Computation World 2014

*Panel CLOUD/SERVICES*

# Challenges in Delivering Large-scale Services over Cloud Environments


Moderator

Christoph Reich, Furtwangen University of Applied Science, Germany

Panelists

Petros Lampsas, Technological Educational Institute of Central Greece, Greece

Yong Woo Lee, University of Seoul, Korea

Ramaswamy Chandramouli, NIST, USA

# Panel Subject: Challenges in Delivering Large-scale Services over Cloud Environments

- Benefits of Cloud Computing environments:
  - Reducing costs and improving efficiency by more closely matching demand and capacity.
  - Improve agility and time to market by reducing infrastructure barriers.
  - The massive scale of cloud computing allow building new applications
- Aspects of challenges in Delivering Large-scale Services:
  - Management of such services, security aspects, Green-IT, area of Internet of Things; Infrastructure (network, …), scalability, …
- Topics proposed by the panelist:
  - P. Lampsas: Energy efficient cloud infrastructures
  - Y.W. Lee: Cloud computing & Internet of Everything (Things)
  - R. Chandramouli: Reliable High Performance Network Bandwidth; Secure APIs; Scalable Storage

# Additional Thoughts of Prof. Dr. Ch. Reich for the Subject: Challenges in Delivering Large-scale Services over Cloud Environments

HOCHSCHULE FURTWANGEN UNIVERSITY | HFU

- Security Challenges:
  - Large-scale services automatically scale up/down in a cloud environment. This dynamics are big security challenges in keeping software up-to-date; complex key management; configuring security tools like IDS; proof compliancy according standards like ISO27001
  - Services in global Cloud environments like Amazon can be provisioned in any country. Different jurisdictions have to be considered, when privacy data is processed.
- Management Challenges:
  - The dynamics makes management of such services more difficult. The management challenges experienced in HPC or Grid environment are scaled up by its dynamic nature.
  - The capacity planning of a Cloud infrastructure is more challenging, if there are many customers running large-scale services.

# Summary

- Minimize Power Consumption: Management of such infrastructure to optimize the power consumption is challenging, but an important
- Cloud infrastructures are the backbone of a Internet of Things world. There a smart environments for user can be achieved.
- Large-scale services arise infrastructure challenges. There is a need for well developed network and Cloud infrastructures.
- New security challenges have to be tackled since Cloud infrastructure are highly dynamic.
- To mitigate the user‘s privacy concerns by the Cloud provider is a major issue and will strongly influence the future success of Cloud Computing

# Cloud computing 2014
## Panel CLOUD/SERVICES

## Challenges in Delivering Large Scale Services over Cloud Environments

Yong Woo LEE, Ph.D.
Professor, University of Seoul
President, Ubiquitous City Consortium for Seoul, Korea
Director, Seoul Grid Center
Chair, The Korean National Committee for ISO JTC1/SC22

