
Bilateral ➔ point-to-point rule	Multi-lateral & Multi-Stake-Holders ➔ common rule
Exploitation and Asymmetry	Zero-sum
National government is leading role	National government is an one member, i.e., Multi-Stake-Holder
United Nations	WEF, World Economic Forum

Recent Challenge to Global Platform

- **You can store and compute the data, wherever you want on the earth.**
- **You may want to control where the data is stored or is processed on the earth.**

- Recognized as **"national security issue".** Then, it would leads to government regulation/law
- Business and company is larger foot-print than country/government….i.e.,**"Global economy".**

(*) We may say country as "economy".


China
North Korea
Pyongyang
Sea of Japan
Seoul
Bo Hai Gulf
South Korea
Gunsan
Yellow Sea
JSC/NASA

G7 Ise-Shima Summit in Japan 2016

- ✓We strongly support an accessible, **open, interoperable, reliable and secure cyberspace** as one essential foundation for economic growth and prosperity, **DFFT(Data Free Flow w/ Trust)**
- ✓We commit to facilitate the **free flow of information to ensure openness, transparency and freedom of the Internet, and a fair and equal access** to the cyberspace for all actors of **digital economy** while respecting privacy and data protection, as well as cyber security.
- ✓We commit to promote a **multi-stakeholder approach** to Internet governance .

Internet by Design

1. Global ➔ **Nation/Government is a stakeholder**
2. **Unique system on the Earth** ➔ **Connected is the Premise**
3. Provision of Alternatives
4. Respects running system
5. Best effort
6. Transparency and end-to-end principle
7. Social eco-system
8. Independency, autonomous and distributed

Business conflict……

- 5W1H;
  - when, where, who, what, why, how

◆Academic or politician ； xx-ever

✓Whenever, wherever, whoever, whatever, how-ever

✓Equality (平等・公平)

◆Business ； only-xx

✓Only now, only you, only here……

✓Fairness (公正)

Big enemy/hurdle for the business of Big-Data and Artificial Intelligence

Unbundling
= On-line

Vertical integration
(closed system)

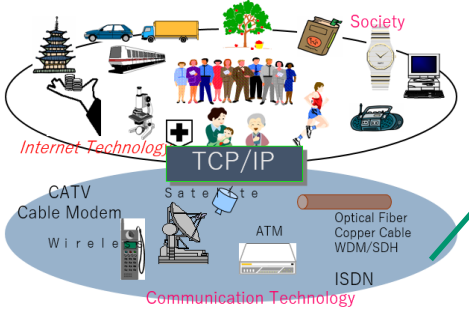
orizontal integration
(co-operative platform)

Discussion with Japanese government

in 2000, e-Japan with IPv6

and

in 2016, Society 5.0 with De-silo-ing



Vision in 20
by Jun Mu

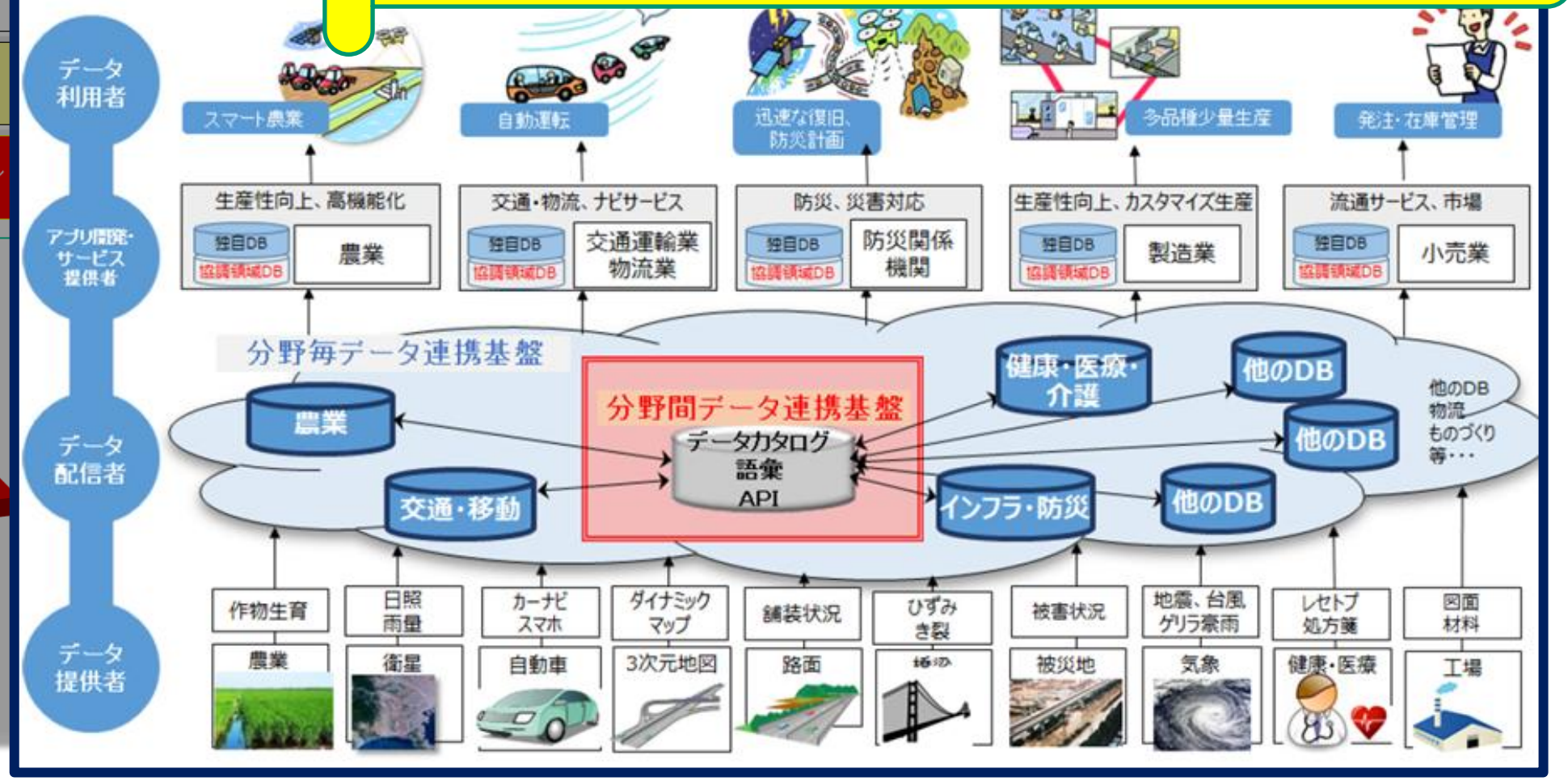
割２００５

電話産業 | 経済産業 | 教育 | 運輸 | 農林 | 放送

インターネット

（融合された）インターネット用イン

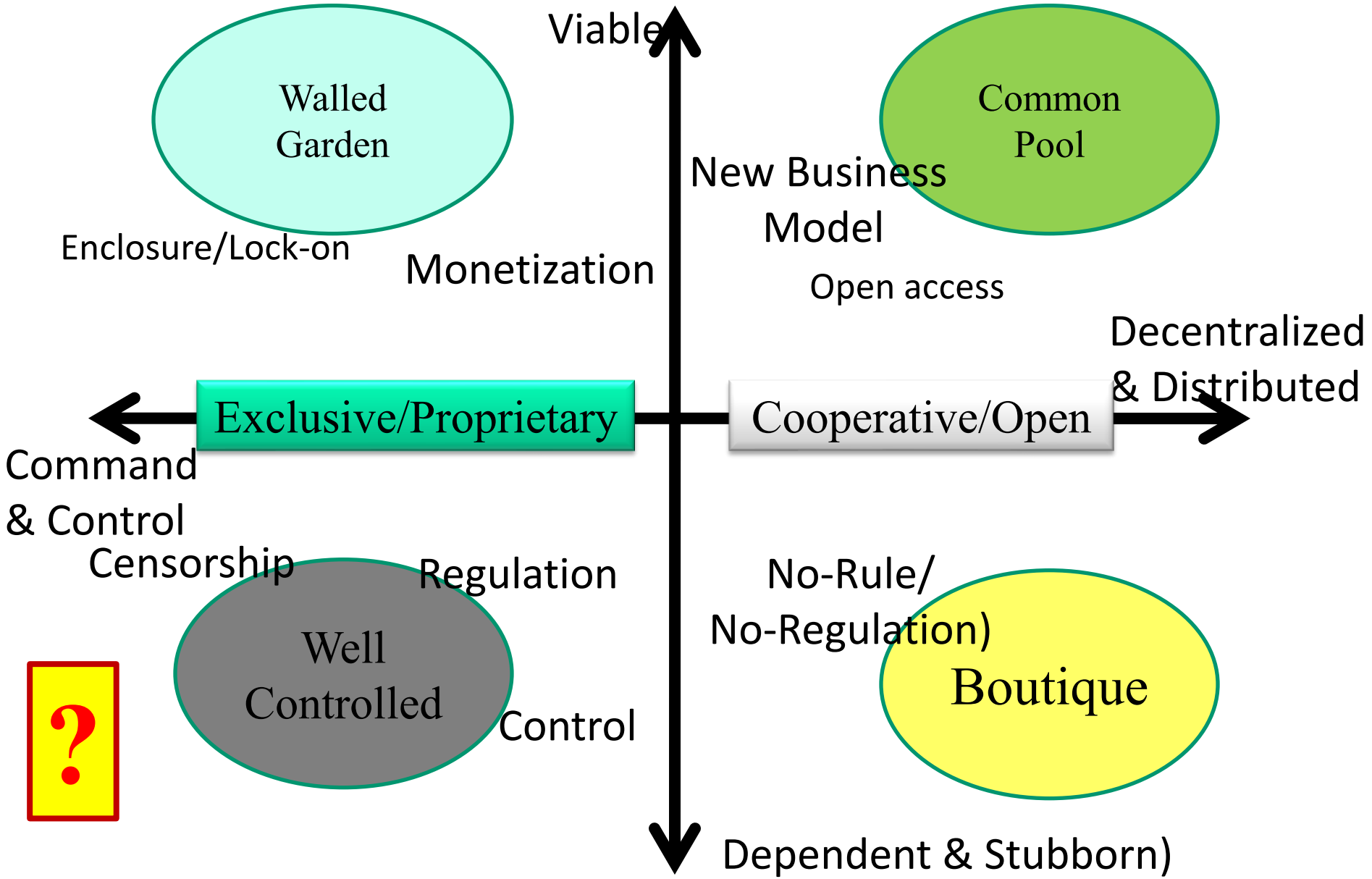
Society 5.0
by Japanese gov. in 2016
= De-Silo-ing & digitally connected



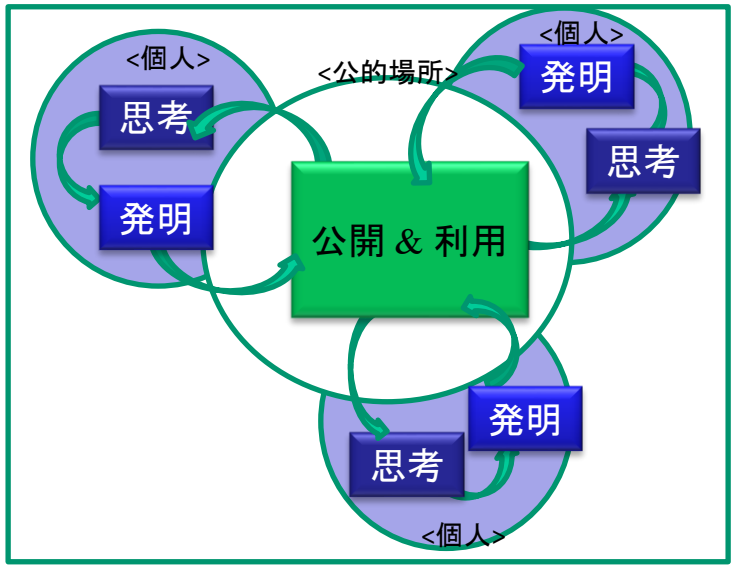
Data Sharing platform among all the industries for Society 5.0 - April 2018 -

1. Standardization is **not** purpose
2. Internetworking is the 1st priority
3. We got protocol translation capability
4. We need transparency to connect
5. Agile development platform
6. Sharing experiences(Coopetition & cooperation)

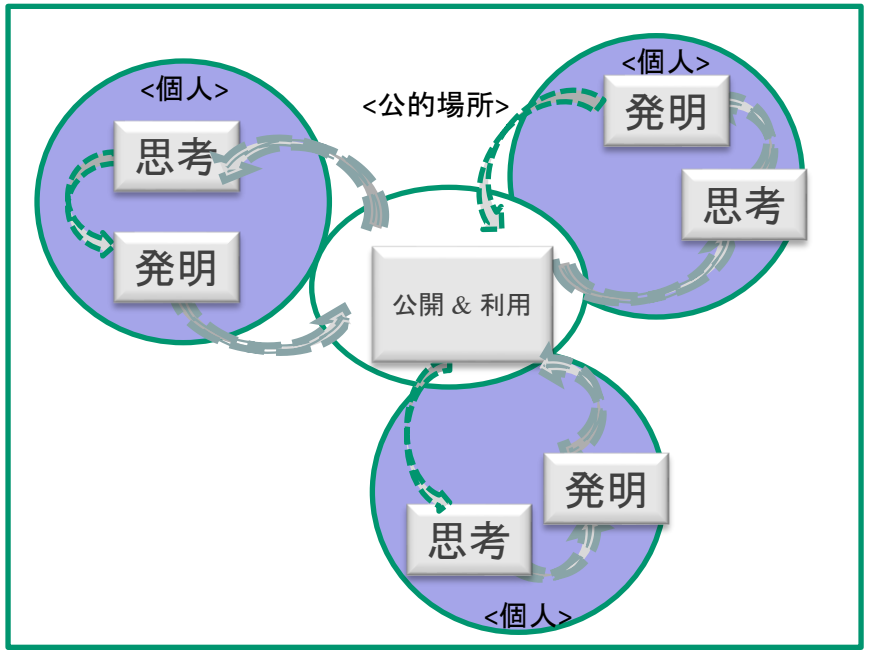
Where should we go ?



