Cloud Computing 2021
Keynote Speaking

ISO/IEC Joint Standards for Linux Standard Base to Support Cloud Computing, IoT, Smart Cities and 4th Industrial Revolution.

Yong Woo LEE, Ph.D.

Professor, University of Seoul

Leader, ISO/IEC JTC1 SC22 WG24 World Linux Standard Group

Chairman, The Korean National Committee for ISO SC22

President, Smart City Consortium for Seoul, Korea

Chairman, Seoul Grid Center

2021.4.22, Porto, Portugal

About the keynote speaker

- Yong (Young) Woo Lee
- Ph.D. from University of Edinburgh, UK
- B.Sc from Seoul National University, Korea
- Best researcher awards in KIST, Korea
- Senior researcher, KIST, Korea
- Principle researcher, KERIS, Korea
- Professor, University of Seoul, Korea,
- Vice president, Korea Internet Society
- President, Institute of Information Tech. UOS
- A Steering Committee Member of "IARIA Cloud Computing Conference" from the first conference till now since 2010.

New ISO/IEC Joint Linux Standards (20) for the Linux Standard Base (LSB)

- 20 = Nineteen standards & One Technical Specification.
- Based on Linux Foundation (LF) 's LSB 5.0.
- Will be published soon.
- ISO = International Organization for Standardization
- IEC = International Electro-technical Commission
- JTC 1 = Joint Technical Committee 1
- SC22 = For Programming Language & Operating system
- WG24 = For Linux Standards

New ISO/IEC Joint Linux Standards

- Linux can be divided into two parts. One is the Kernel and the other is user interface.
- There are more than three hundred Linux Distros. Their kernels are identical (same) but their user interfaces are different from each other. So, it was required to have a common standard user interface for compatibility.
- The user interface has been made into the Linux Standard Base(LSB) by Linux Foundation(LF).
- The nineteen ISO/IEC standards and one TS have been made based on LF's LSB.
- They will replace the old eight ISO/IEC LSB standards which were published in 2006.

New ISO/IEC Joint Linux Standards

- The standards will make many kinds of Linux distros compatible.

- Virtual Machine and Docker Container method can be alternative ways to use different Linux distros.

Linux Standard Base (LSB)

- "The goal of the LSB is to develop and promote a set of open standards that will increase compatibility among Linux distributions and enable software applications to run on any compliant system even in binary form. "

- "In addition, the LSB will help coordinate efforts to recruit software vendors to port and write products for Linux Operating Systems."

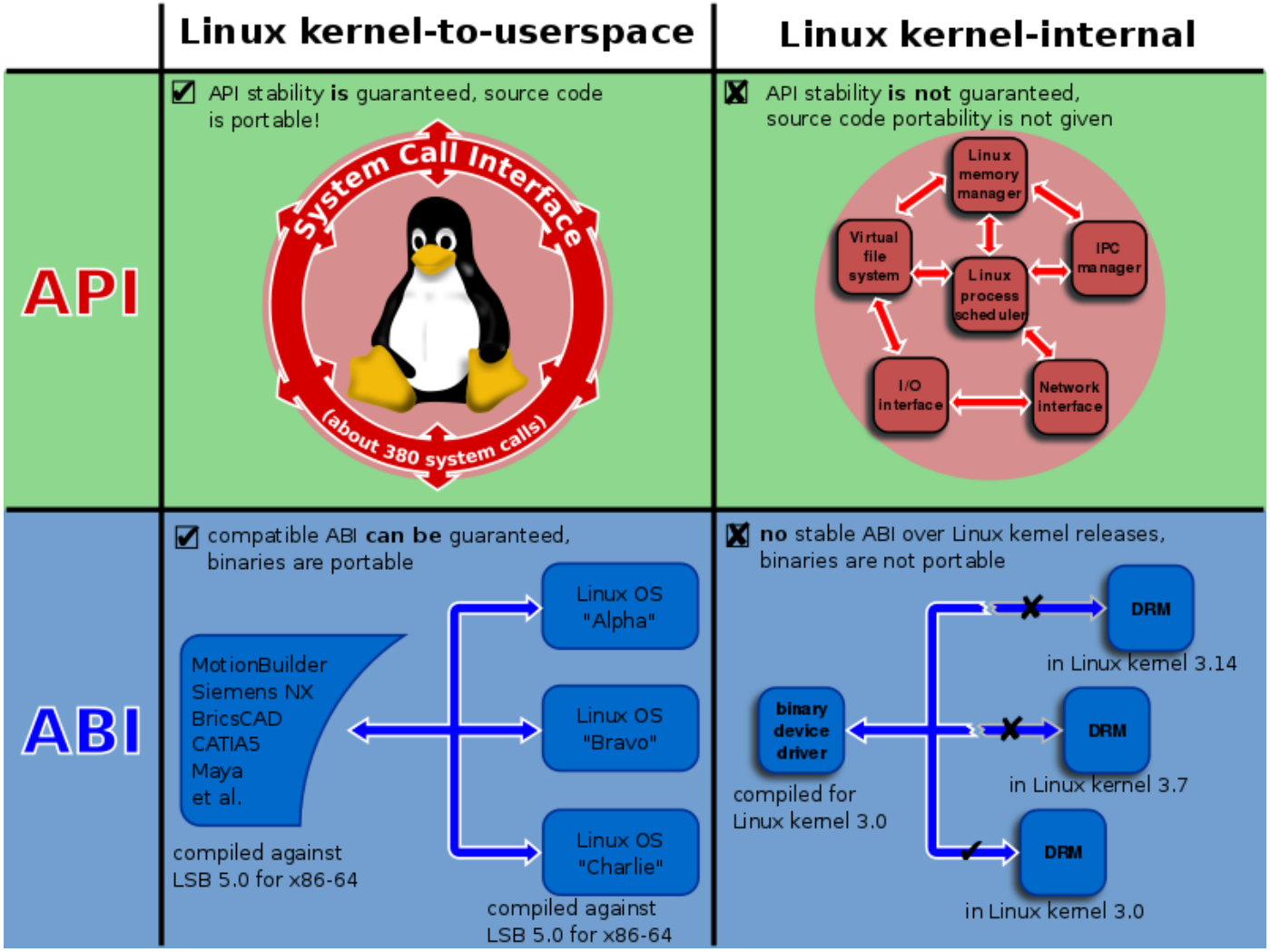
Linux Standard Base (LSB)

- "The Linux Standard Base (LSB) is a joint project by several Linux distributions under the organizational structure of the Linux Foundation to standardize the software system structure, including the Filesystem Hierarchy Standard used in the Linux kernel." - wiki

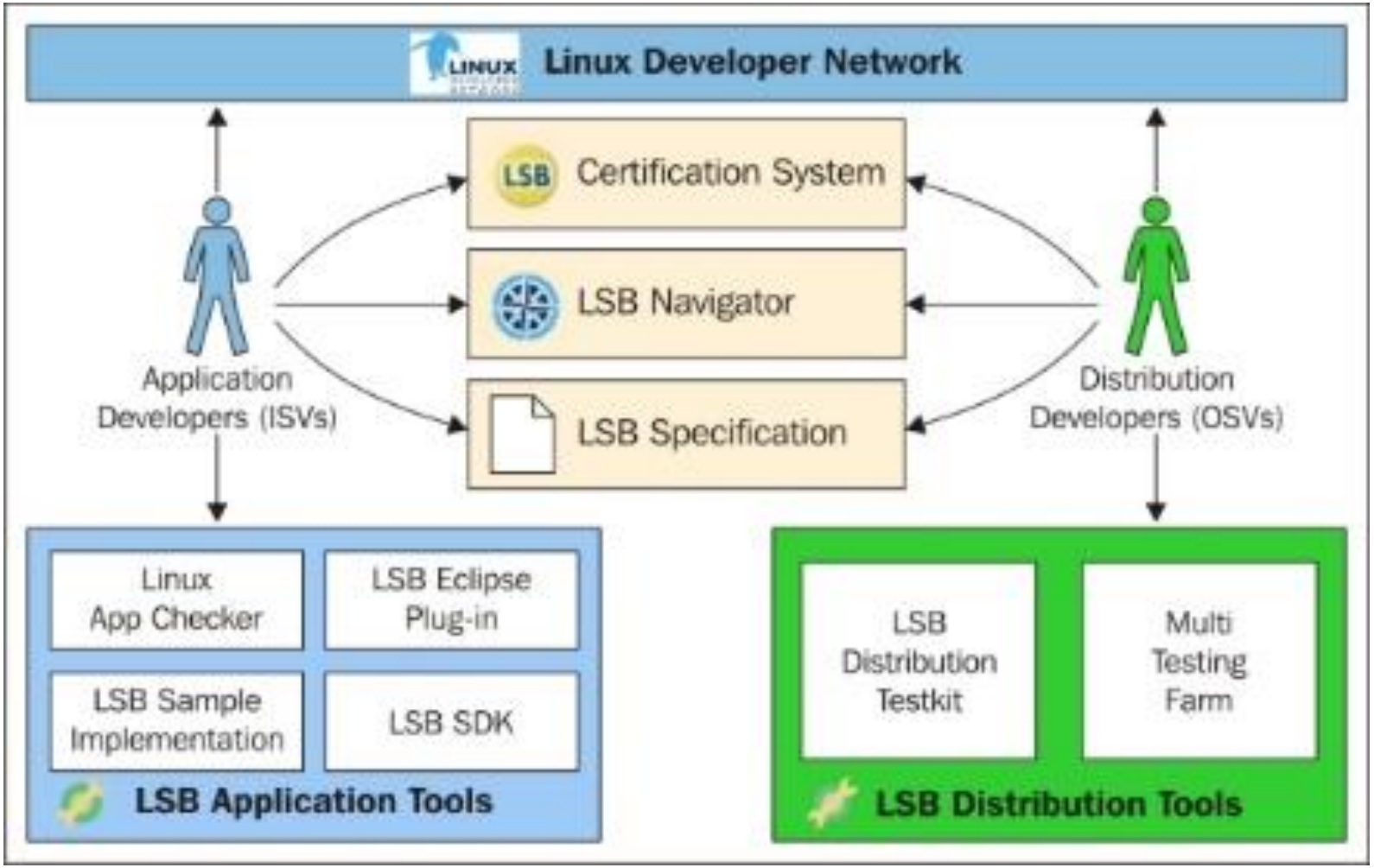
- "The LSB is based on the POSIX specification, the Single UNIX Specification (SUS), and several other open standards, but extends them in certain areas." - wiki