**2014. 5. 26**

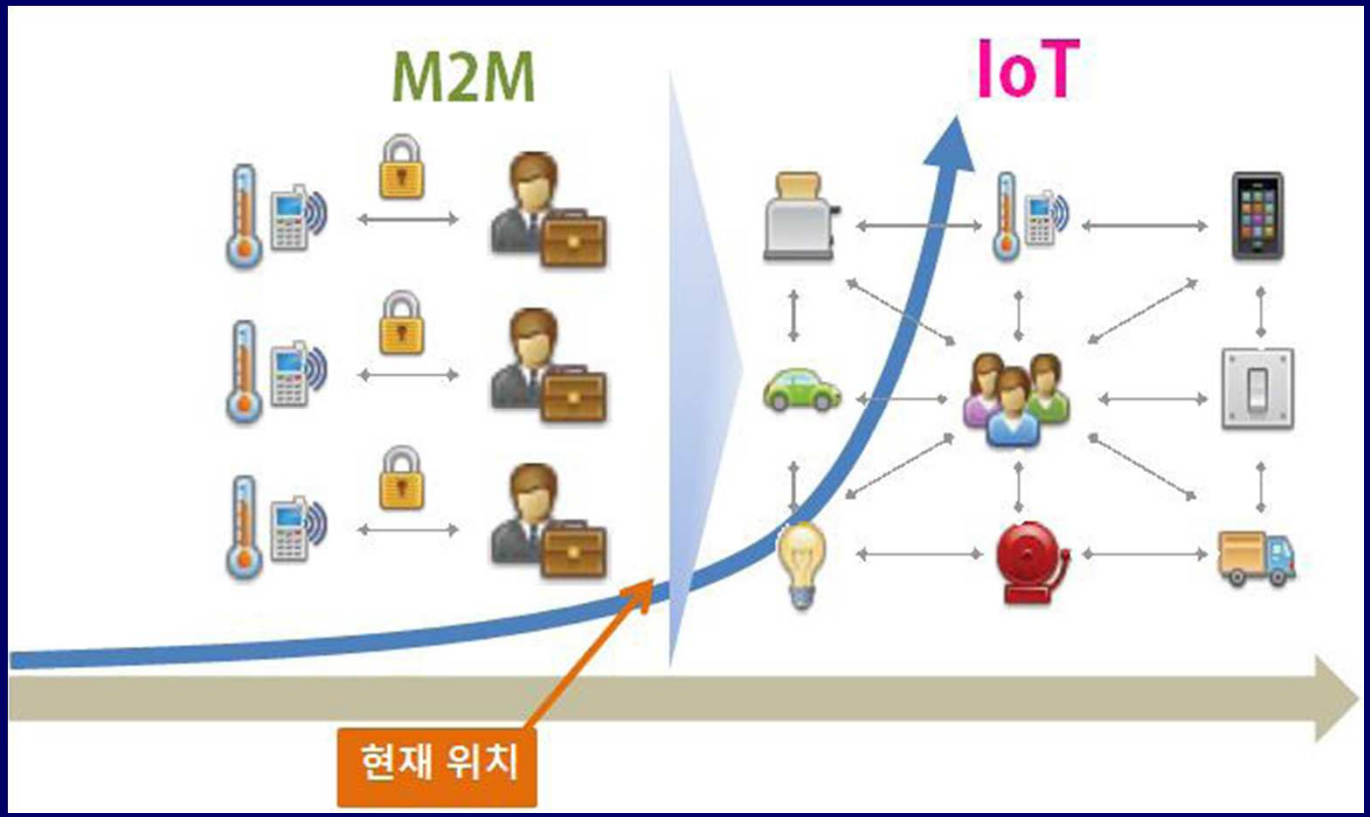
# Large Scale Servics

- Internet of Things (Everything)
- Smart City
- E-government
- Mobile computing
  - Giga Korea
  - 2018 in Winter Olympic Game in Korea.