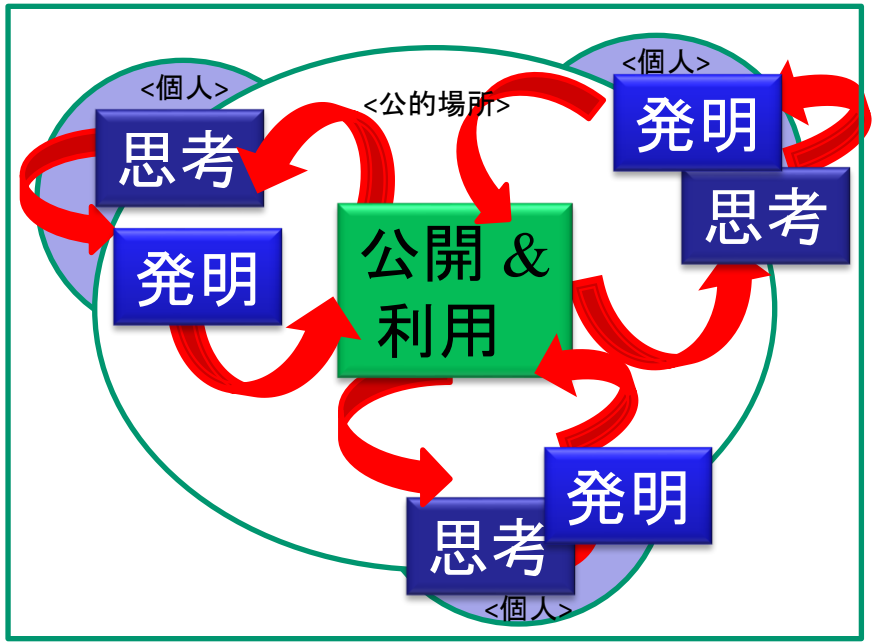
What is the core discipline and objective of Intellectual Property and copyrights?



Too strong regulation and restriction



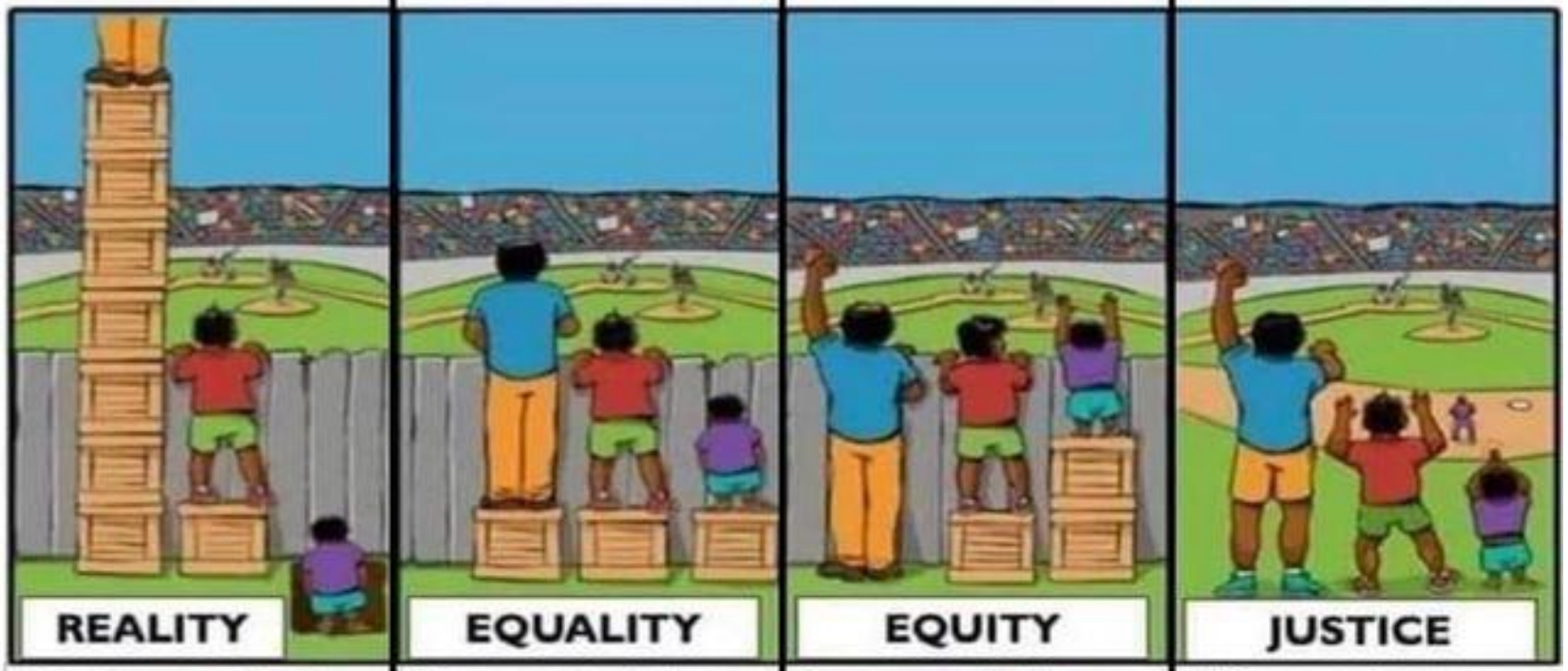
Engagement and encouragement of collaboration



公正(fairness) vs 公平(equity)

- 公平 ; equity
  - “結果として”の 不偏 (impartiality as a result)
  - 苦労しなくても 同じ 結果を提供。。。
- 公正; fairness, justice
  - “手続・規則の” 不偏・不変 (equality of opportunity/process)

➢公平・公正の実現には、賢い手段が必要になる。



REALITY

One gets more than is needed, while the other gets less than is needed. Thus, a huge disparity is created.

現実

ある人は必要以上に、一方、他の人は必要以下に。
そうして大きな格差が生まれる状態。

EQUALITY

The assumption is that everyone benefits from the same supports. This is considered to be equal treatment.

平等

誰もが同じサポートから恩恵を受けることが前提。
これは平等な扱いと考えられる状態。

EQUITY

Everyone gets the support they need, which produces equity.

公平

誰もが必要なサポートを受けることができ、それが公平性を生む状態。

JUSTICE

All 3 can see the game without supports or accommodations because the cause(s) of the inequity was addressed. The systemic barrier has been removed.

公正

不公平さの原因が解決されたことで、3人ともサポートや融通することなしに試合に参加することができる。
システム上の障壁が取り除かれた状態。

出典／madewithangus.com　和訳／廣川 景俊さん

Internet by Design

1. Global ➔ **Nation/Government is a stakeholder**
2. Unique system on the Earth ➔ **Connected is the Premise**
3. **Provision of Alternatives** ➔ not optimize, intentionally
4. **Respects running system** ➔ Practice principle, than theory
5. Best effort
6. Transparency and end-to-end principle
7. Social eco-system
8. Independency, autonomous and distributed

Realize “Internet” Architecture

- Internet is the “logical” structure, not the TCP/IP nor structure constructed by switches , routers or servers.
- “Internet “ provides “commons”, where all the digital information on the globe is transparently transmitted and shared
- The key of “Internet architecture” is provision of “Alternatives”.

Dr. Robert Kahn

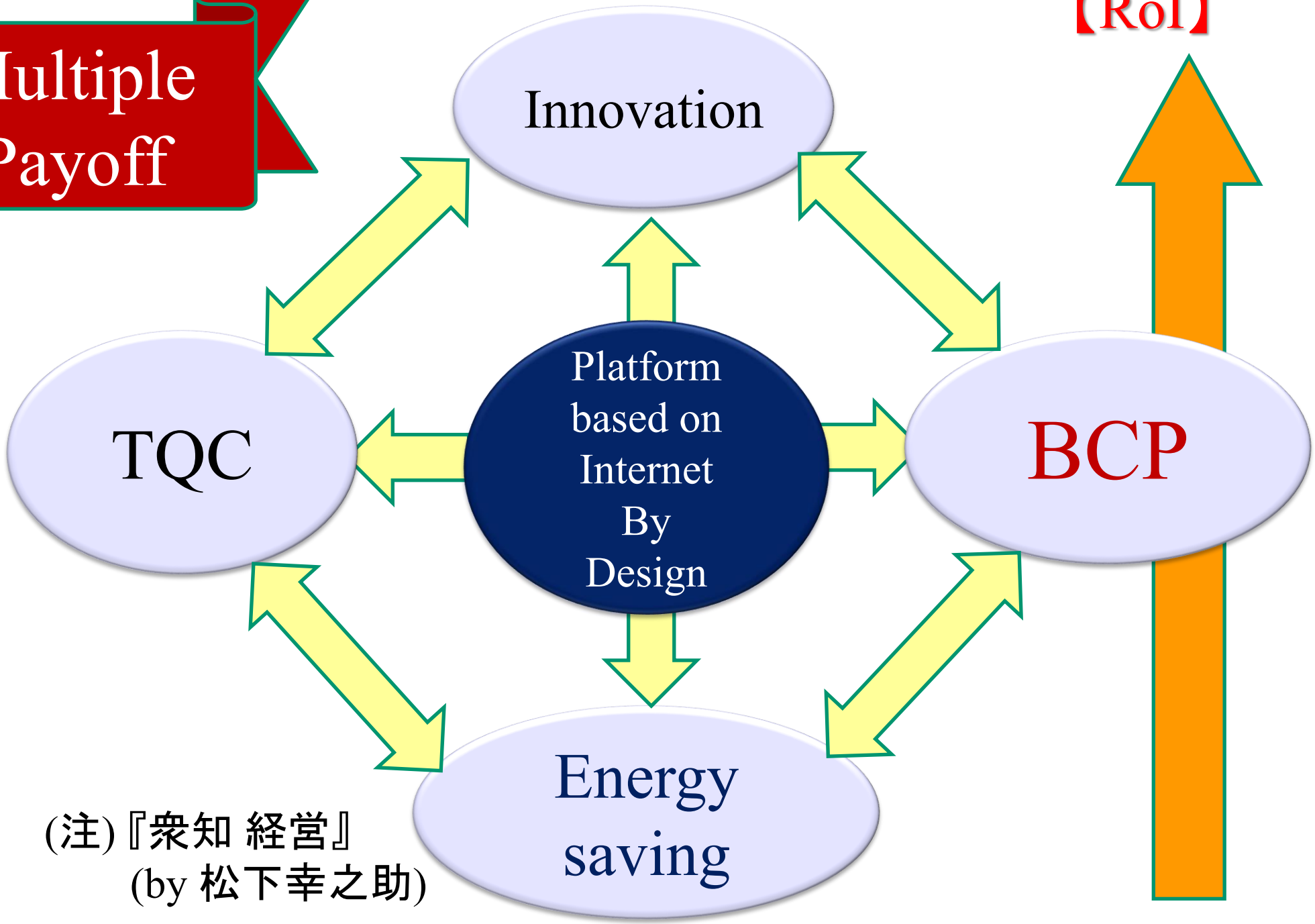
- ✓ **Opportunity for alternatives to survive**
- ✓ **Do not ask how to use (transparency & Neutrality)**

➔ **innovative technology finds**

”unexpected” usage

Necessity is not mother of invention, Invention is mother of necessity
(Melvin Kranzberg second law)

Multiple Payoff



(注)『衆知 経営』
(by 松下幸之助)

for “Open-Data”

1. User can **to access and to use** the lawful data, **with the same way**.
2. User can **connect/put the sensor**, that does not harm the network, with their choice, with the same way.
3. User can **provide service** using the open-data.