- "The LSB compliance may be certified for a product by a certification procedure." - wiki

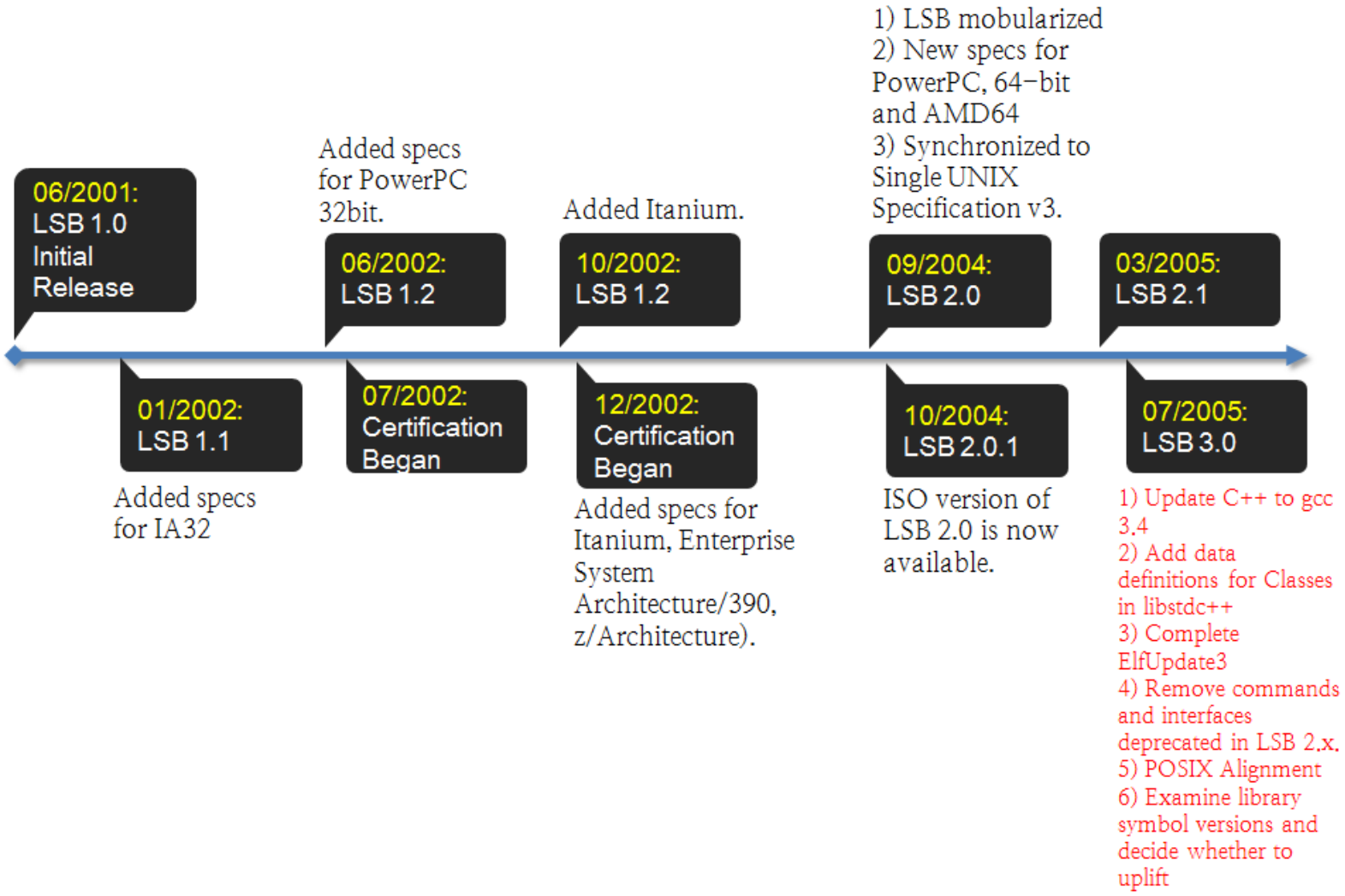
Linux Standard Base (LSB) -wiki



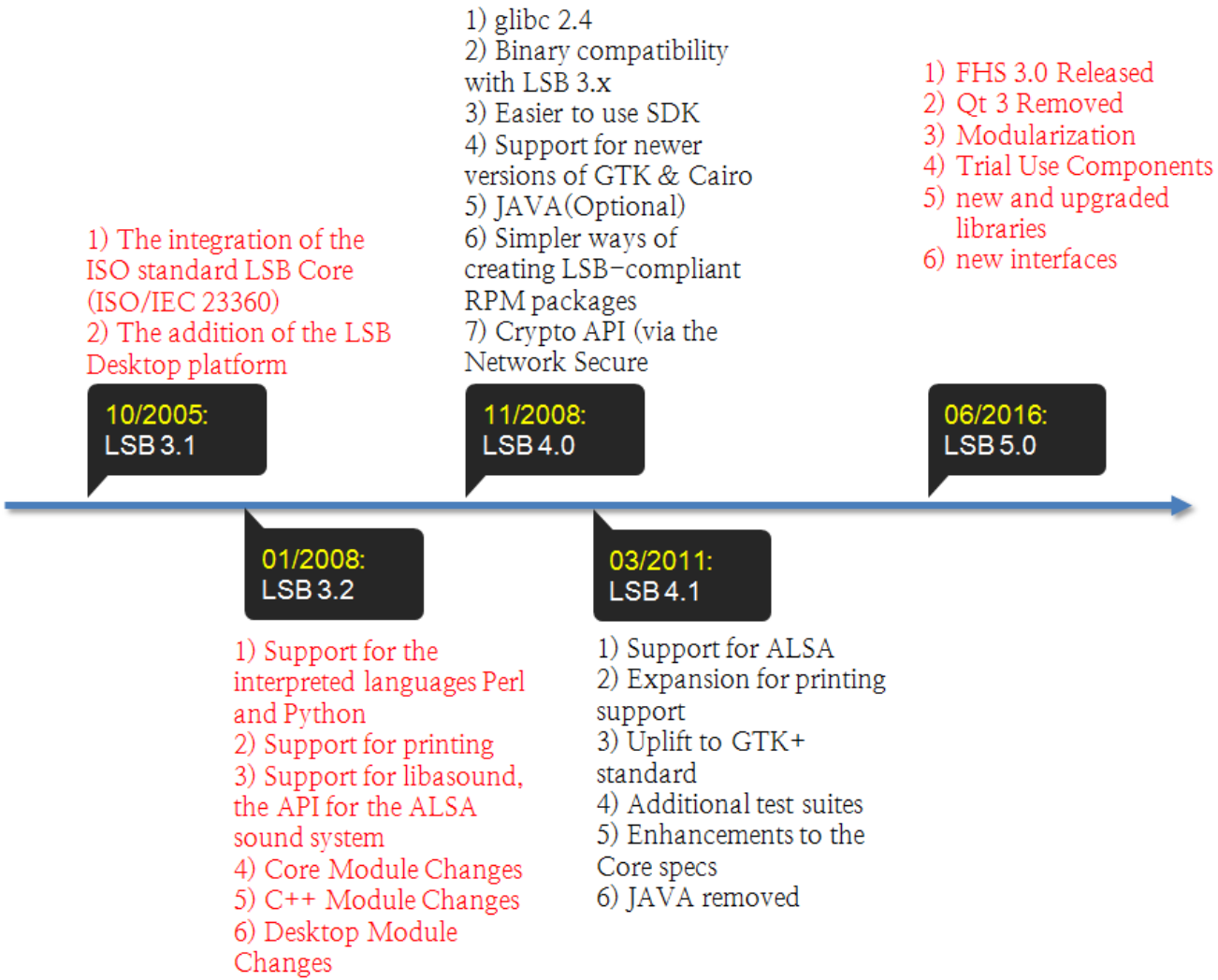
Linux Standard Base (LSB)



Linux Standard Base (LSB)



Linux Standard Base (LSB)