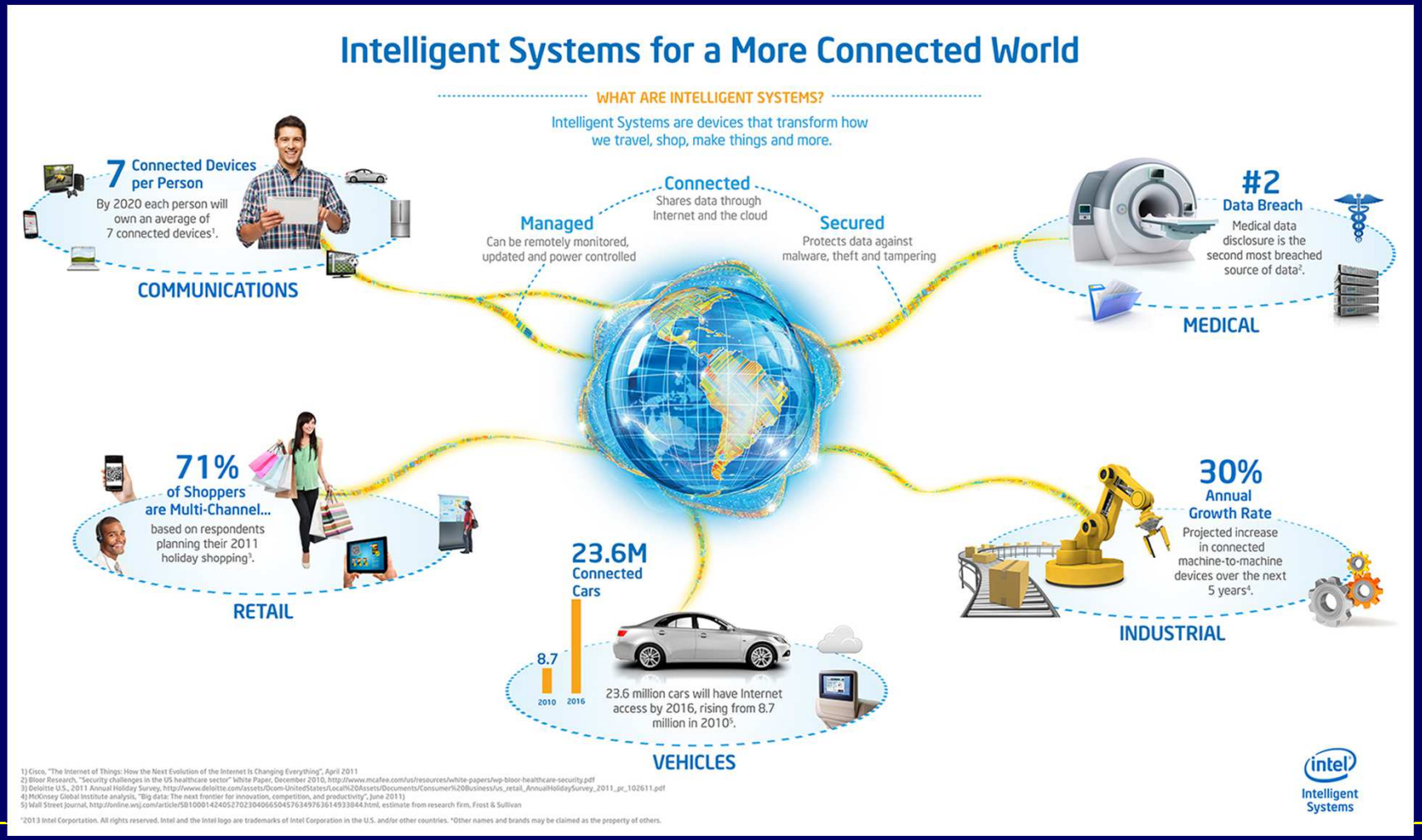
# IoE

- Companies and organizations explain the Internet of Things in various ways, but the Internet of Things, or IoT, is most commonly described as an ecosystem of technologies monitoring the status of physical objects, capturing meaningful data, and communicating that information through IP networks to software applications.
- The recurring themes in all definitions of the Internet of Things include smart objects, machine to machine communication, RF technologies, and a central hub of information.
- See more at http://blog.atlasrfidstore.com/internet-of-things-and-rfid#sthash.maX6z58Z.dpuf

# Korea thinks



# IoE by Intel


Intelligent Systems for a More Connected World
WHAT ARE INTELLIGENT SYSTEMS?
Intelligent Systems are devices that transform how we travel, shop, make things and more.
Connected
Shares data through Internet and the cloud
Managed
Can be remotely monitored, updated and power controlled
Secured
Protects data against malware, theft and tampering
7 Connected Devices per Person
By 2020 each person will own an average of 7 connected devices[1].
COMMUNICATIONS
#2 Data Breach
Medical data disclosure is the second most breached source of data[2].