Green Univ. of Tokyo Project

- GUTP, established in **June 2008**.
  - 46 private companies and 20 NPOs (as of January 2012)
- **Eng.Building No.2**, in Hongo Campus
  - Targeted reduction; **15% in 2012, 50% in 2030**
  - 12 floor high, R&D and R&E activities
  - Established October 2005
- **5 major campus and new I-REF building**
- More than saving energy
  - Sustainability
  - New functions and business
- Global Standard
  - **IEEE1888**
  - **NIST SGIP CoS**
  - **ISO/IEC JTC1 SC6**
  - **Chinese GB**

東京大学
THE UNIVERSITY OF TOKYO

Energy Saving at The University of Tokyo in Summer of 2011

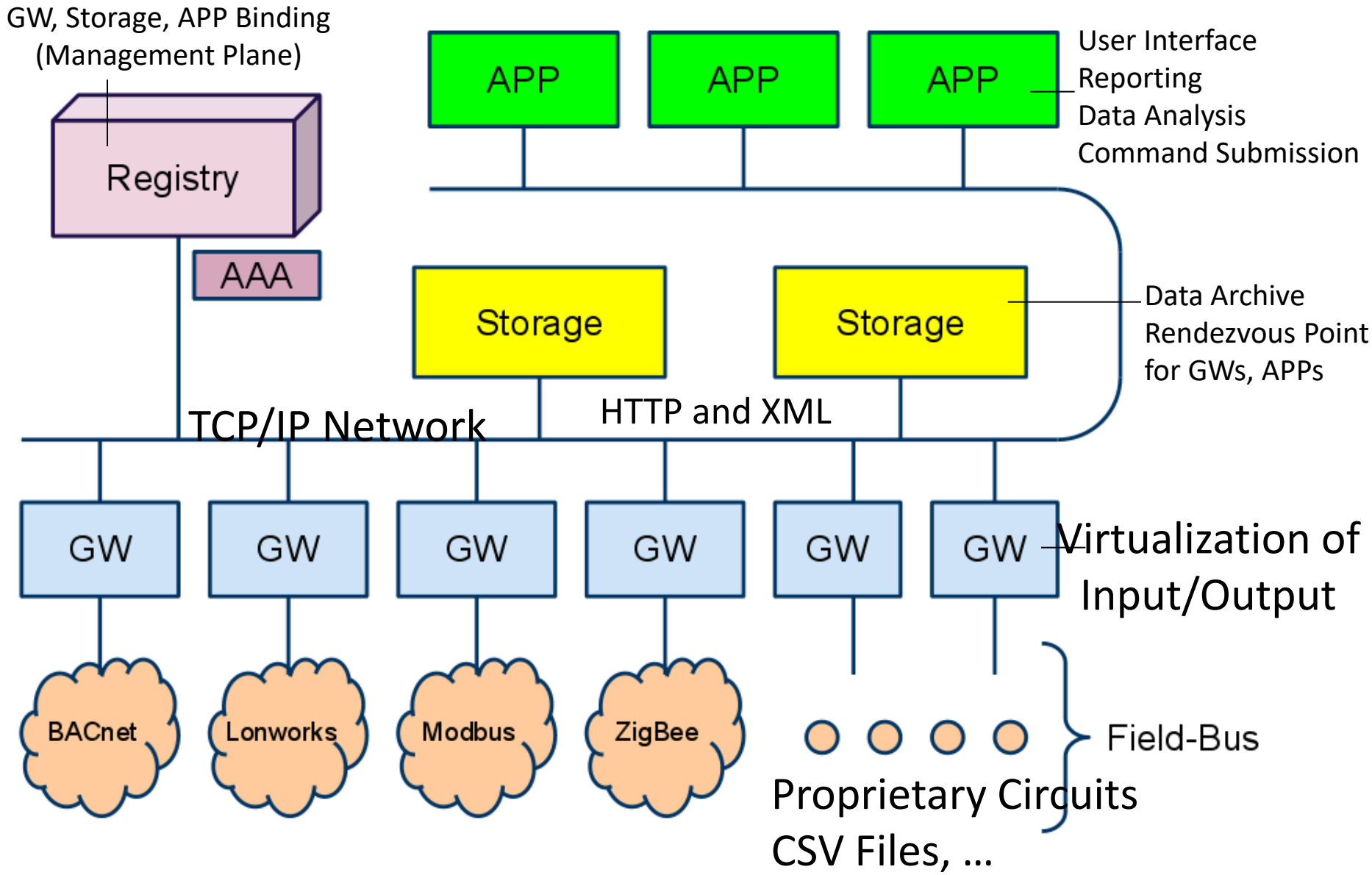
	Peak (2010)	**Peak (2011)**	**Total (2011)**	**RoI**
Major 5 campus	66 MW ($60M/yr)	69% (△31%)	75%-78% (22%-25%)	less than 1 month
Eng. No2 Bldg.	1 MW ($1M/yr)	56% (△44%)	69% (△31%)	2 yrs

【Contributions】

1. Multi-Vender for sustainability
2. Global Standards for procurement
3. No-Government funding

Procurement and Operation guide for The Univ. of Tokyo
http://www.tscp.u-tokyo.ac.jp/documents/tokyodaigakukouikisetubinet.pdf

IEEE1888 System Architecture



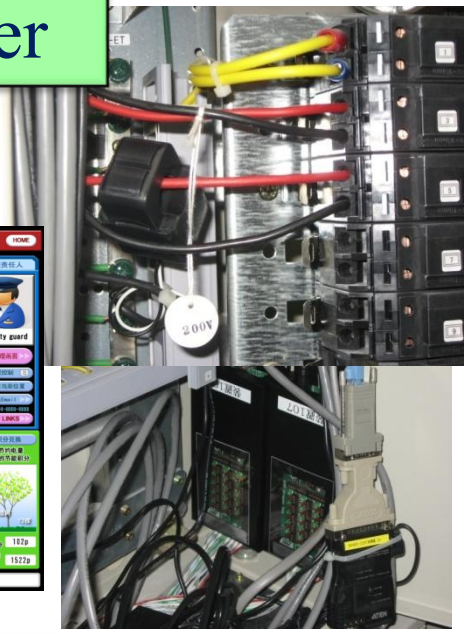
IEEE1888 Syst

Independency of SW players from HW, i.e., SDN

Data Centric for 1. Transparency 2. BigData

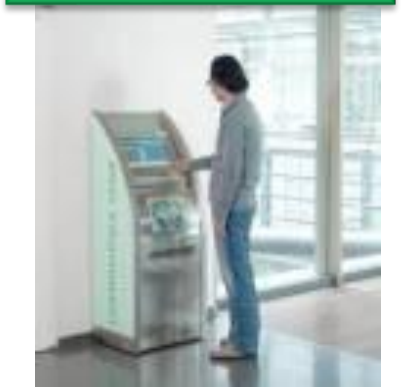
Integration and Interoperability via GW for legacy and {new} unique systems