New ISO/IEC Joint Linux Standards

1. ISO/IEC 23360-1-1 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base common definitions
2. ISO/IEC 23360-1-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification, generic part
3. ISO/IEC 23360-1-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification, generic part
4. ISO/IEC 23360-1-4 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base languages specification, generic part
5. ISO/IEC 23360-1-5 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base imaging specification, generic part
6. ISO/IEC 23360-1-6 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base graphics and Gtk3 specification (A technical Specification)

New ISO/IEC Joint Linux Standards

7. ISO/IEC 23360-2-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification for IA32
8. ISO/IEC 23360-2-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification for IA32
9. ISO/IEC 23360-3-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification for IA64
10. ISO/IEC 23360-3-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification for IA64
11. ISO/IEC 23360-4-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification for AMD64
12. ISO/IEC 23360-4-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification for AMD64

New ISO/IEC Joint Linux Standards

13. ISO/IEC 23360-5-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification for PPC32
14. ISO/IEC 23360-5-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification for PPC32
15. ISO/IEC 23360-6-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification for PPC64
16. ISO/IEC 23360-6-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification for PPC64
17. ISO/IEC 23360-7-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification for S390
18. ISO/IEC 23360-7-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification for S390
19. ISO/IEC 23360-8-2 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base core specification for S390X
20. ISO/IEC 23360-8-3 Information technology — Programming languages and their environment — Operating systems — Linux Standard Base desktop specification for S390X

Why? => To support the following

1. Cloud Computing, Grid Computing.
2. Smart Devices : Embedded system.
3. Internet of Things (Internet of Everything).
4. Mobile computing and systems
5. The 4th Industrial Revolution
6. Smart Society.
   - ❖ Smart Home, Smart Building, Smart City.

Consideration (1)

- **There are explosive need for the open source free operating system to make the smart society, which has been and will be accelerated by cloud computing, smart devices, Internet of Things, the 4th industrial revolution, smart home, smart city, etc. toward the smart society.**

- **Thus, there has been strong thirstiness toward the free open source operating system and now we see many children of Linux for them.**

Consideration (2)

- For example, when we see the case of smart phones, there are Google's Android which is based on Linux, yet we have Tizen and some others that are also based on Linux.

- What I want to say regarding the matter is "Let them go as they want. We will prepare proper and useful Linux standards as a minimal care to the children of Linux and Linux society."

- ISO and IEC standards in Linux can be the very attractive, reliable and useful to Linux end users, Linux industry, Linux market, Linux based convergence industry, and Linux based convergence market.

Current position of Linux

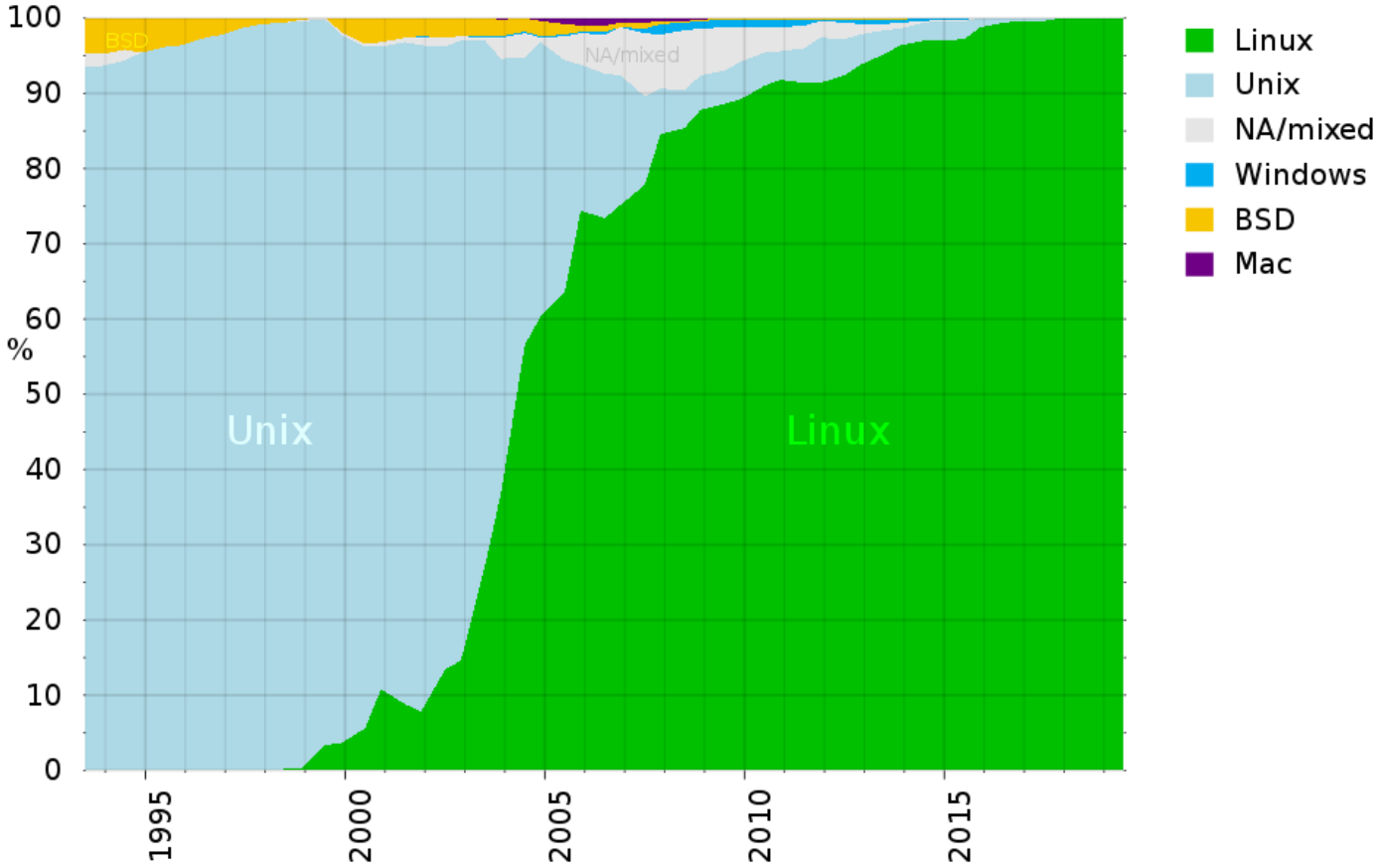
A market based analysis

Cloud Computing

- ❖The size of cloud market is larger than 100 billion US dollars now.
- ❖More than 90% of cloud systems use Linux.
- ❖We can say that all Clouds lead to Linux.

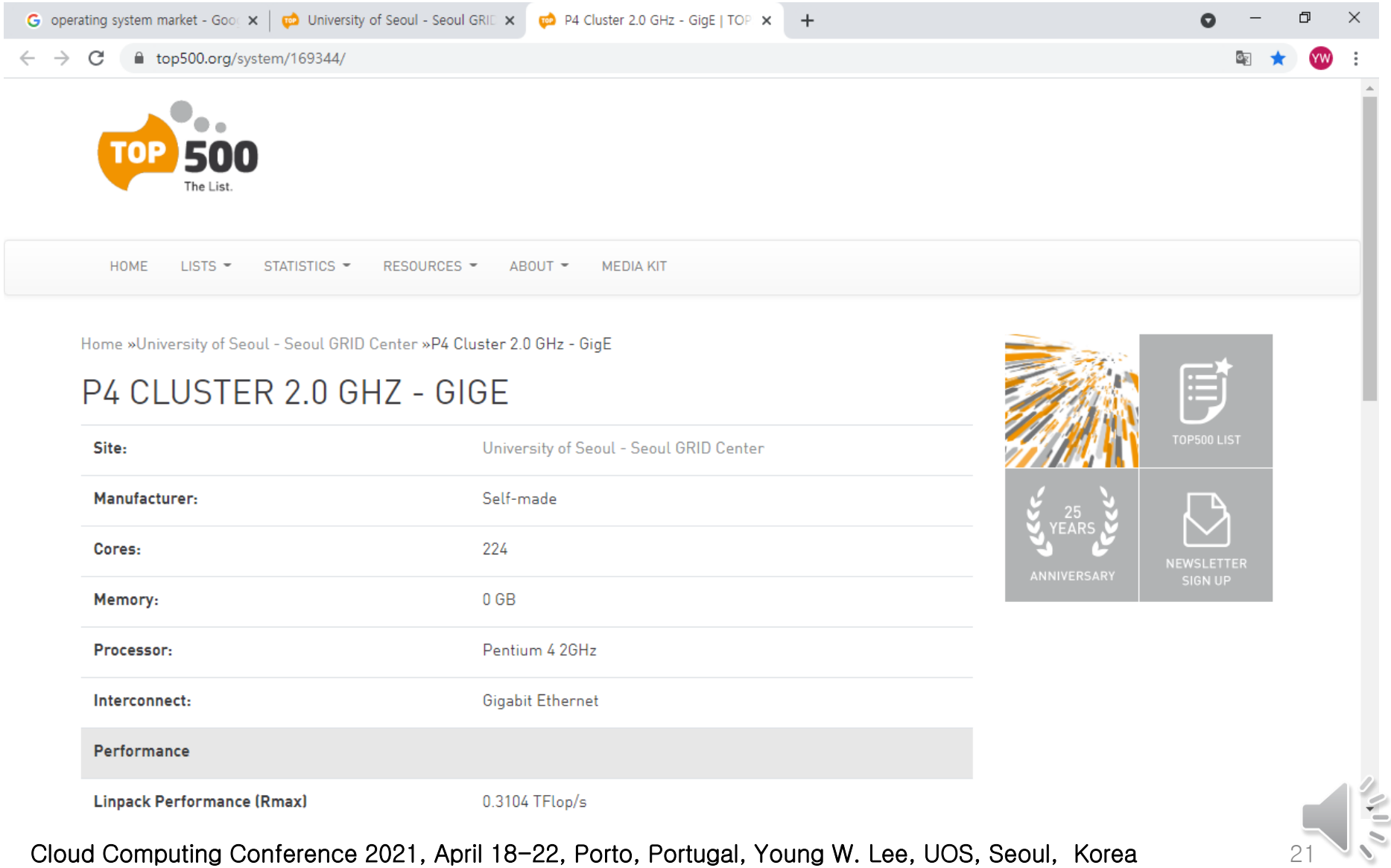
Supercomputers: wiki
Linux : 100%

Starting in 2017, every top 500 fastest supercomputer uses Linux as its supercomputer operating system.