MEDICAL
71% of Shoppers are Multi-Channel...
based on respondents planning their 2011 holiday shopping[3].
RETAIL
23.6M Connected Cars
8.7
2010
2016
23.6 million cars will have Internet access by 2016, rising from 8.7 million in 2010[5].
VEHICLES
30% Annual Growth Rate
Projected increase in connected machine-to-machine devices over the next 5 years[4].
INDUSTRIAL
1) Cisco, "The Internet of Things: How the Next Evolution of the Internet Is Changing Everything", April 2011
2) Bloor Research, "Security challenges in the US healthcare sector" White Paper, December 2010, http://www.mcafee.com/us/resources/white-papers/wp-bloor-healthcare-security.pdf
3) Deloitte U.S., 2011 Annual Holiday Survey, http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/Consumer%20Business/us_retail_AnnualHolidaySurvey_2011_pr_102611.pdf
4) McKinsey Global Institute analysis, "Big data: The next frontier for innovation, competition, and productivity", June 2011
5) Wall Street Journal, http://online.wsj.com/article/SB10001424052702304066504576349763614933844.html, estimate from research firm, Frost & Sullivan
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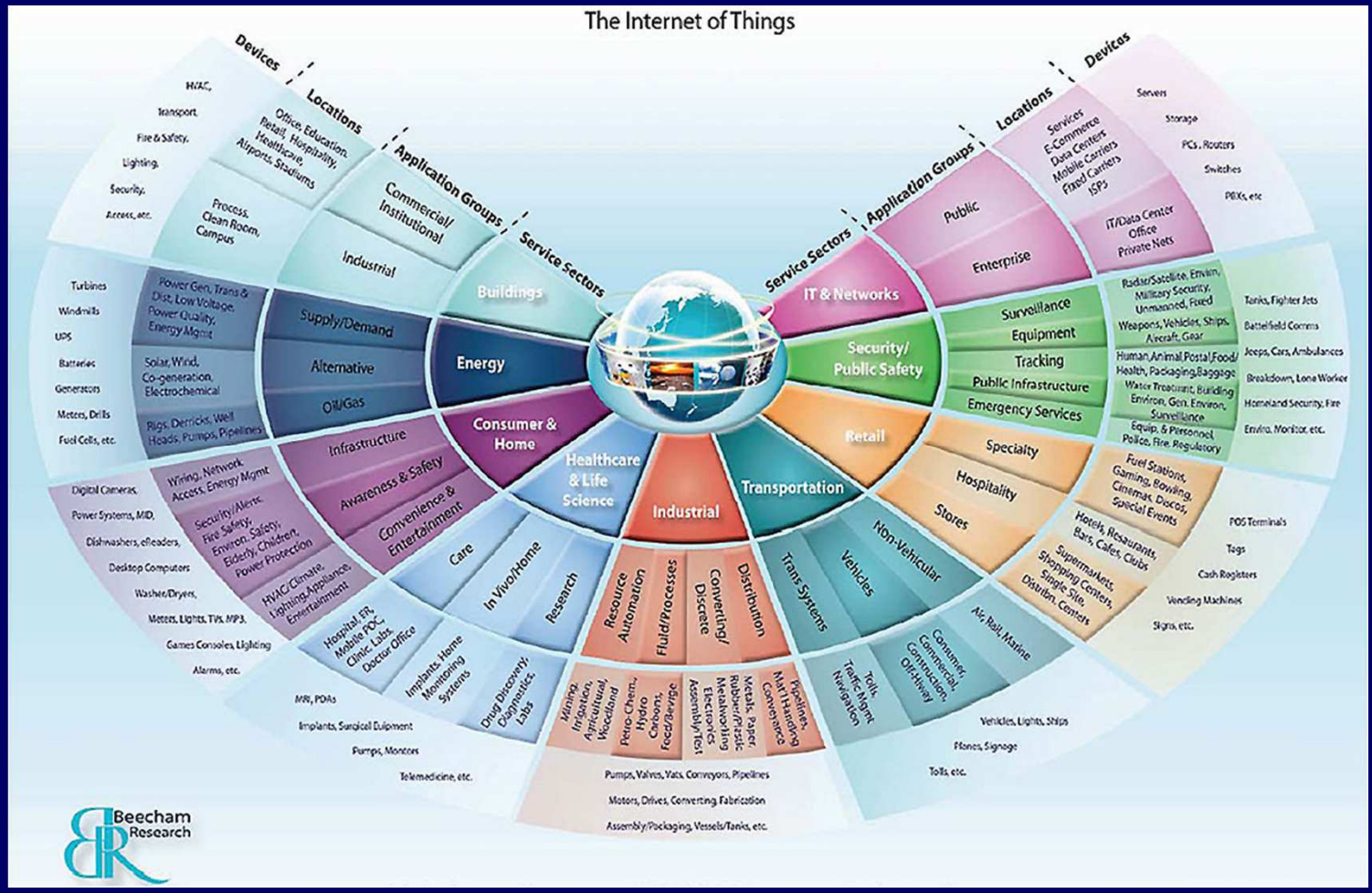
intel
Intelligent Systems