Smart Meter

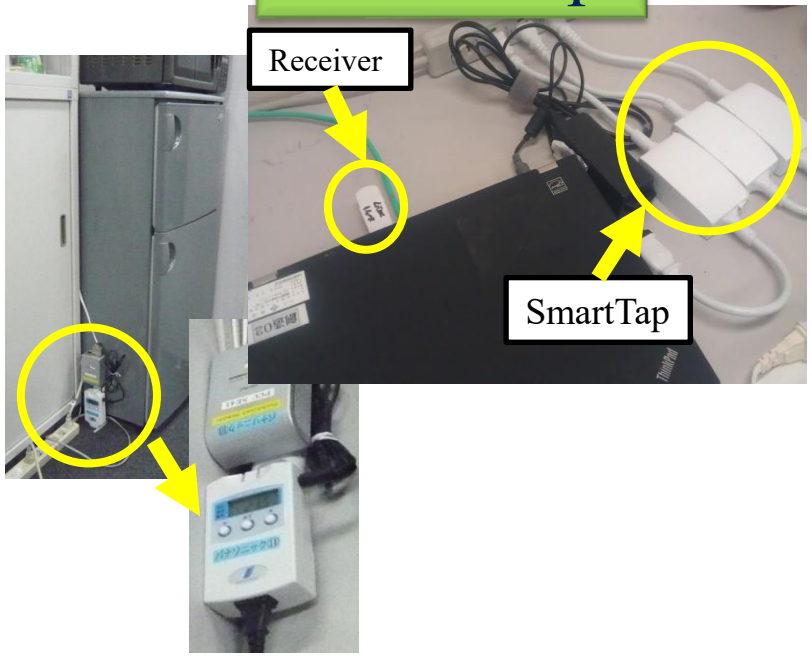


With Smart Phone

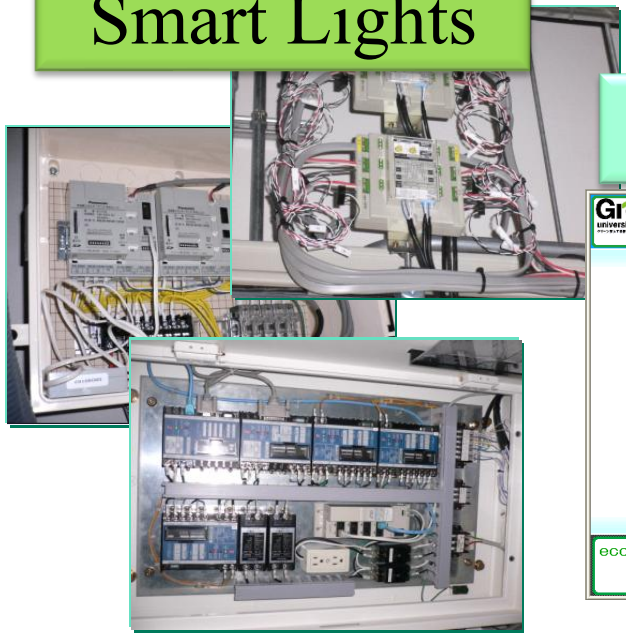
Smart Kiosk



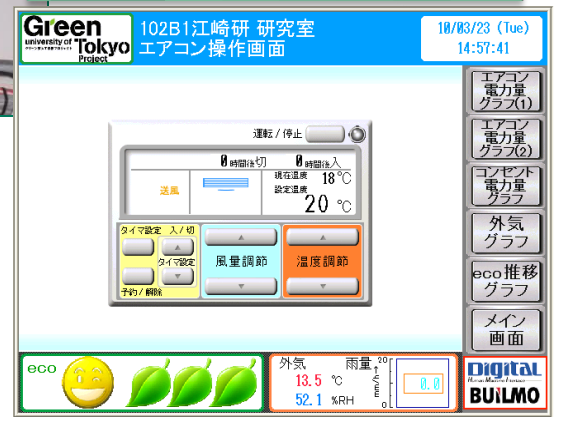
Smart Tap



Smart Lights



Smart HVAC

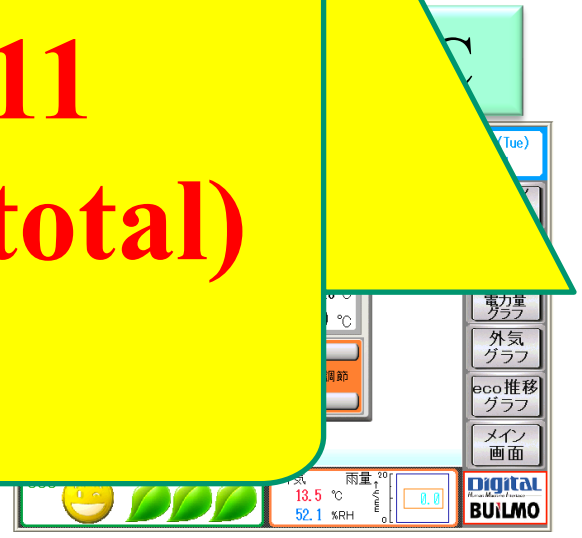


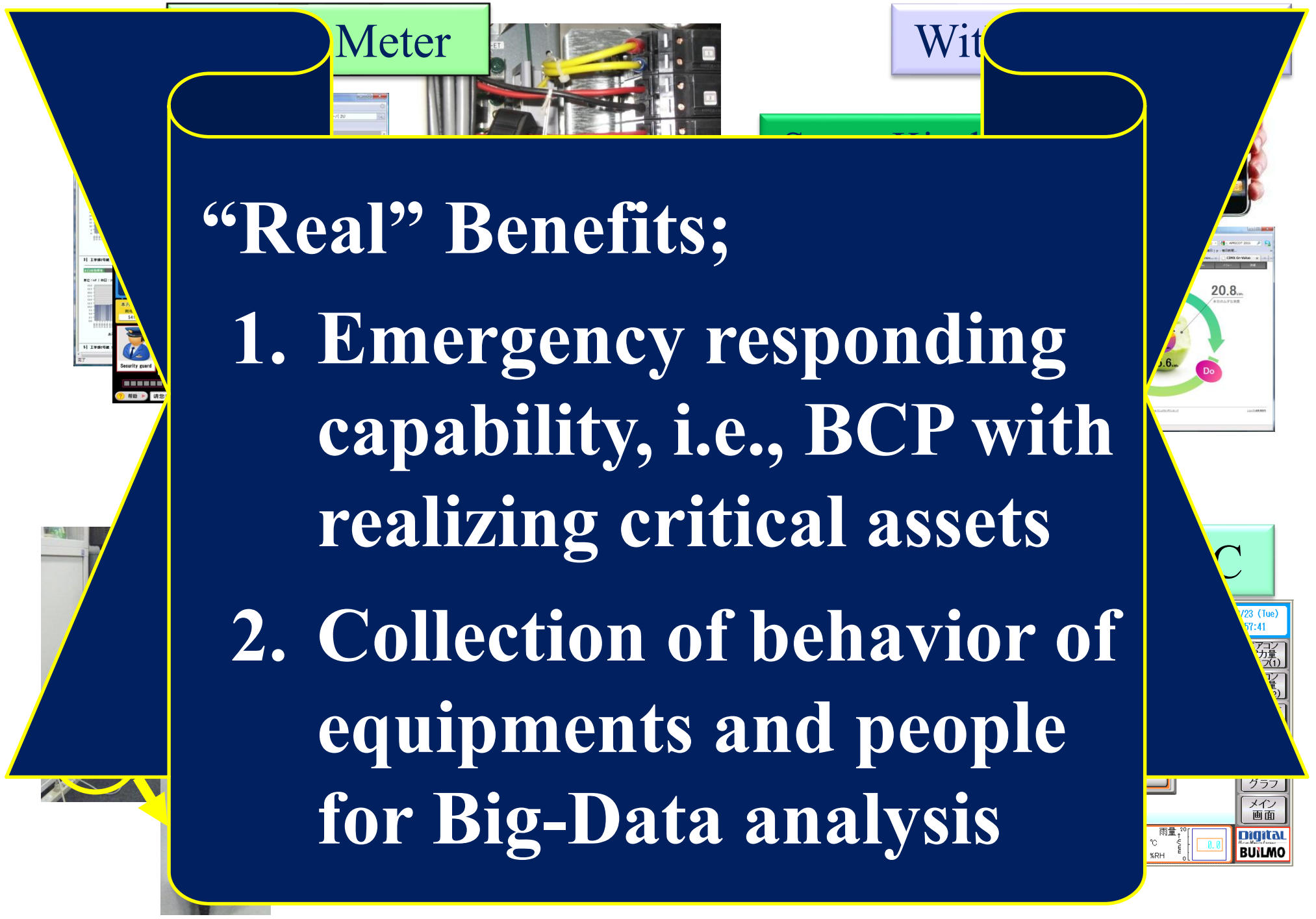
Smart Meter

With Smart Phone

Smart Kiosk

1. Multi-vendor
   - ✓ More than 10 vendors
2. More than 2,000 points
3. Energy saving in 2011
   - ✓ 44%(peak), 31%(total)
4. 2 year RoI



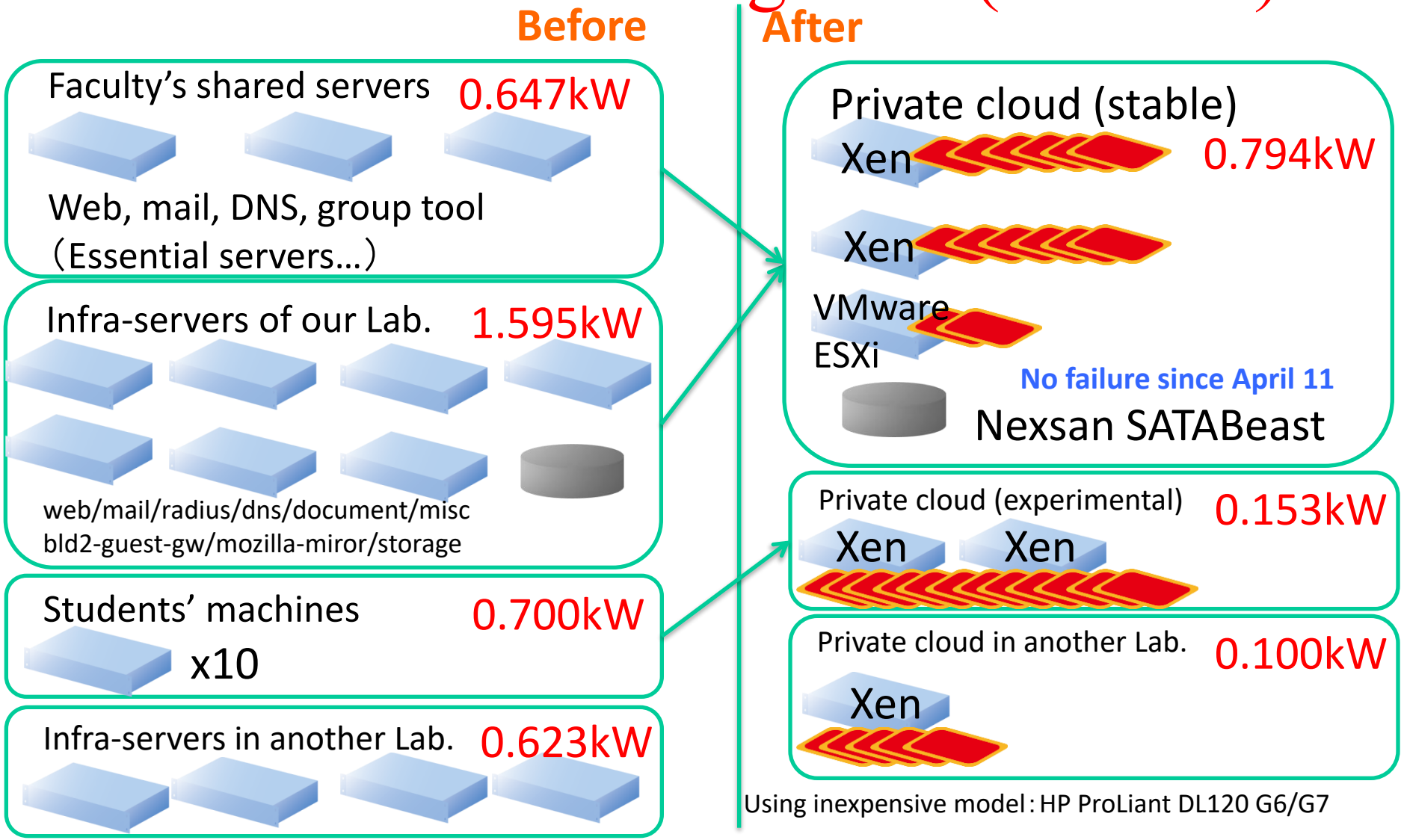


"Real" Benefits;

1. Emergency responding capability, i.e., BCP with realizing critical assets
2. Collection of behavior of equipments and people for Big-Data analysis

Private Cloud in our Lab.

Achievement: Saving 71% (2.52kW)!



Private Cloud in our Lab

RoI of investment

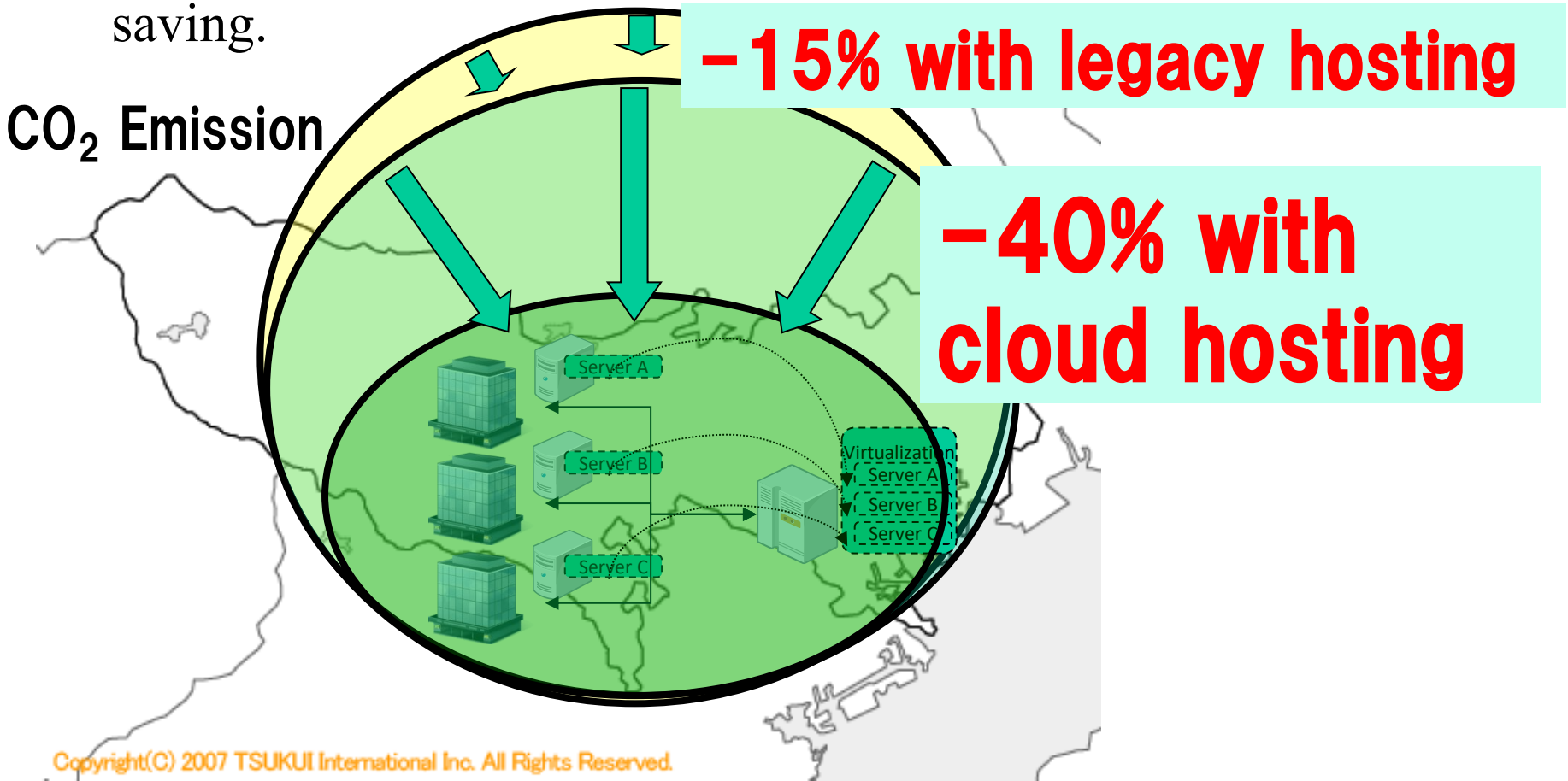
➔ 6 months (w/ PUE=2.0)

"True" benefits for us;

1. Manageability of system
2. BCP for power incidents
3. Comfortable environment

Strategic Energy Saving in Tokyo ?