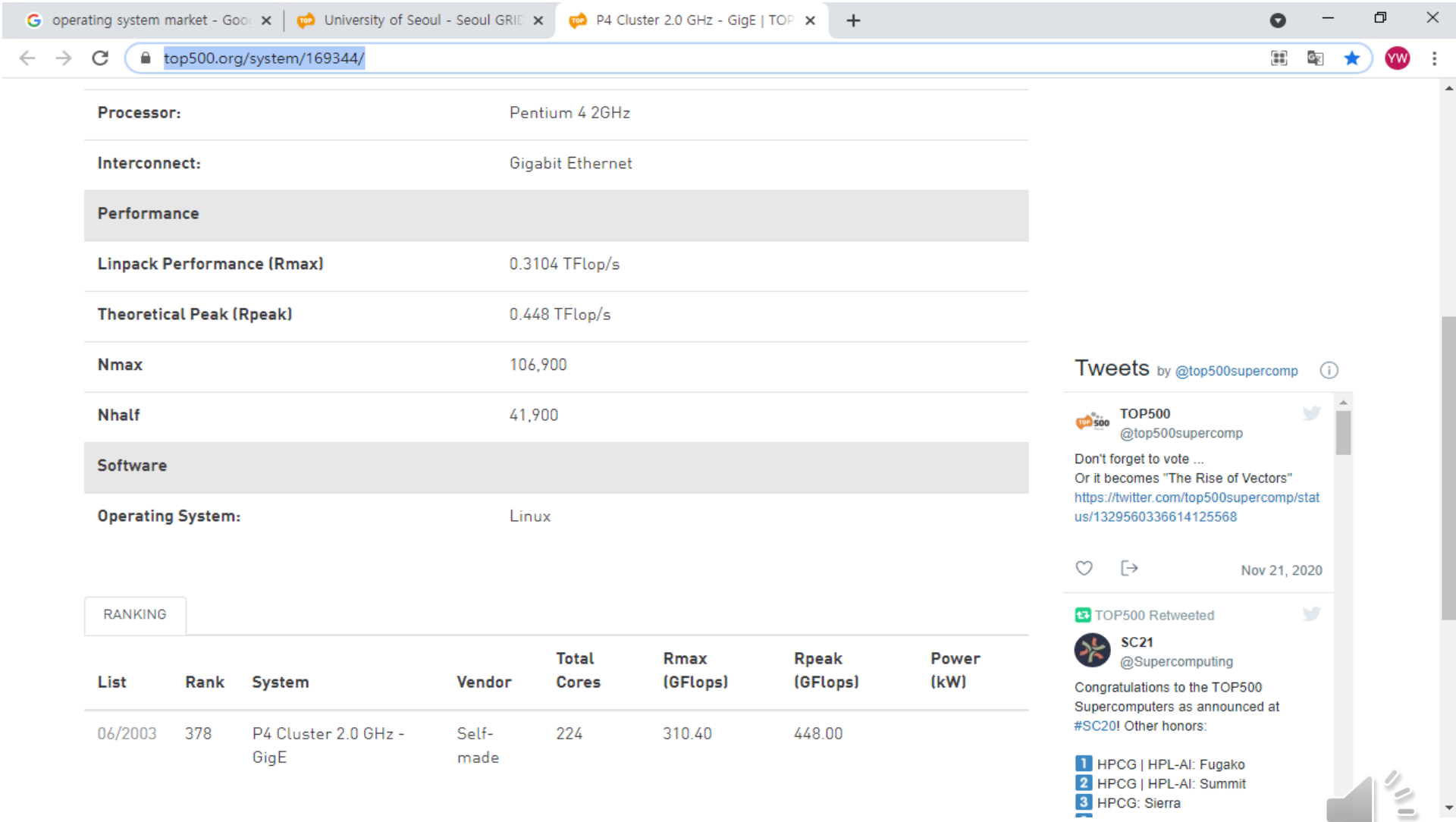
Top 500 supercomputers on 2003 June

https://www.top500.org/system/169344/



Top 500 supercomputers on 2003 June

https://www.top500.org/system/169344/



Mainframes : wiki

Linux distributions have become increasingly popular on mainframes in the last decade partly due to pricing and the open-source model. [2013 wiki]

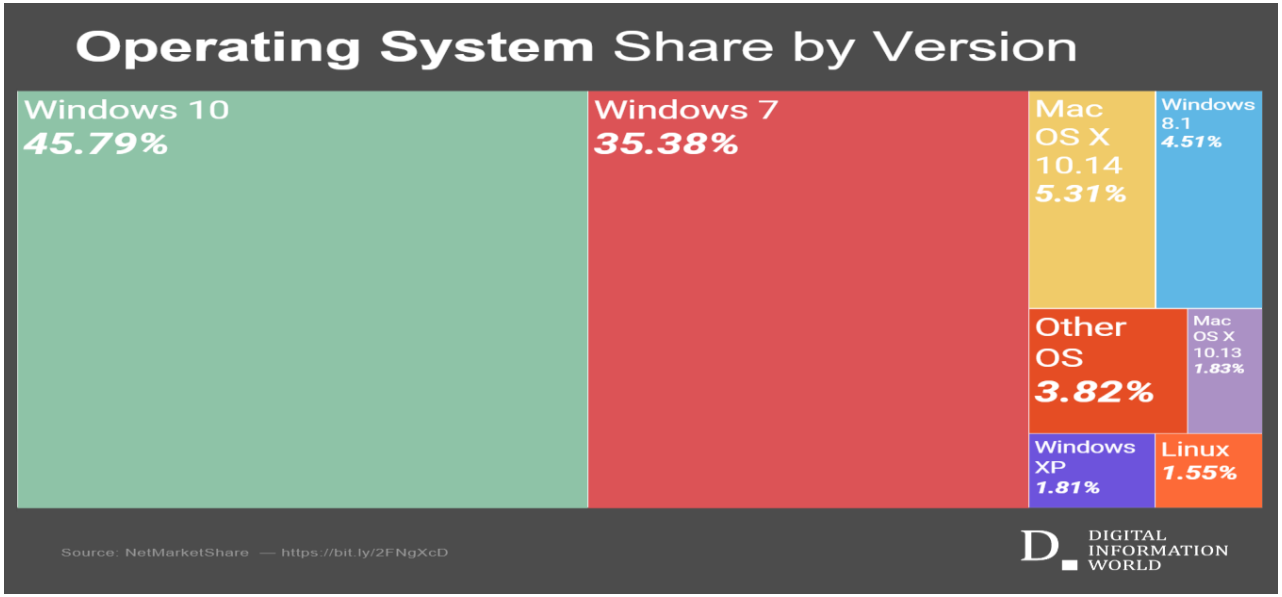
IBM announced its investment of one billion US dollars to Linux in 2000.

In December 2009, computer giant IBM reported that it would predominantly market and sell mainframe-based Enterprise Linux Server. [2013 wiki]

As of March 2016, Red Hat is the second largest corporate contributor to the Linux kernel version 4.14 after Intel. On October 28, 2018, IBM announced its intent to acquire Red Hat for $34 billion. The acquisition closed on July 9, 2019.

The most common operating system for mainframes is IBM's z/OS. Operating systems for IBM Z generation hardware include IBM's proprietary z/OS, Linux on IBM Z, z/TPF, z/VSE and z/VM.