# Cisco & Beecham Research

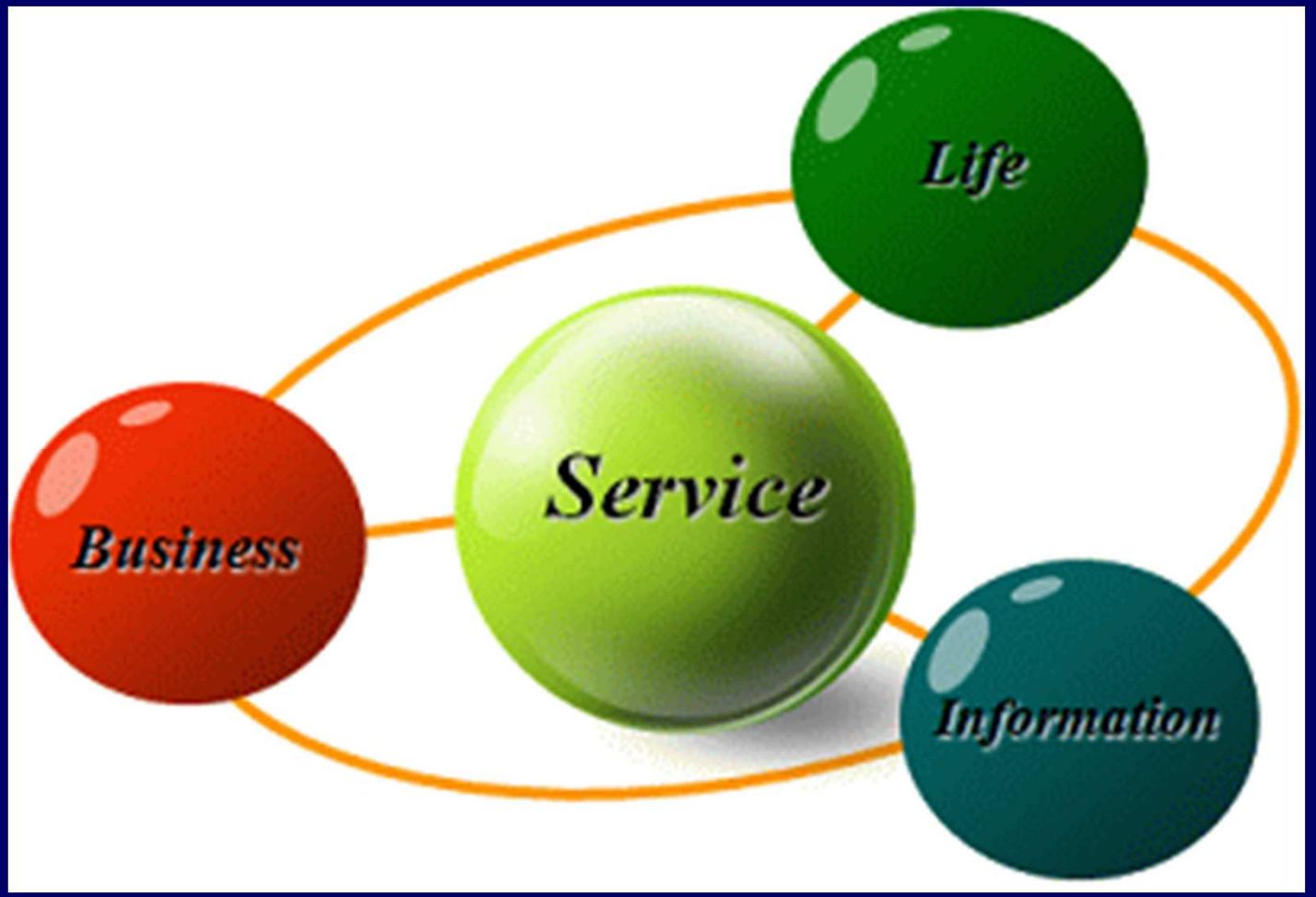


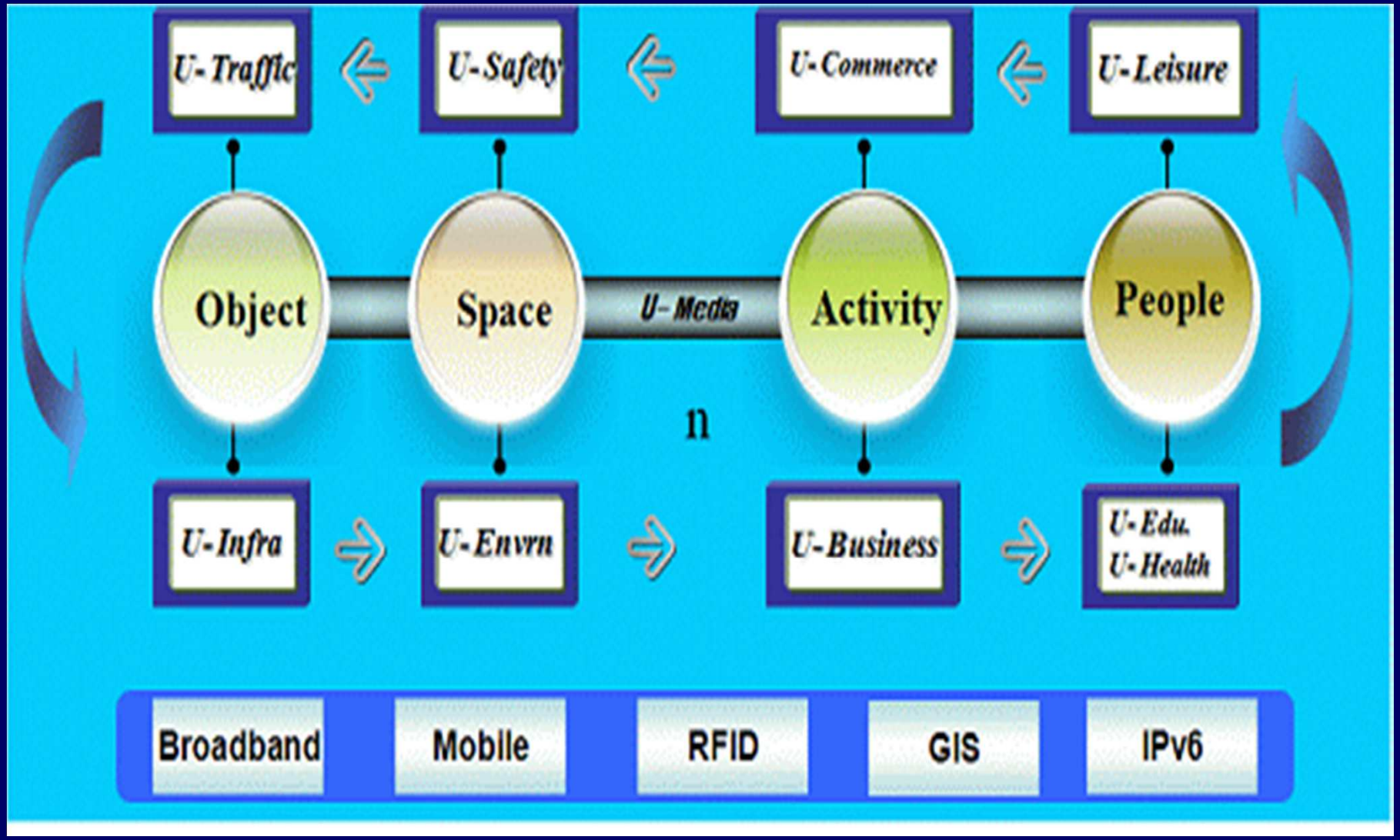
# IoT by iStockphoto/chris_lemmens

# Smart City

- A future city
  - Is a ubiquitous City
  - converges ICT & City.
  - allows the citizens to use the services anytime, anywhere and with any accessing devices.
  - covers a wide range of areas.