1. Move and accommodate servers in the offices into iDC , hosting service, will lead to 15% energy saving
2. Vitalize the servers and integrate into a single physical machine, i.e., cloud computing, will lead to 40% energy saving.



Strategic Energy Saving in Tokyo ?

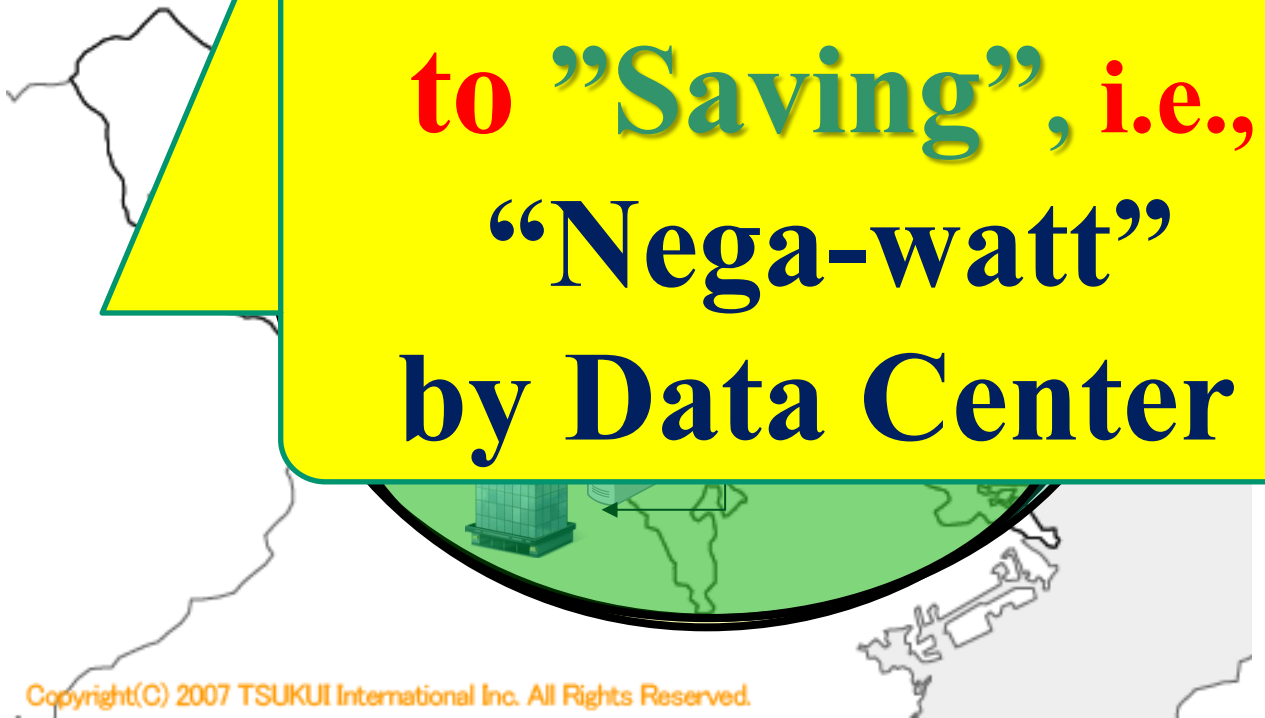
1. M…ommodate servers in the off…,
   ho…e, will lead to 15% energy sa…
2. Vita…al
   mach…ergy
   saving…

Energy
“Consumer”
↧
to ”Saving”, i.e.,
“Nega-watt”
by Data Center

CO_2 Emiss…

…cy hosting

…ith
…sting



2011年東日本大震災；“Computer-Go-To-DataCnter”

Discussion with Tokyo about Data Center

1. 2008; DC consumes a lot of power, so it is a devilish evil existence

   (*) Get out of Tokyo. We didn't realize that I would lose a good industry

2. 2010; In total, DC is a good guy who contributes to reducing power consumption

   (*) {Bonus}: I wonder if online accounting will contribute tax evasion and revenue.

3. 2012; DC prevented the collapse of the Japanese economy in 3.11 for BCP

   ① Prove earthquake resistance of Japanese quality buildings and equipment

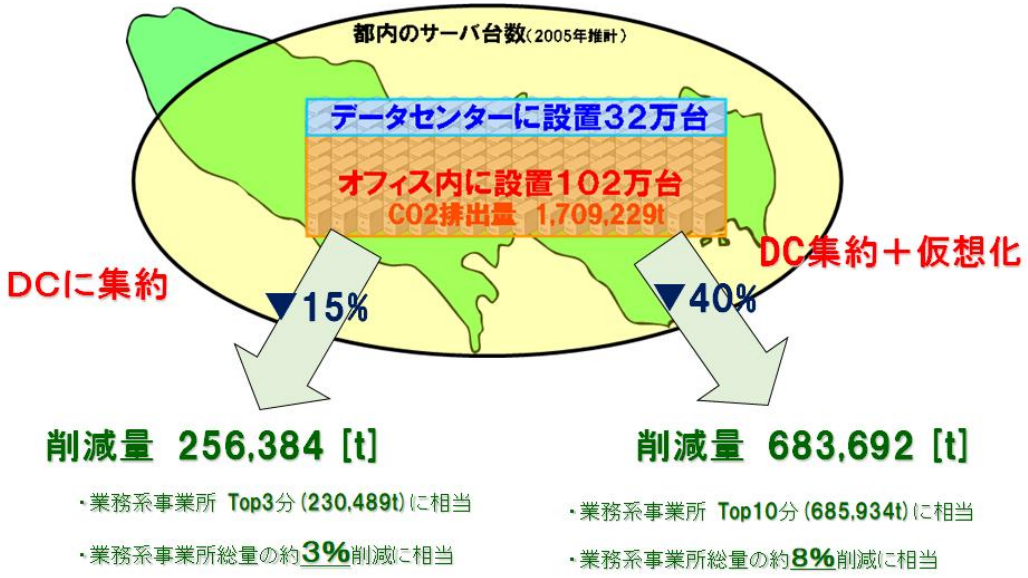
   ② In the Greenhouse Gas (CO2) Environmental Ordinance, apply exceptions to data centers.

   ③ To reduce the amount of electricity used at business establishments

   With data center (15% reduction)

   Cloud service (40% reduction)

Recommended to use Cloud and DC.



Google

デジタル化による炭素排出量大幅削減

- 企業や自治体がオンプレミスからGoogle Appsに移行することで**最大85%の省エネ効果を達成できる**と、グーグルが試算している。
  - グーグルは2021年6月27日、企業や自治体がオンプレミスからGoogle Appsに移行することで最大85%の省エネ効果を達成できるとする試算結果をブログで紹介した。「クラウドサービスの利用で作業効率の向上に加え、エネルギー消費量や二酸化炭素の排出量の減少とコスト削減につながる」としている。
  - 試算によれば、**企業や自治体がメールシステムをオンプレミスからGmailに移行することで、最大80倍のエネルギー効率が得られるという。**さらにオフィスアプリケーションを含めてオンプレミスからGoogle Appsに移行すれば、省エネ効果は65～85%に達するとした。
  - 同社によると、1万7000人の「Google Apps for Government」ユーザーがいる**米国一般調達局（GSA）ではオンプレミスからの移行で二酸化炭素排出量が85%削減され、年間想定では28万5000ドルのコスト削減効果につながった**としている。

ITmedia エンタープライズ

Google

日経XTECH 日経クロステック

2021年4月23日

- 米グーグルは同社における「脱炭素」の進捗状況を20214月20日（米国時間）に発表した。2030年までにデータセンター（DC）やオフィスなどを二酸化炭素（CO2）を排出しないカーボン・フリー・エネルギーで24時間365日運営する目標を掲げており、**既に5カ所のDCでその目標をほぼ達成**したとする。
- 進捗状況はスンダー・ピチャイ最高経営責任者（CEO）名義のブログで発表した。グーグルは脱炭素の取り組みを3つのステップに分類している。

① 第1ステップは自社が排出するCO2に相当する**カーボンオフセット(CO2排出権)を購入**する「カーボンニュートラル」で、グーグルは07年になし遂げた。

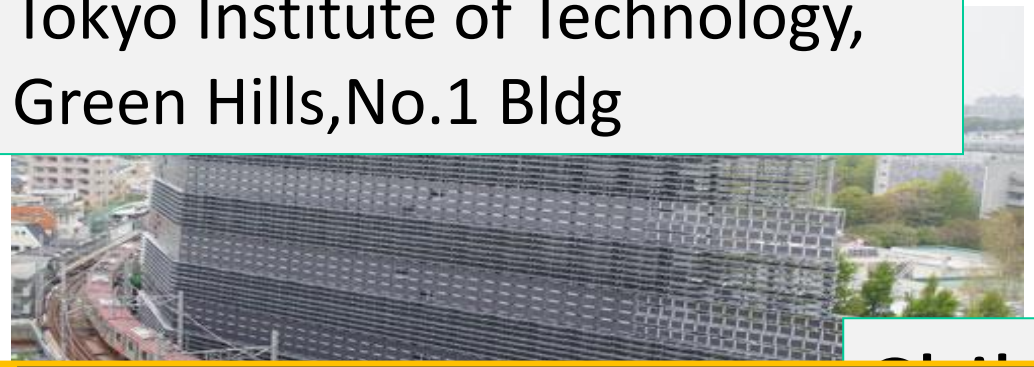
② 第2ステップは同社の年間電力使用量に相当する**再生可能エネルギーを購入**する「100%リニューアブル（再生可能エネルギー）」で17年に達成した。

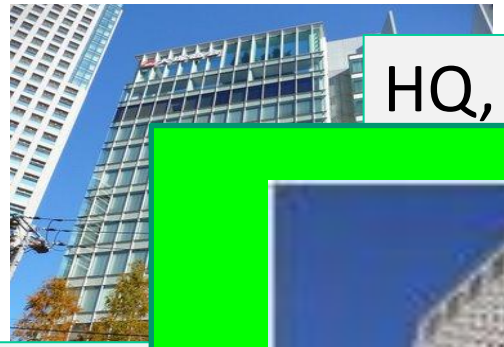
【クラウド型データセンターが都会から疎開可能になった!!】

➔ DataCenter-Go-to-RenewalEnergyPowerPlant(REPP)

③ そして第3ステップとしてDCやオフィスが**消費する電力を常時クリーンエネルギーでまかなう**「24/7 カーボンフリー(24時間365日脱炭素)」を30年までに達成する。

Tokyo Institute of Technology,
Green Hills,No.1 Bldg





HQ, Otsuka Corp.