PCs and Laptops



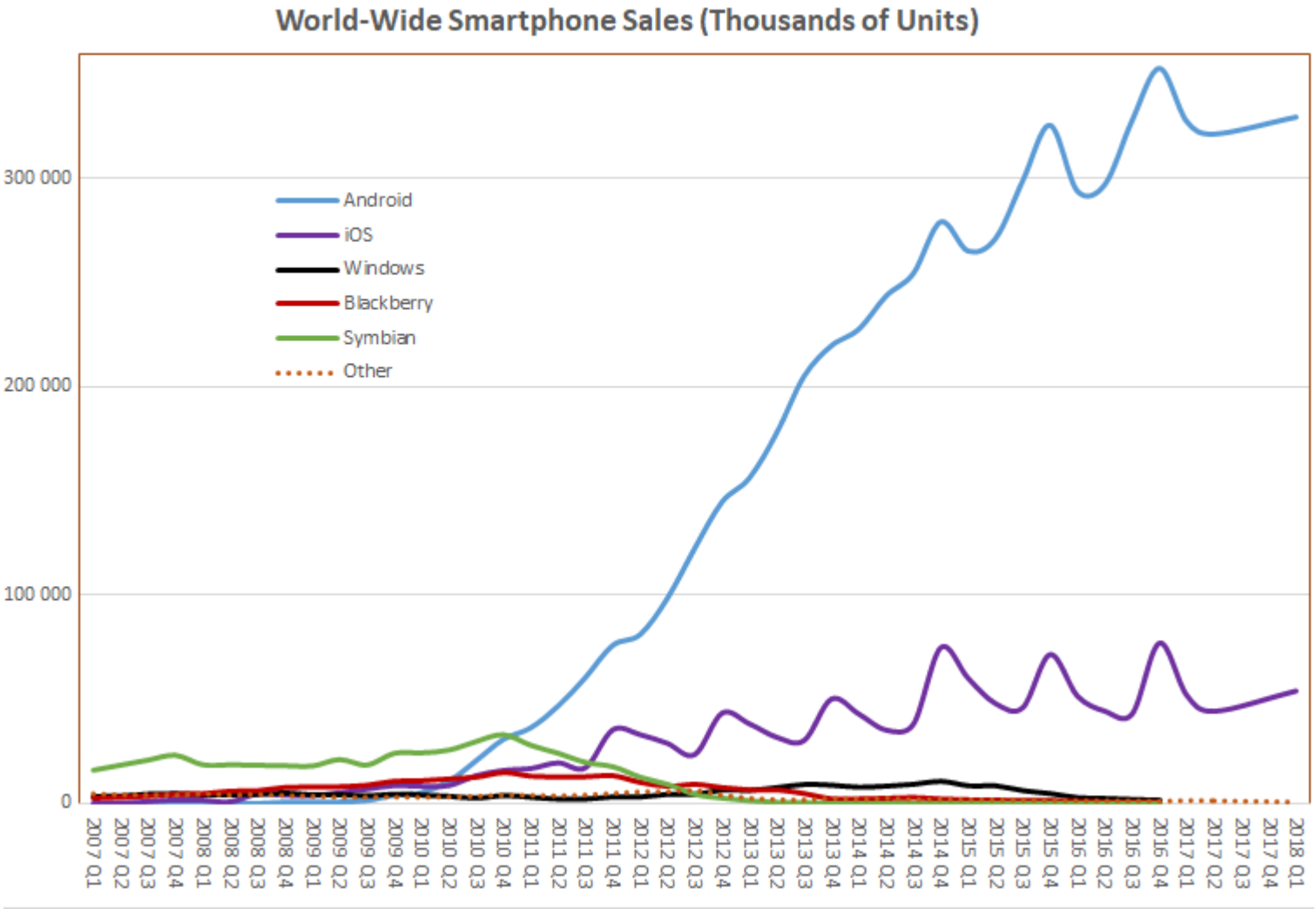
Market Share figures for May 2019 and June 2019

https://www.digitalinformationworld.com/2019/07/global-operating-system-market-share.html

- In 2019, Microsoft released Window 10 Linux.

- Microsoft released its Windows 10 Update on May 2020.
  - A “major” update to Windows 10,
  - The biggest change to the May 2020 Update is that it includes the Windows Subsystem for Linux 2 (WSL 2), with a custom-built Linux kernel.

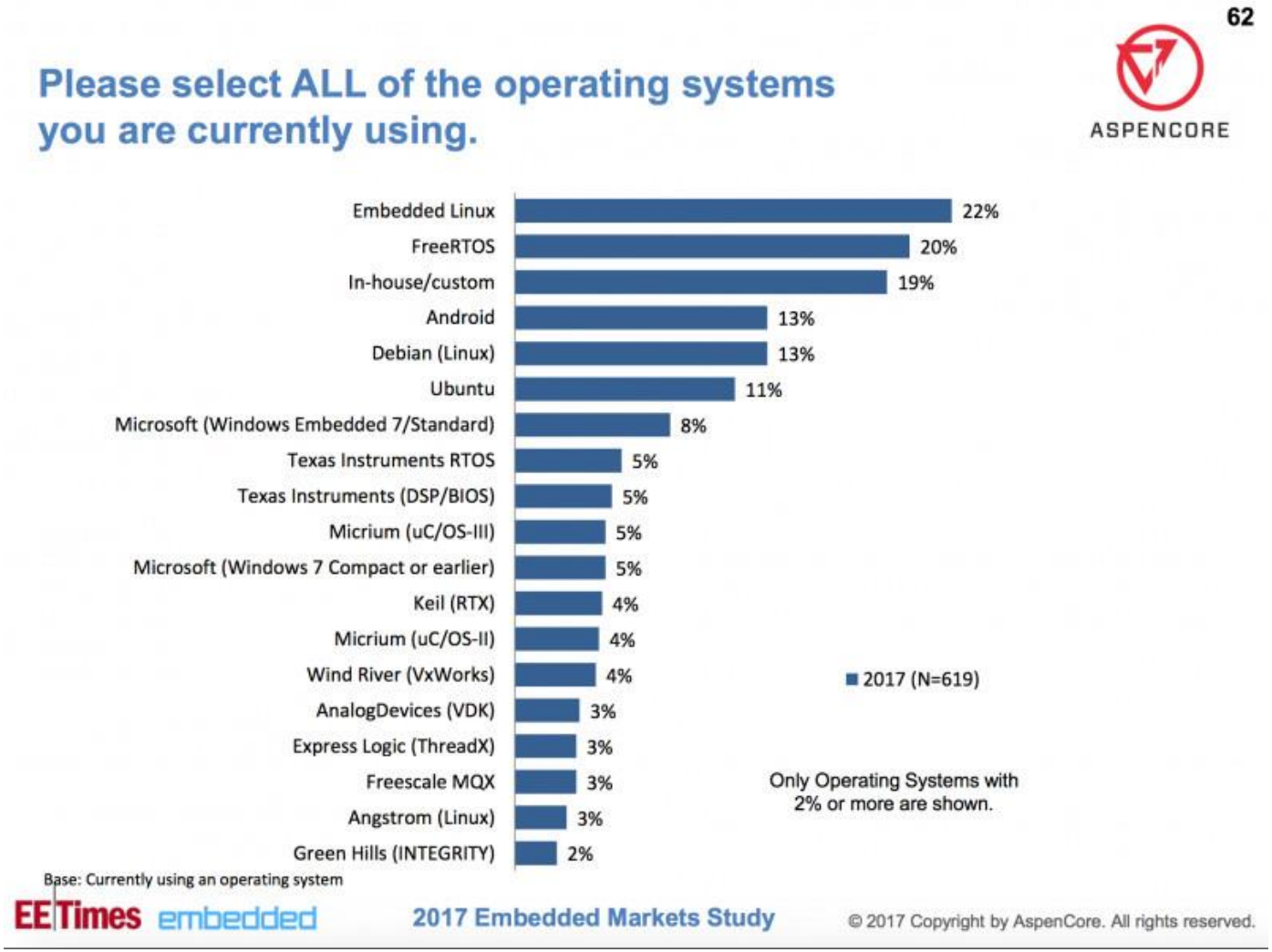
Smartphone OS : wiki.



Linux Based OS for Smart Devices

- Android : Google
- Tizen : Samsung, Intel, …
- WebOS : LG, …
- ……

Embedded System



http://linuxgizmos.com/files/aspencore_os.jpg

The ISO/IEC Standards for Linux Standard Base are to support the followings.