# [The Concept of U-City.


Life
Service
Business
Information


U-Traffic
U-Safety
U-Commerce
U-Leisure
Object
Space
U-Media
Activity
People
U-Infra
U-Envrn
U-Business
U-Edu.
U-Health
Broadband
Mobile
RFID
GIS
IPv6

# Large Scale Servics

- Internet of Things (Everything)
- Smart City
- E-government
- Mobile computing
  - Giga Korea
  - 2018 in Winter Olympic Game in Korea.

# 1. History of Korea's e-Government

**Inception**

1978~1996

Building Administrative Networks (1987~1996)
Implementing Administrative Computerization (1978~1987)

**Foundation**

1996~2000

Building nationwide broadband networks
Promoting Informatization

**Launch**

2001~2002

11 major tasks for e-Government Services

**Diffusion**

2003~2007

31 major tasks for e-Government Services

**Maturity**

2008~

Expansion of integration of e-Government

# 1. Government Integrated Data Center

- Separately managed information systems are consolidated by establishing NCIA

Information systems of government agencies integrated and managed together

## Seamless & Flawless Operation Achieved

- Stable integrated IT management for 24 / 7
- Monthly system failure time : 67min ▶ 1.15min

## IT Management Improved

- 67% of employees licensed for ITIL (IT Infra. Lib.)
- Number of systems managed per person : 1.8 ▶ 13

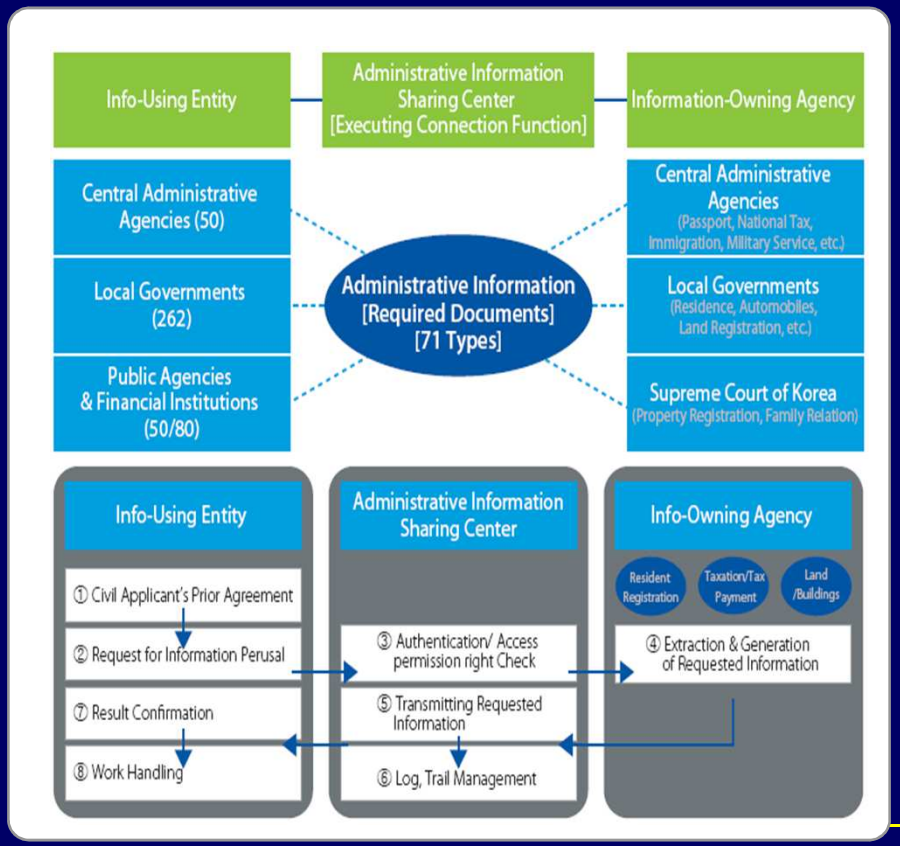
## Security Environment Consolidated

- 8-layer protection / 4-step analysis against intrusion
- Cyber attack / intrusion detection system equipped
- Dual system for natural disaster relief

※ NCIA: National Computing & Information Agency

# 2. Government Information Sharing

- **To minimize required documents and office visits by expanding Gov't information sharing to the entire public sector and financial institutions**
  - change from register & provider-centered, to customer-tailored Gov't info. Sharing
  - prevent misuse of critical information and promote Gov't info. sharing among agencies




## Expansion of Gov't info. sharing

- **Expanding types of information inquires.: 92 types → 120 types(2012)**
- **Expanding # of agencies: 415(2010) → 455(2012)**

Number of agencies sharing information:

- public: 313(administrative org.), 124(public org.)
- private:) 18

## Enhanced Transparency

- **Developing 'One Screen Service' to show only needed info.of citizens to public officials**
- **Developing Gov't info. relay system to improve the management of Gov't info. relay service**

# Large Scale Servics

- Internet of Things (Everything)
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# Smart City & Internet of Things & E-government & Mobile computing


- Requires limitless computing power : IaaS
- Various software in mobile devices : SaaS
- Smart city deals with huge volumes of data usually and a wide range of data in real time mode usually.
- Human beings are a factor.