Microsoft Japan
HQ in Tokyo

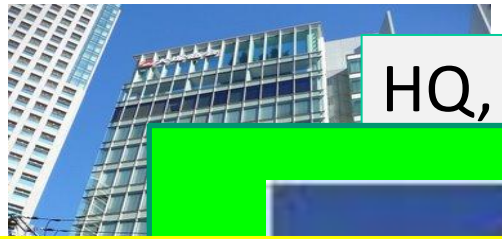
Best Current Practice for Commercial Building

1. Facility management control by Internet Tech. (i.e., IEEE1888)
2. Servers have gone to Data Center = No server room in the bldg

SEIKO Solutions
Factory in Thailand

CANON S Tower
(Canon MJ HQ)

f Technology,
Bldg



HQ, Otsuka Co

【**Finance: Lifetime Cost with comfortable office**】

1. Before; Reduce Initial cost for new office (BS)
2. During; Reduce running cost & comfortable (PL/CF)
3. Migrate; Reduce restoring cost (BS)

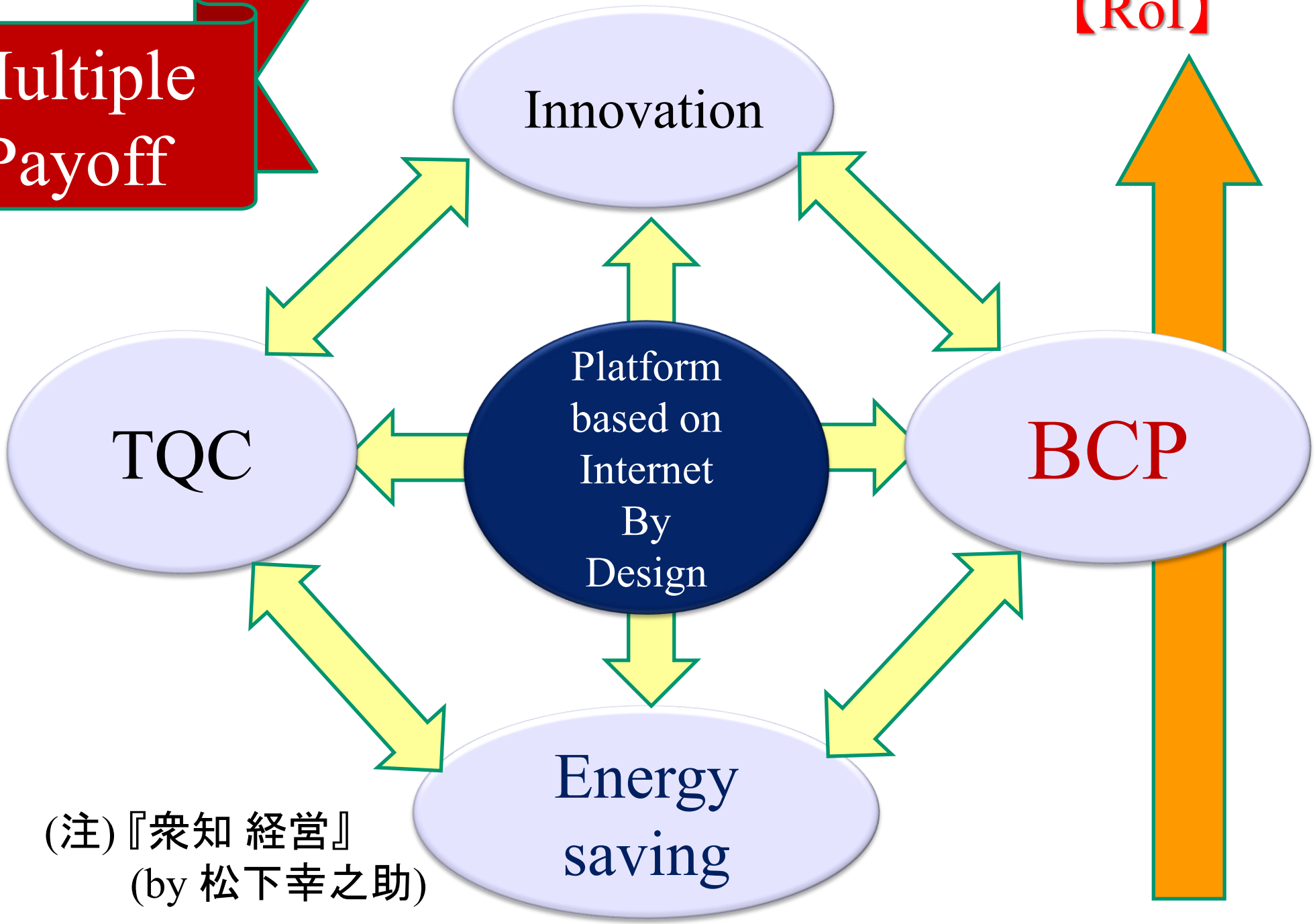
【**Security: BCP, i.e., Risk management**】

1. Intellectual property protection
2. Remote on-line office, against incidents (e.g., disaster)
   ➔ as well as support of handicapped employees

Factory in Thailand

(Canon MJ HQ)

Multiple Payoff



(注)『衆知 経営』
(by 松下幸之助)

“Cloud-by-Default” for multiple pay off

(June 2018 by Japanese gov.)

1. “De-silo-ing” of isolated departments for sharing platform for **sustainable digital innovation**, by distributed data repository (**not centralized**) using such as LOD(Linked Open Data).
2. Cyber Security by experts, **“security-by-design”**
3. Reduction of CAPEX and OPEX, including **head counts**
4. **BCP against natural disasters**
5. **Energy saving** for reduction of carbon footprint **against global warming**

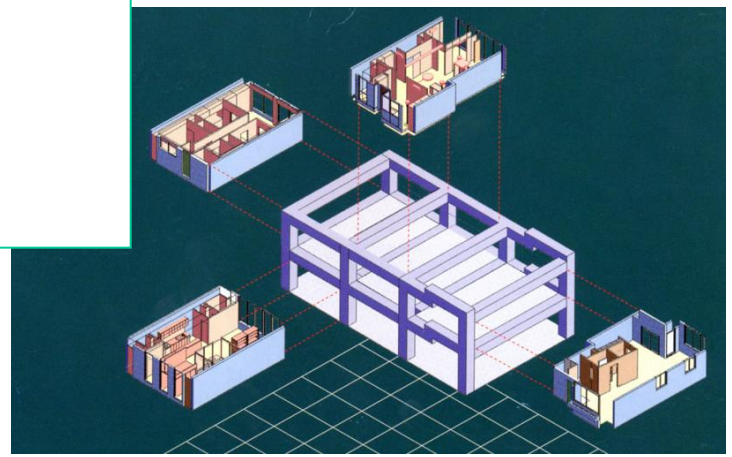
Internet by Design

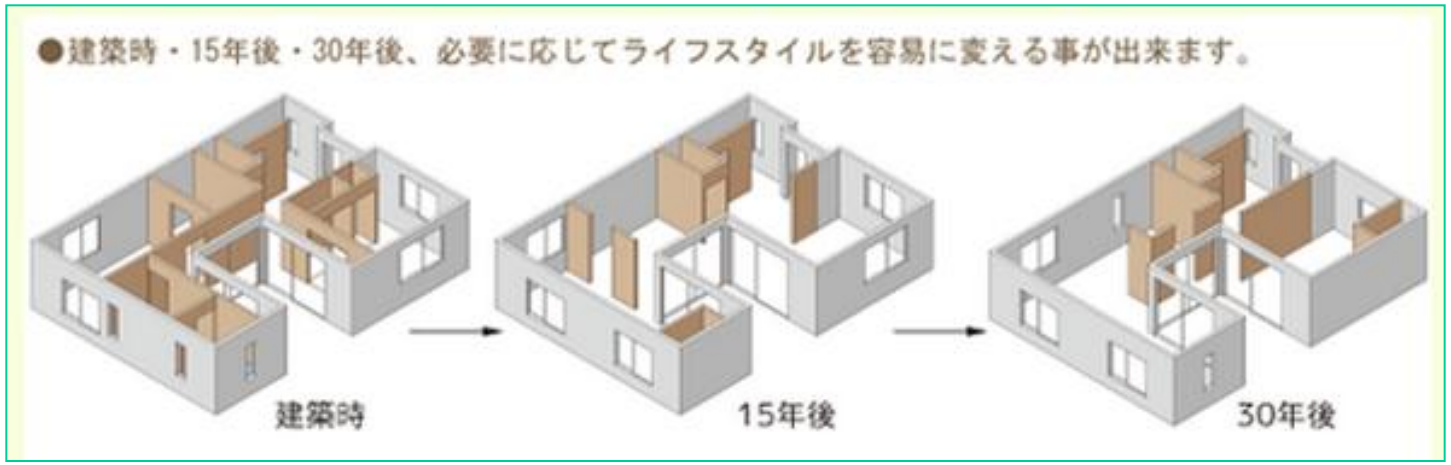
1. Global ➔ **Nation/Government is a stakeholder**
2. Unique system on the Earth ➔ **Connected is the Premise**
3. **Provision of Alternatives** ➔ **not optimize, intentionally**
4. **Respects running system** ➔ **Practice principle, not theory**
5. Best effort
6. Transparency and end-to-end principle
7. Social eco-system
8. Independency, autonomous and distributed

Skelton & Infill By Prof. Nicholas John Habraken (MIT)

Skeleton
: Building Skeleton, which can be used for more than 100 years
・The structrure with enhanced durability

Infill:
interior that can be flexibly changed according to the lives of the residents





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8. Independency, autonomous and distributed

How the Internet works ?

1. Network of networks
   a. Mercy is not for the people (deliver others' packets)
   b. All participants are owner and operator

2. **Deliver digital package to destination**
   a. **Deliver any type of content**
   b. **Use any transmission media**
   c. **Forget the digital package, once hand it to the neighbor**

Best Effort

H Logistics s ?

1. (*) digital package corresponds to “container” or “pallet” in logistics system
   (*) “humanbeing” can do the same as “digital package”

2. **Deliver the package to the destination**

   a. **Deliver any type of physical object**

   b. **Use any transmission media**

   c. **Forget the digital package, once off-load the package and take care the next package.**

Enough quality by Best Effort

1. “Guaranteed” service is actually “Best-Effort”
   - If beyond its capability/capacity, it fails.

2. “competition” leads to quality improvement
   - Opportunity of alternatives
   - Replace-ability (by Open and module structure)

3. Because daily service is “best-effort”,
   continue services even in abnormal/emergency
   - Continue service, even with low quality

Wide variety of business

I. Why banks use mainframe computer ?

- ✓ No calculation error !!! By IBM CPU (POWER)

II. Google/FaceBook vs, Amazon/Yahoo!

- ✓ A/Y; No error because of Online-Shopping

  (*) However, it is far relaxed than banks !

- ✓ G/F; None could criticize their results……

(*) Now, how about the date for decision making in professional organizations ?

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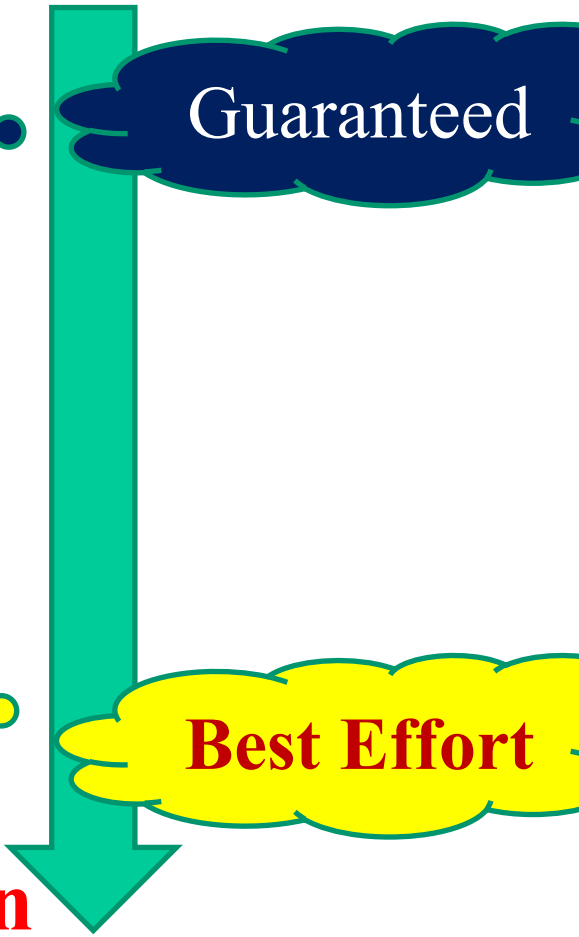

(*) Now, how about the date for decision making in professional organizations ?

Wide variety of business

I.

II.

There are calculations;

(1) any bit error can not be allowed, and

(2) (2) some bit errors can be allowed !!!

However,

Especially decision making for high profit rate or high risk business may need only few significant figures ”with probability” (=uncertainness), but large amount of data to deliver the figures.