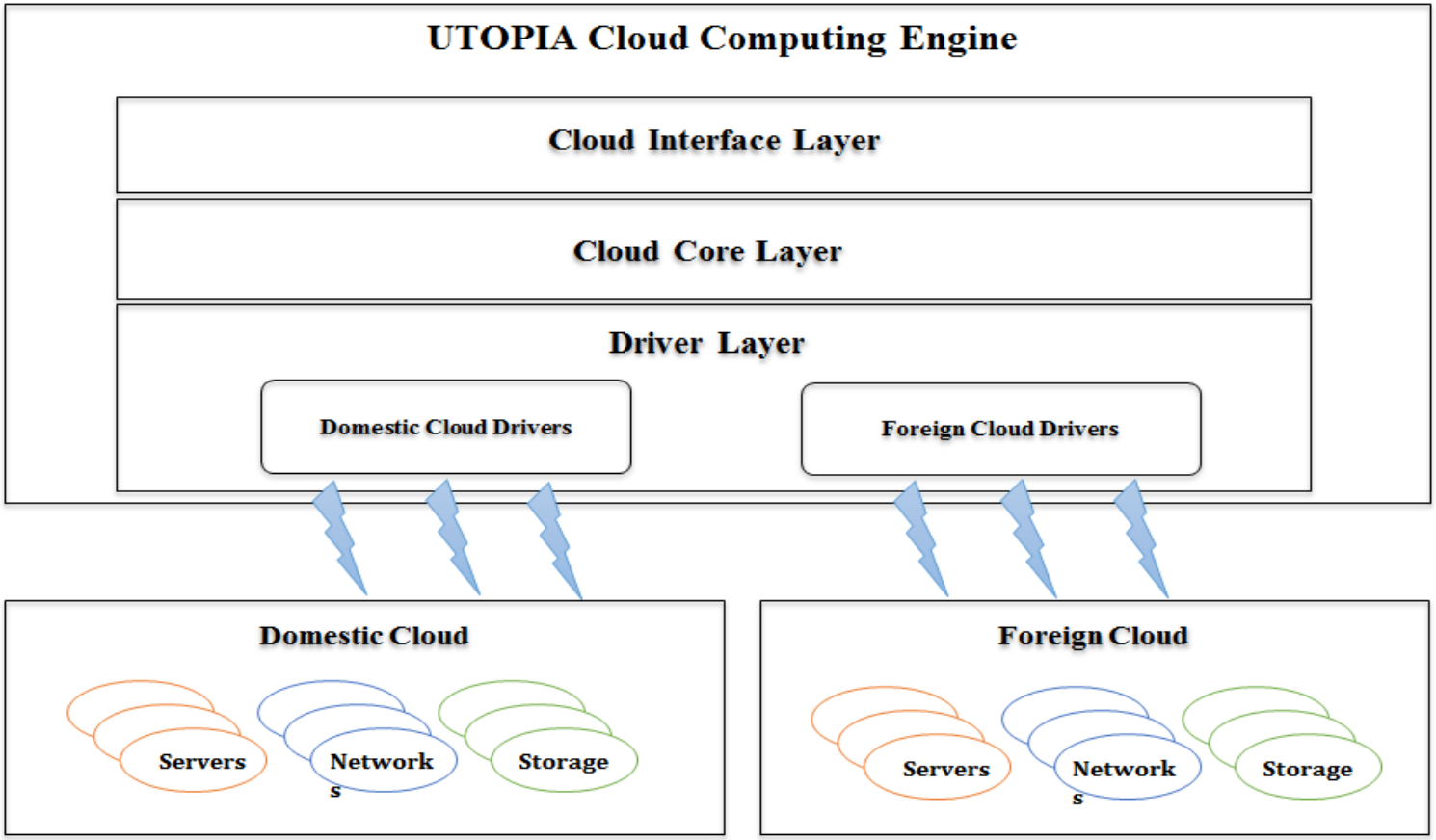
1. Cloud Computing
2. Internet of Things (Everything).
3. Smart Devices : Embedded system.
4. Mobile Computing and Mobile Systems
5. The 4th Industrial Revolution.
6. Smart Society
   - ❖ Smart Home, Smart Building, Smart City

1. The New ISO/IEC standards for Linux standard base are to support cloud computing

Very Useful to Cloud Computing

- For migration in clouds.
  - Migration is moving from one cloud to another.
  - Migration among different clouds.
  - Migration in a hybrid cloud.
- For compatibility
- For portability

Very Useful to Cloud Computing



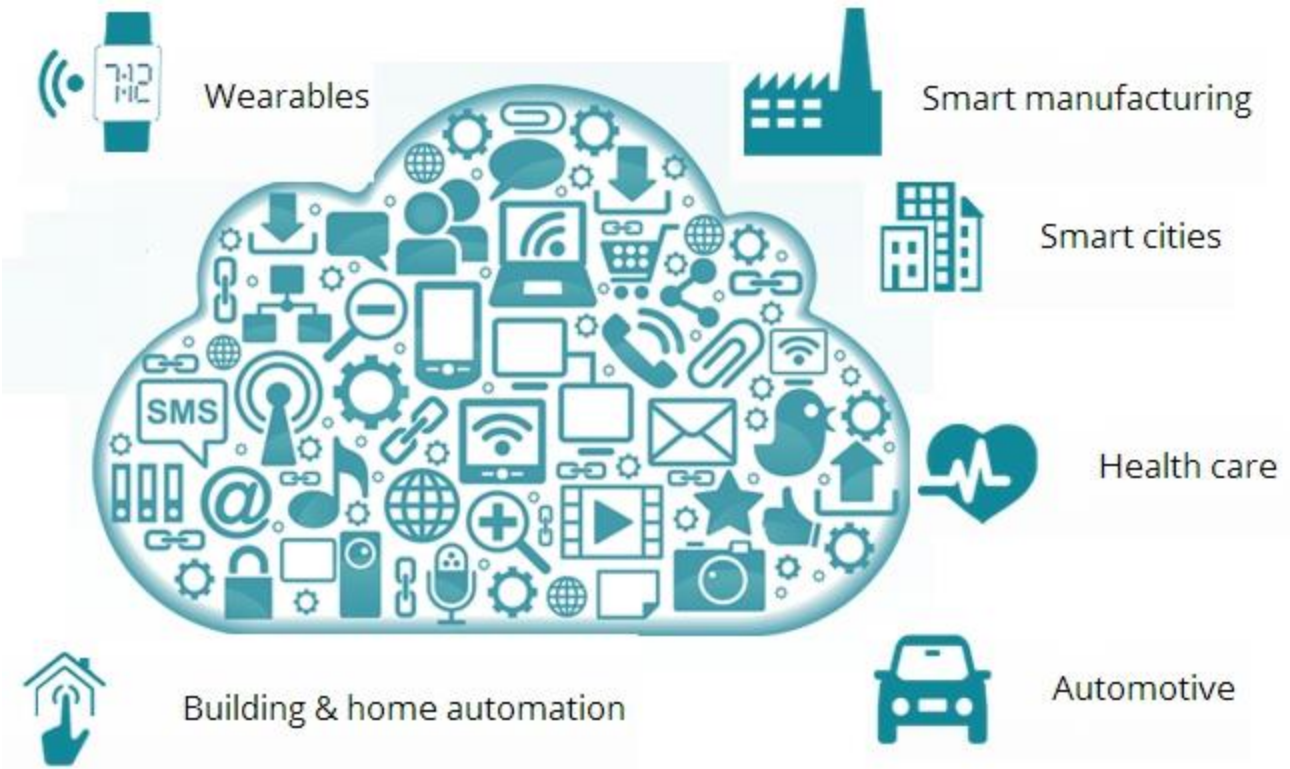
- Domestic Cloud = Cloud systems inside the smart city
- Foreign Cloud = Cloud systems outside the smart city

Who works for cloud standards?

Who works for cloud standards?

- https://cloud-standards.org/?title=Main_Page

Cloud Computing is essential for smart devices, IoT, mobile systems, the 4th industrial revolution, smart home, smart cities, and smart society.



https://www.kipost.net/news/articleView.html?idxno=108210

Cloud Computing is essential for the E-government.

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

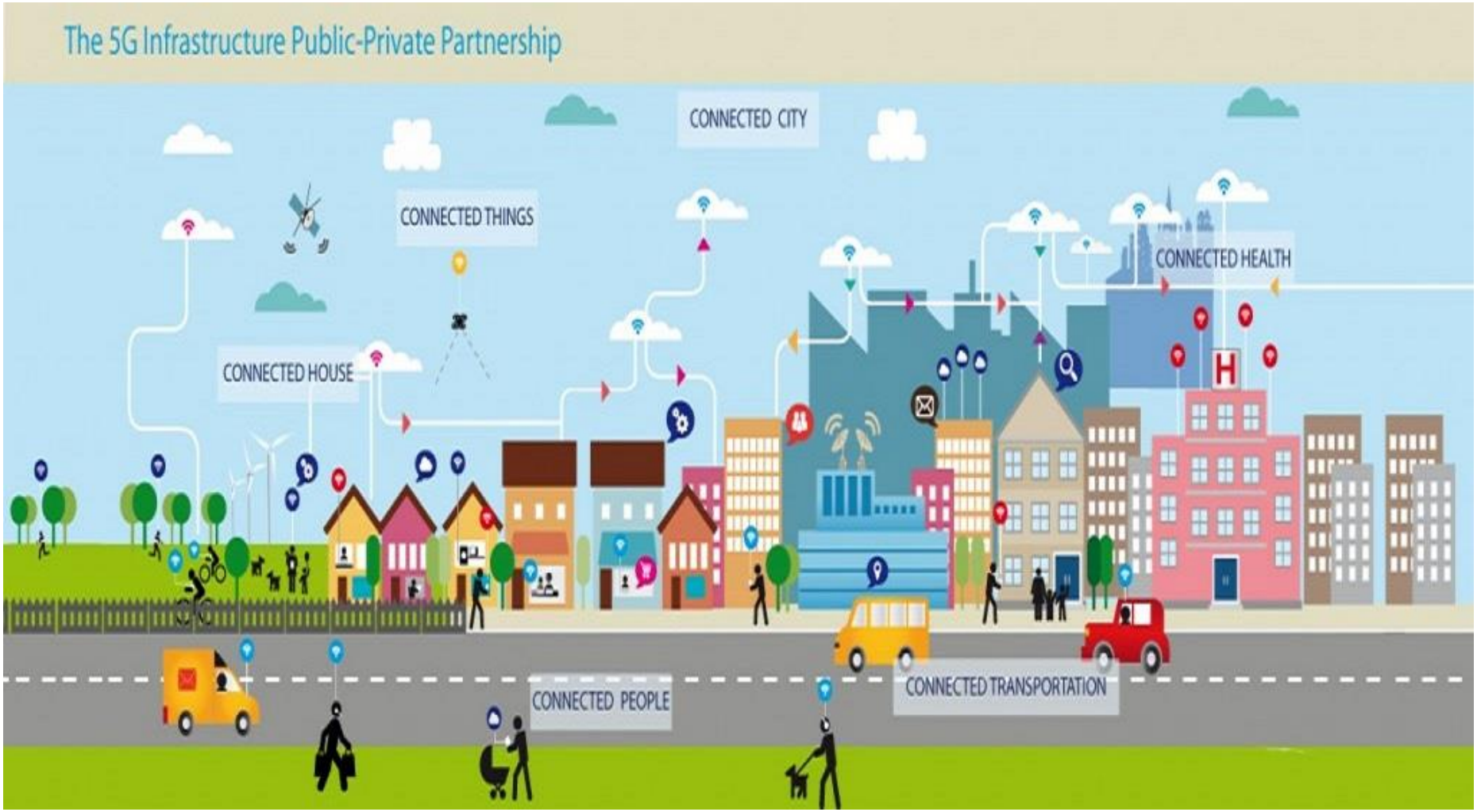
※ NCIA: National Computing & Information Agency

Korea's E-government Best Practices

Cloud Computing is essential for mobile computing.