# Conclusion

# Challenges in Delivering Large-scale Services over Cloud Environments

**Energy Efficient Cloud Infrastructures**

Petros Lampsas

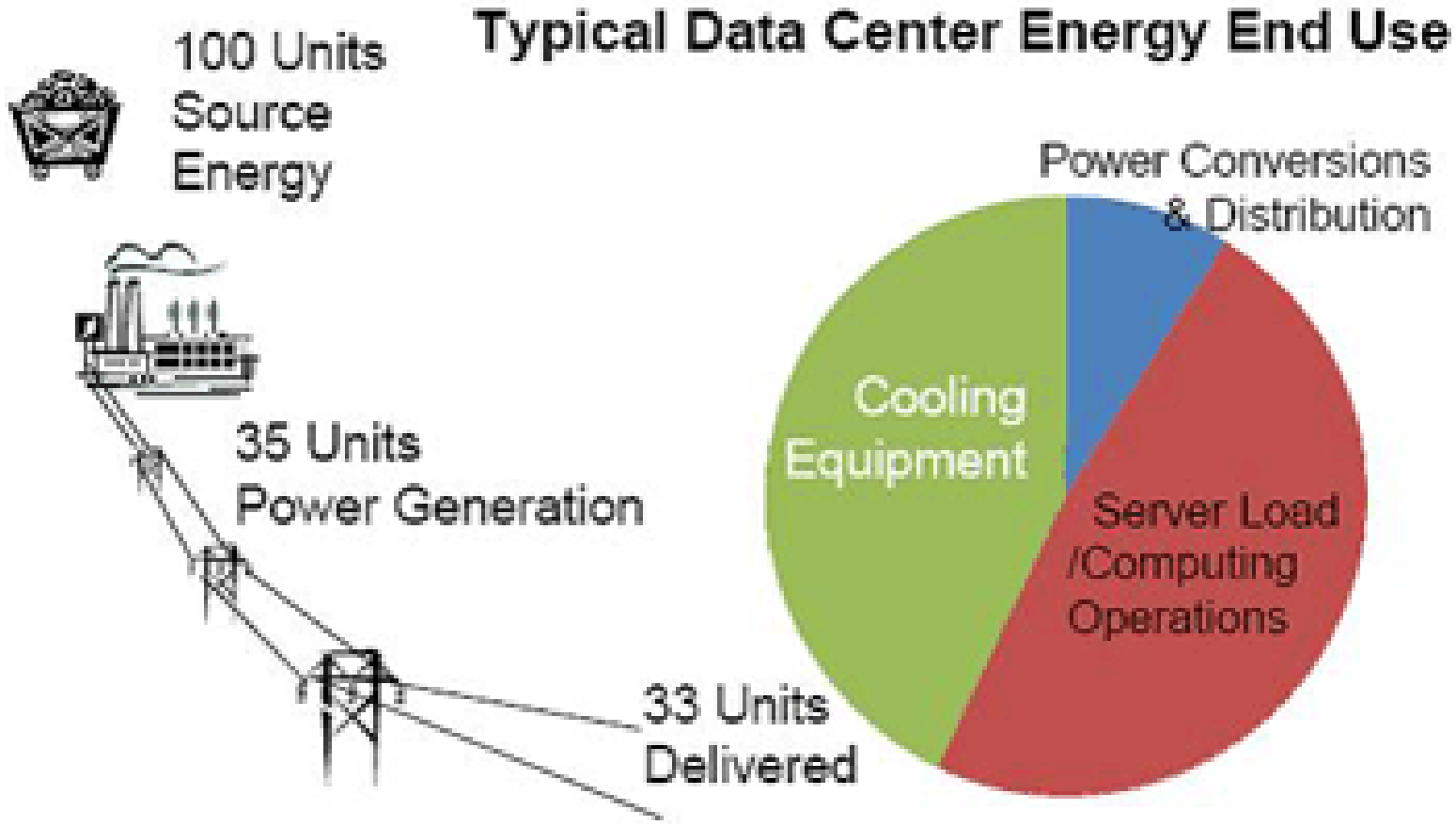
Professor, Department of Computer Engineering

Central Greece University of Applied Sciences

# Facts

- Up to 3% of all electricity powers Data Centers (DCs); expected to increase in the years to come
- Data centers can consume up to 100 times more energy than a standard office building
- Energy benchmarking is not standardized and/or adopted by all peers (Power Usage Effectiveness – PUE and Total Power Usage Effectiveness – TUE are the most prominent metrics)