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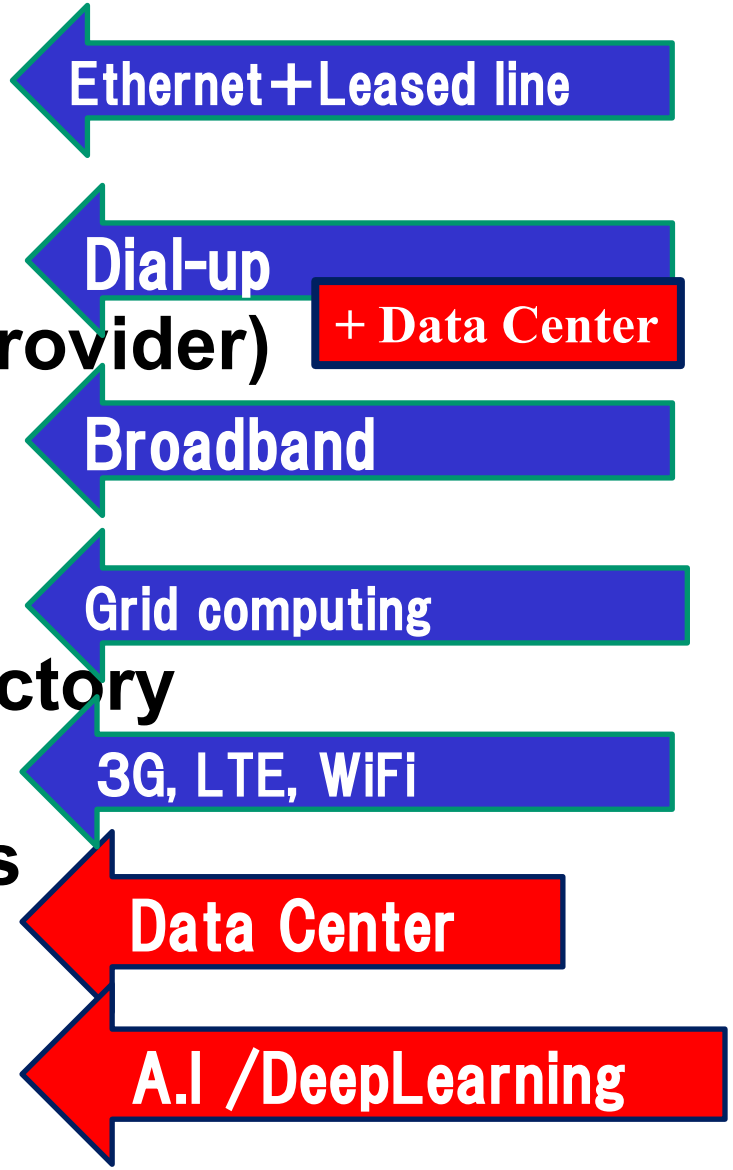
Positive spiral between C/S and P2P

1. CS: Main Frame
2. P2P: UNIX Work Station
3. CS: ISP(Internet Service Provider)
4. P2P: File sharing
5. CS: Google information factory
6. P2P : Smart-Phone, Tablets
7. CS : Mobile Cloud ?
8. P2P : Edge-Heavy ?



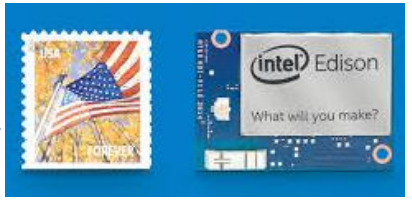
Improvement of computers per decade in a past

	1960s factory	1970s Office	1980s WS	1990s PC	2000s Note	2010s SmartPhone
CPU (MIPS)	0.1	1	10	100	1k	10k
Memory (GB)	0.01	0.1	1	10	100	1k (1T)
Weight (g)	10k	1k	100	10	1	0.1
Mobility	10^{-15}	10^{-12}	10^{-9}	10^{-6}	10^{-3}	1

Mobility＝MIPS x GB ÷g （improve 10^3 per decade)

Now, **in 2020s**
cloud architecture in the **back-end**
at Data Center
is expanding
into IoT space, **“fog”** or **“edge-heavy”**
computing, in the **front-end**

Improvement of computers per decade in a



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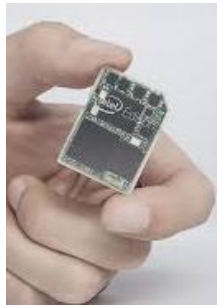
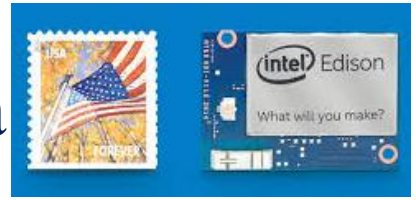
CPU (MIPS)	0.1	1	10	100	1k	10k	100k
Memory (GB)	0.01	0.1	1	10	100	1k (1T)	10k (10T)
Weight (g)	10k	1k	100	10	1	0.1	0.01
Mobility	10^{-15}	10^{-12}	10^{-9}	10^{-6}	10^{-3}	1	10^{-3}



Mobility＝MIPS x GB ÷g （improve 10^3 per decade)

Now,
AI
inside the chip !

in a



						2010s SmartPhon	2020s ボタン
CPU (MIPS)	0.1	1	[illegible]	100	1k	10k	100k
Memory (GB)	0.01	0.1	1	10	100	1k (1T)	10k (10T)
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Mobility	10^{-15}	10^{-12}	10^{-9}	10^{-6}	10^{-3}	1	10^{-3}

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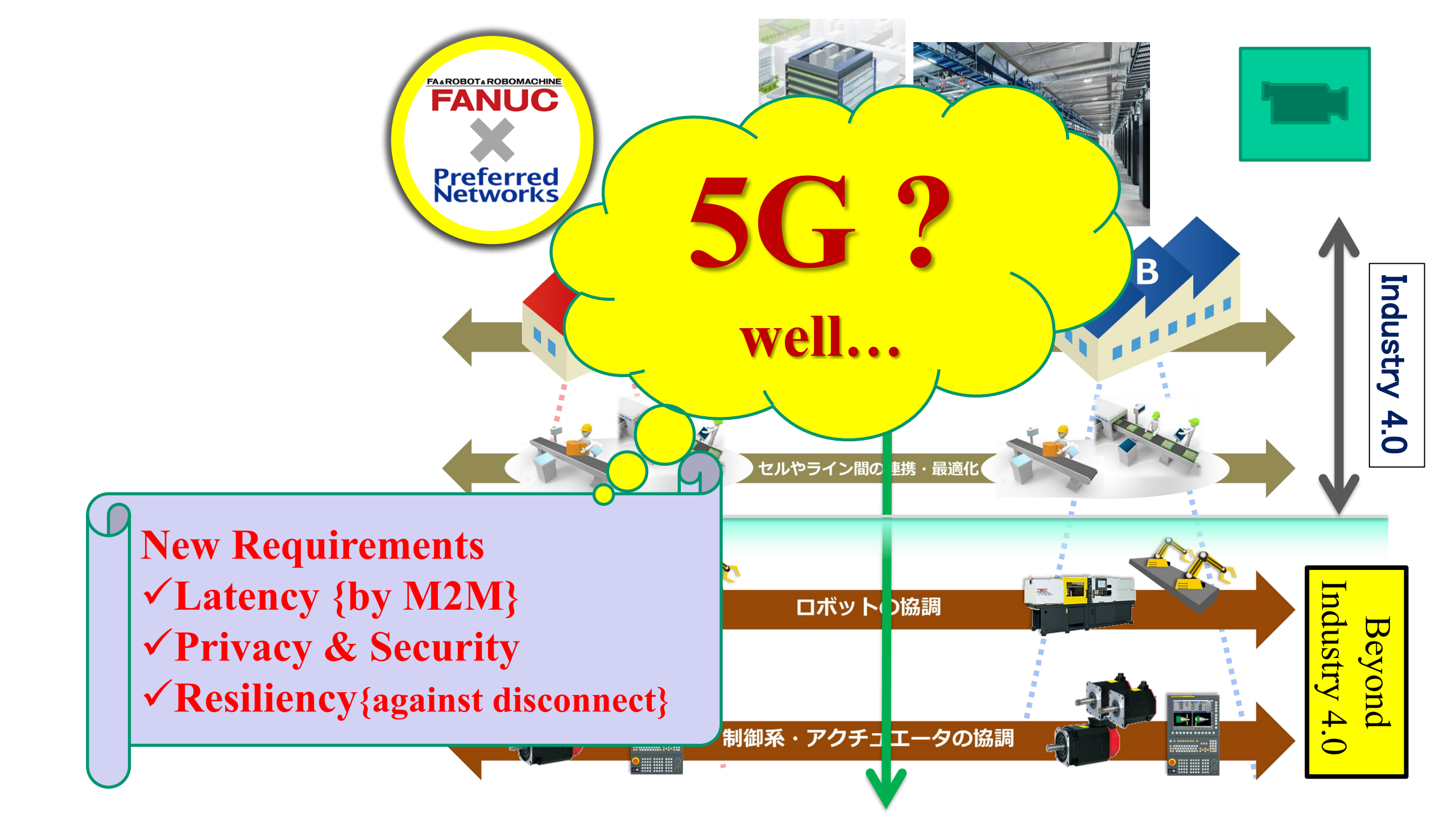
FA&ROBOT&ROBOMACHINE
FANUC
×
Preferred Networks
5G ?
well…
B
Industry 4.0
セルやライン間の連携・最適化
ロボットの協調
制御系・アクチュエータの協調
Beyond Industry 4.0
New Requirements
✓Latency {by M2M}
✓Privacy & Security
✓Resiliency{against disconnect}

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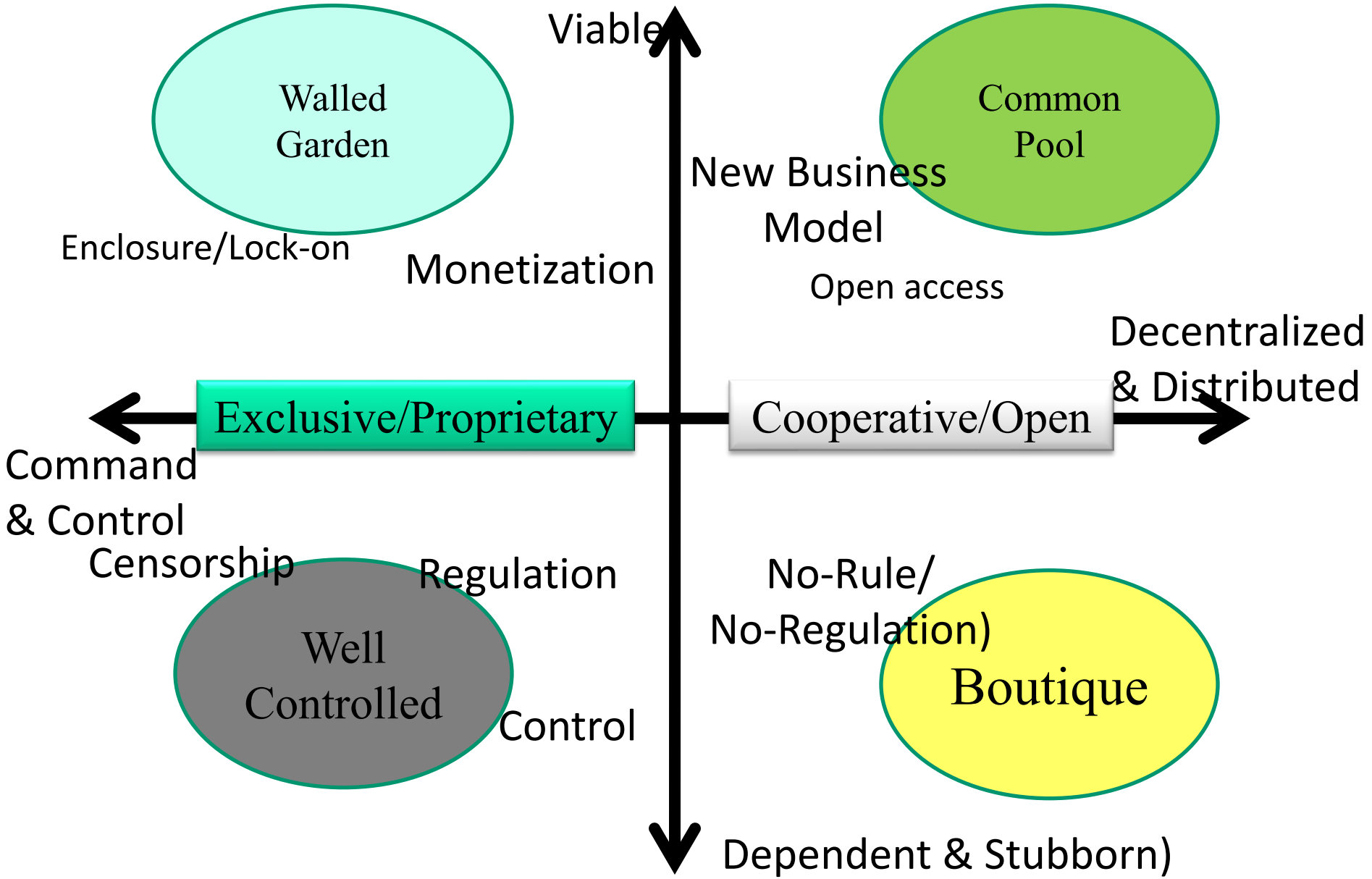
8. **Independency, autonomous and** distributed ➔ **Keep diversity for survive**