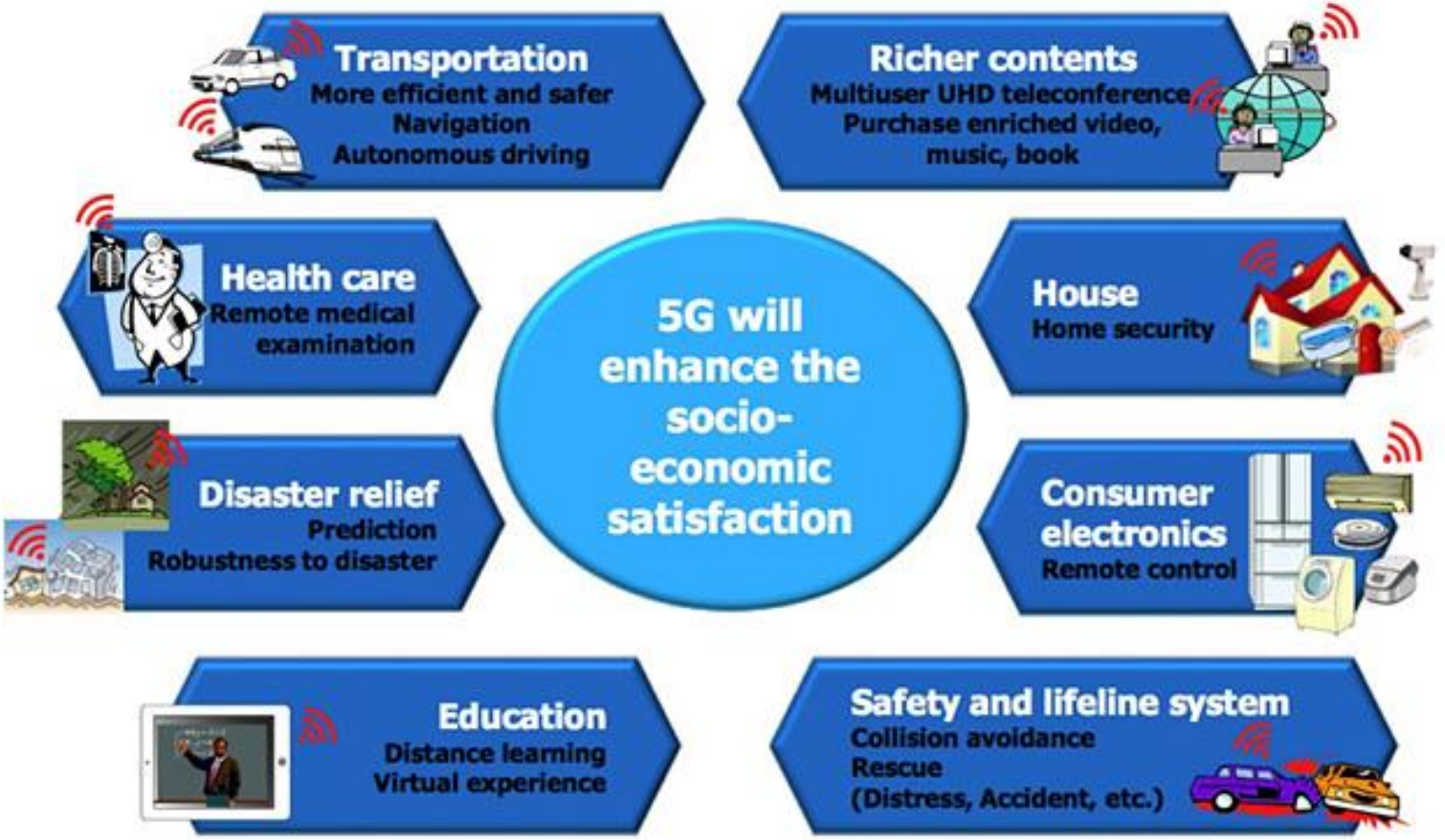
http://aceadvt.in/2018/10/23/5g-mobile-network/

Cloud Computing is essential for mobile computing.



http://aceadvt.in/2018/10/23/5g-mobile-network/

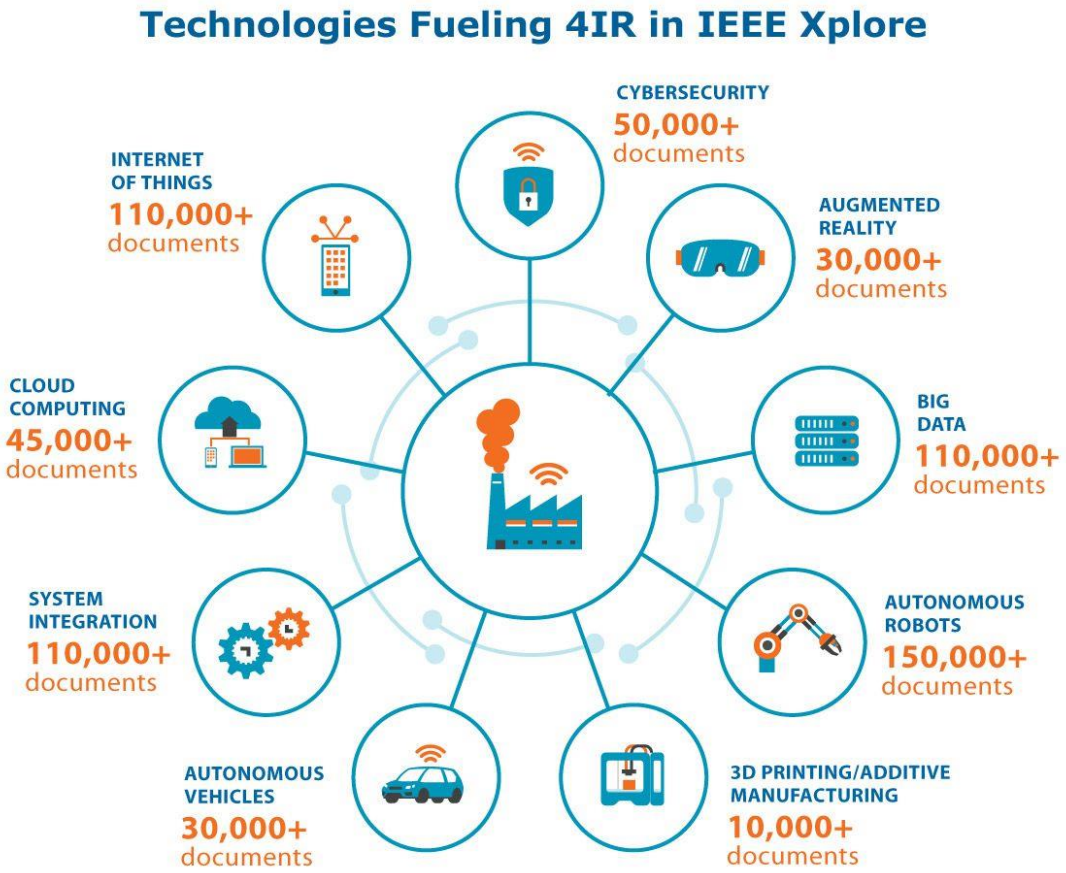
Cloud Computing is essential for mobile computing.



https://5gmf.jp/en/about-5g/

Cloud Computing is essential for smart cities

Cloud Computing is essential for the 4th Industrial Revolution.



https://innovate.ieee.org/innovation-spotlight-ieee-fueling-fourth-industrial-revolution/