# How Energy is Consumed in a DC



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# Designing energy efficient DCs

- Power Conversion and Distribution
- Server Load/Computing Operations
  - Server innovation
  - Virtualization
  - High efficiency power supplies
  - Load management
- Cooling Equipment
- Alternative Power Generation


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# The software part

- Although 15% of the energy entering a DC is consumed by the computing elements, there is space for optimization
- Use IT to save energy in IT!
- Areas of interest in IT-based DC energy efficiency:
  - VM migrations (within/across DCs)
  - data replication
  - server consolidation
  - minimization of VM to VM communication

# References


- http://energy.gov/eere/downloads/saving-energy-data-centers-applying-best-practices, Saving Energy in Data Centres, Applying Best Practices, US Department of Energy
- PUE: A comprehensive examination of the metric, https://www.thegreengrid.org/~/media/WhitePapers/WP49-PUE%20A%20Comprehensive%20Examination%20of%20the%20Metric_v6.pdf?lang=en
- GreenCloud: A New Architecture for Green Data Center
- CloudNet: Dynamic Pooling of Cloud Resources by Live WAN Migration of Virtual Machines

# *Challenges in Delivering Large-Scale Services over Cloud Environments*

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***The Fifth International Conference on Cloud Computing, GRIDs, and Virtualization– CLOUD COMPUTING 2014***

**May 25 - 29, 2014**

**Venice, Italy**

# Factors for Delivering Large-Scale Cloud Services

- ***Reliable High Performance Network Bandwidth***
- ***Scalable Infrastructure***
- ***Standardized APIs***
- ***Big Data Processing Engines & their Management Tools***

# Factors for Delivering Large-Scale Cloud Services

- ***Reliable High Performance Network Bandwidth***
  - *Cloud Provider may have a data center with a high performance network fabric*
  - *Limitation is on the Network infrastructure the Cloud Consumer uses to access the resources in Cloud Provider's Data Center*

# Factors for Delivering Large-Scale Cloud Services

- ***Scalable Infrastructure***
  - *Main Infrastructure Components that needs to be scaled are: Computing, Storage, Data Center's Network fabric*
  - *Scaling Computing Resources*
    - ***Server Virtualization***
  - *Scaling Storage Resources*
    - ***Storage Area Network (SAN)***
    - ***Virtualization of Storage***

# Factors for Delivering Large-Scale Cloud Services

- ***Scalable Computing Infrastructure - Server Virtualization***

  *- Limiting Parameter VM Density-*

  *Number of VMs in a Virtualized Host*

  *- Factors limiting VM Density*

  *Number of Processor Cores in the Host*

  *Number of Physical Network Ports*

# Factors for Delivering Large-Scale Cloud Services

- ***Storage Infrastructure Limitation***
  - *Properly Tiering Storage Resources*
  - *Capacity Allocation for Tier 1, Tier 2, Tier 3 etc*
  - *Lack of Management Tools that provide visibility into Storage allocations in SAN environments deployed in Virtualized Infrastructures*

# Factors for Delivering Large-Scale Cloud Services

- ***Data Center Network Fabric***
  - *Virtualized Hosts need to be clustered to create large Resource Pools*
  - *Size and Number of Clusters limited by Network fabric of the Data Center*
  - *Software Defined Networks (SDN) has the potential to provide a Scalable Network Infrastructure*

# Factors for Delivering Large-Scale Cloud Services

- ***Standardized APIs***
  - *Two Scalable components need to be integrated to have an overall scalable Infrastructure*
  - *To facilitate integration Standardized APIs are required*

# Factors for Delivering Large-Scale Cloud Services

- ***Standardized API .. Contd***
  - *Helps implement security solutions whose assurance measures can be evaluated based on some common well-understood security metrics*
  - *This is an example of a situation where standardization not only provides interoperability but also better security*

# Factors for Delivering Large-Scale Cloud Services

- ***Big Data Processing Engines & their Management Tools***
  - *Large-Scale Cloud services need tools to capture & process Big Data (characterized by Volume, Velocity & Variety)*
  - *"Open Data" policies adopted by many national governments have opened the flood gates for huge volumes of data*

# Factors for Delivering Large-Scale Cloud Services

- ***Big Data Processing Engines & their Management Tools .. Some Examples***
  - *Pharma Companies are making use of extensive clinical data made public for developing customized medicines*
  - *Consumer behavior data gathered by professional marketing companies & Social Media data are used for targeted advertisements & product development*

# Factors for Delivering Large-Scale Cloud Services

- ***Some Barriers***
  - *Concern about adequacy of data protection measures at Cloud Provider (Both Data Content as well as Data Media Protection – Disk Arrays and other storage mediums)*
  - *Overcoming challenges in Data Protection Technologies (e.g., Cryptographic Key Management Issues in the Cloud)*