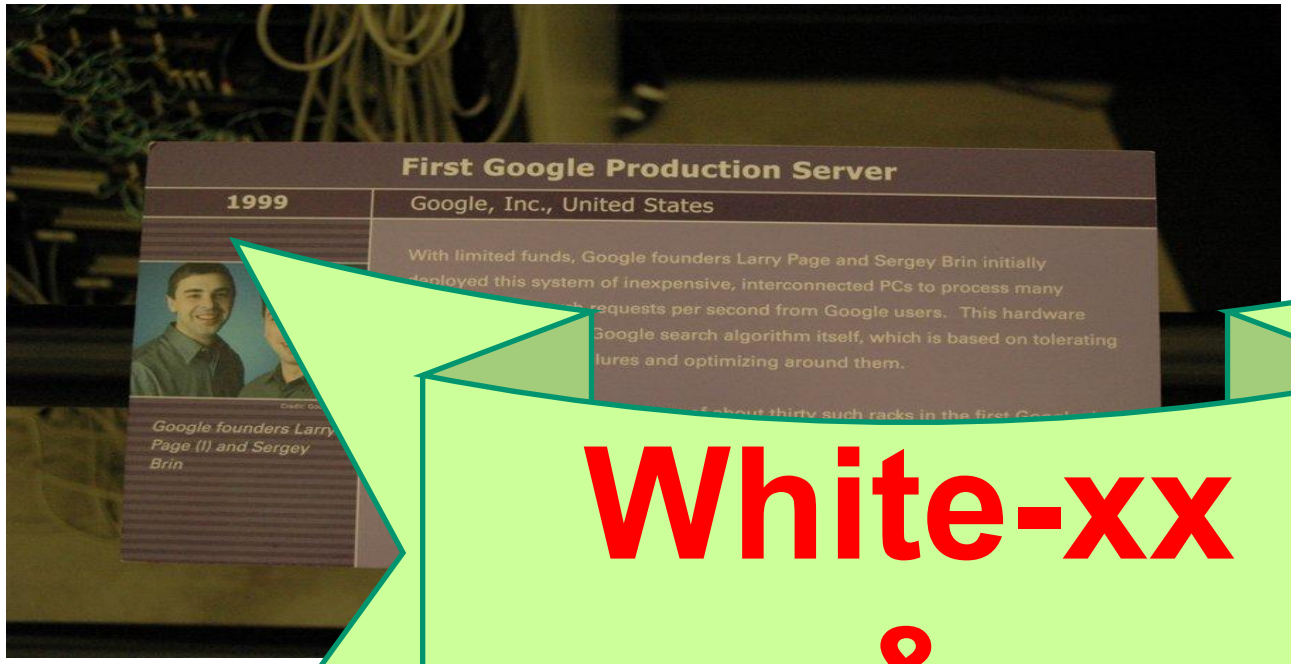
Where should we go ?



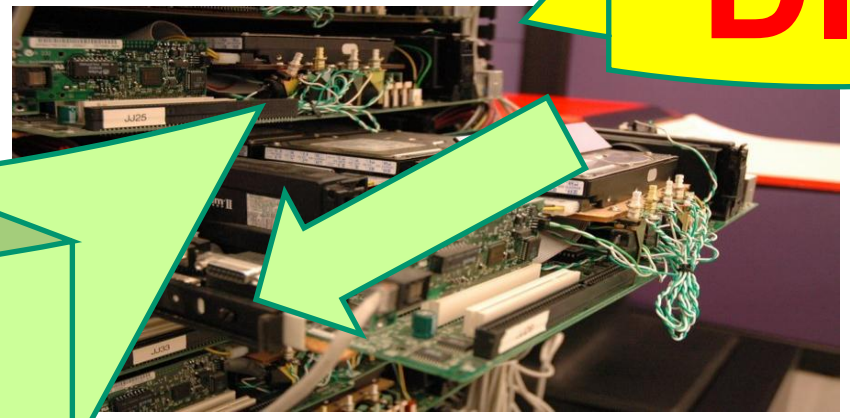
What happped in IT & Internet industry

- Re-build of business structures based on "user-initiated" discipline

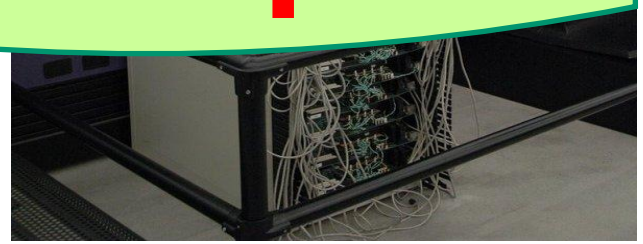
  - Disruption of Silo(Stove&Pipe) business structure
  - Open technologies (got a space of unique technologies)
  - **Ownership of data belongs to end-user**
    - ➔ (End-to-End, **Transparency, Neutrality**)
  - Migration of business chain from PUSH to PULL
  - Global business is promises
  - Digital Defined (= **Native Digital, Digital{Cyber} First**)

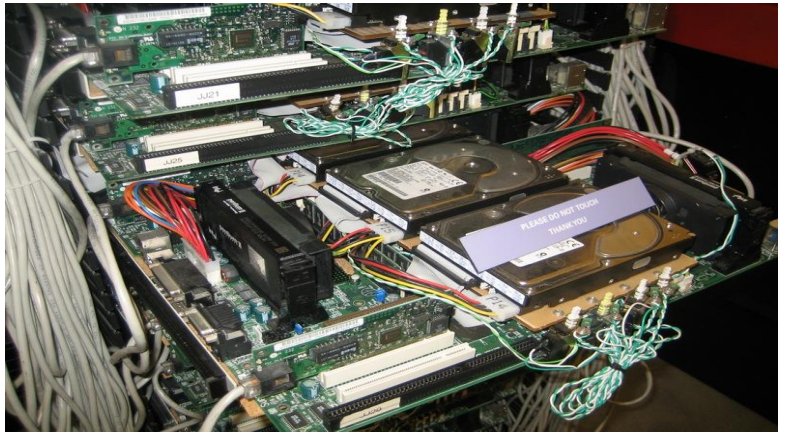


DIY



White-xx & DevOps





DevOps: Eco-System N

User defined

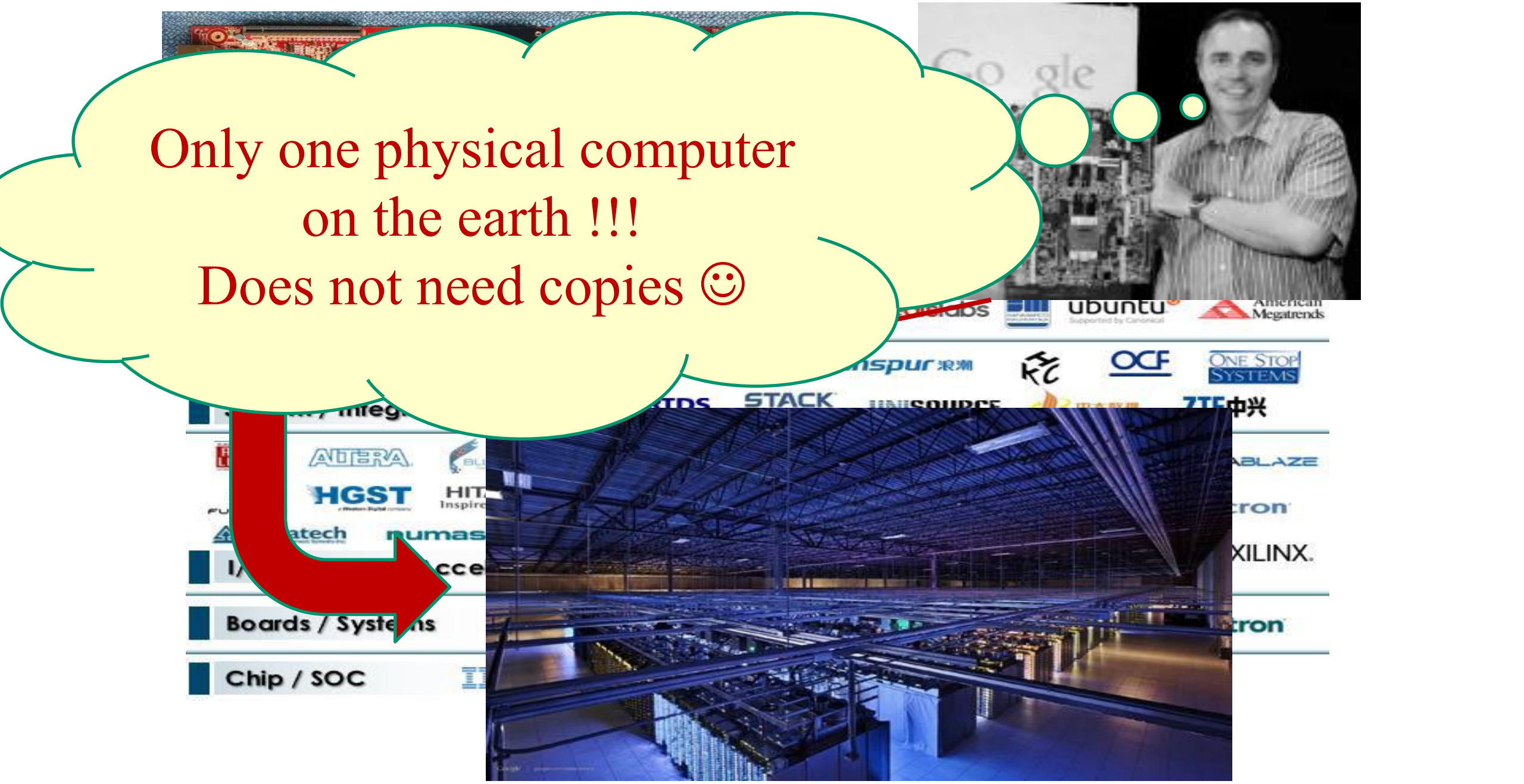
PUSH(Supply-Chain)
⇨ PULL(Demand-Chain)

サービス

価値の変換

コンピューティング・リソース

Vendor defined


Only one physical computer
on the earth !!!
Does not need copies ☺
Boards / Systems
Chip / SOC
ALTERA
HGST
STACK
OCF
ONE STOP SYSTEMS
XILINX

The Internet is for everyone

Internet Society

1. Single and **unique on the Globe**, not multi-national, but **by multi-stake-holder(MSH)**.
2. **Across national boundaries**, to empower individual, organization, community and society
3. Common, open, transparent[1], end-to-end, cooperating, **collaborative**[2] and digital **sharing platform**
   – Distributed, **autonomous** and social platform, i.e., **one for all, all for one**
4. Providing **alternatives and opportunities** for innovations
5. Digital platform with **best effort & end-to-end**[3] discipline

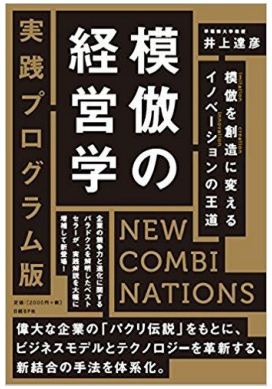
1) **"No" Man-In-the Middle, e.g., no censoring for End-to-End encryption**
2) **Collaborative security by ISOC(Internet Society)**
3) **End-node includes "server", as well as client**

ISOC Strategic Action on Security

1. **“Collaborative Security”** for restoring the “trust” in the Internet
   a. Core-internet security (focusing on routing and DNS)
   b. Security for IoT system (under reviewing)
2. Collaboration by **Multi-Stake Holder**
3. **End-to-end encryption** (protecting **individual**)
4. **Policy developments** around trust and security

Innovation comes out by copying

By Prof. T.Inoue of Waseda Univ.



- There are **horizontal** copy and **vertical** copy
  - Horizontal : Improvement
  - Vertical : Innovation

  (*) **flying up (= abstraction) and swoop down (=apply) at different site.**

  Higher altitude corresponds to higher abstraction and looks obvious at the end.
  Lower altitude goes to near site, where a lot of competitors (i.e., **Red-Ocean**).

- Business or research {is **"also" copying**}
  1. Anti-theses of conventional works
  2. Find out a difference/uniqueness, based on conventional works
  3. Propose new idea/knowledge through the combination(=copying) of some legacy works.

Copy and apply the essences and discipline of Internet's

- Structure
- Implementation
- Operation

to the other business domains