2. The New ISO/IEC standards for Linux standard base are to support smart devices.

Linux Drives the Open Source Car

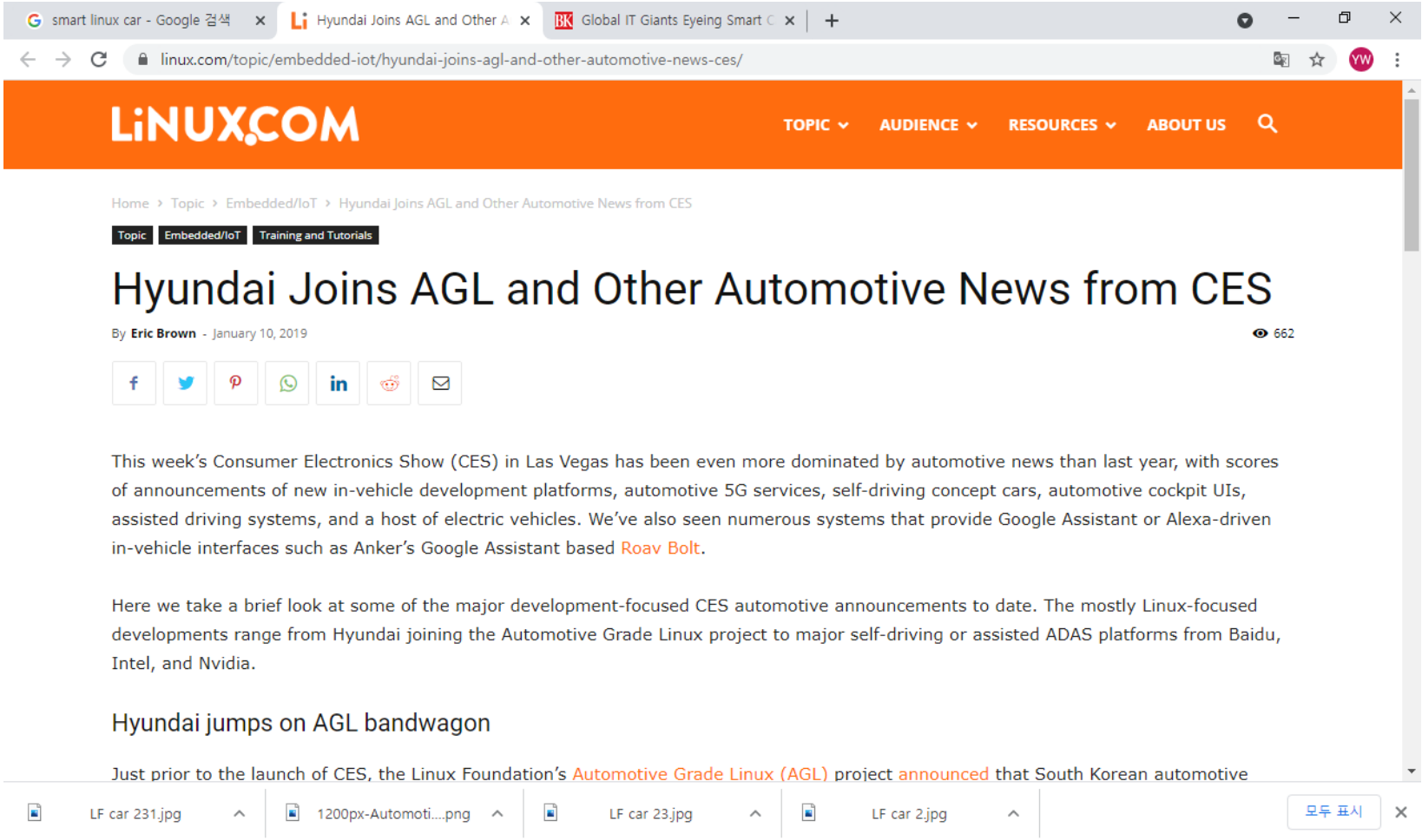
https://www.phoronix.com/scan.php?page=news_item&px=AGL-Linux-CES-2020

A Linux-powered smart truck by Tesla

“It's not just Tesla with Linux under the hood. Audi, Mercedes-Benz, Hyundai, and Toyota, to name a few, all rely on Linux.”

http://linuxgizmos.com/files/aspencore_os.jpg

Linux Drives Hyundai Smart Cars.



https://www.linux.com/topic/embedded-iot/hyundai-joins-agl-and-other-automotive-news-ces/

It's a Linux-powered car world

By Steven J. Vaughan-Nichols | January 4, 2019

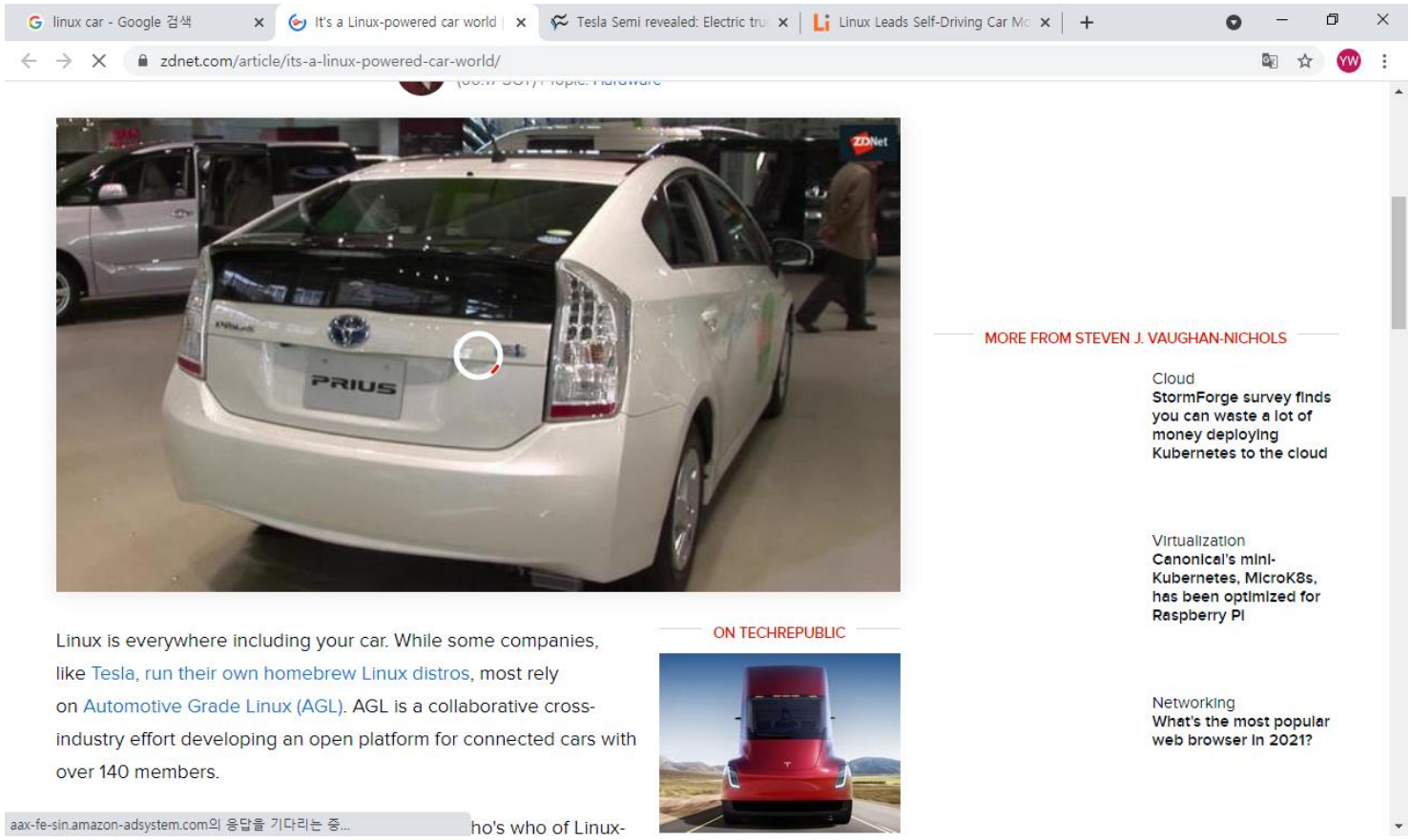
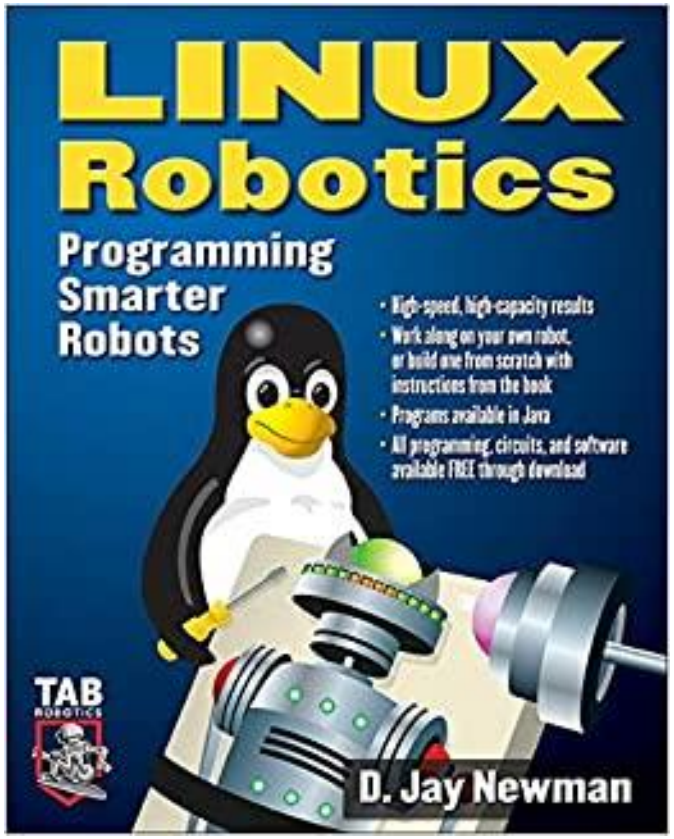


Figure from https://www.zdnet.com/article/its-a-linux-powered-car-world/

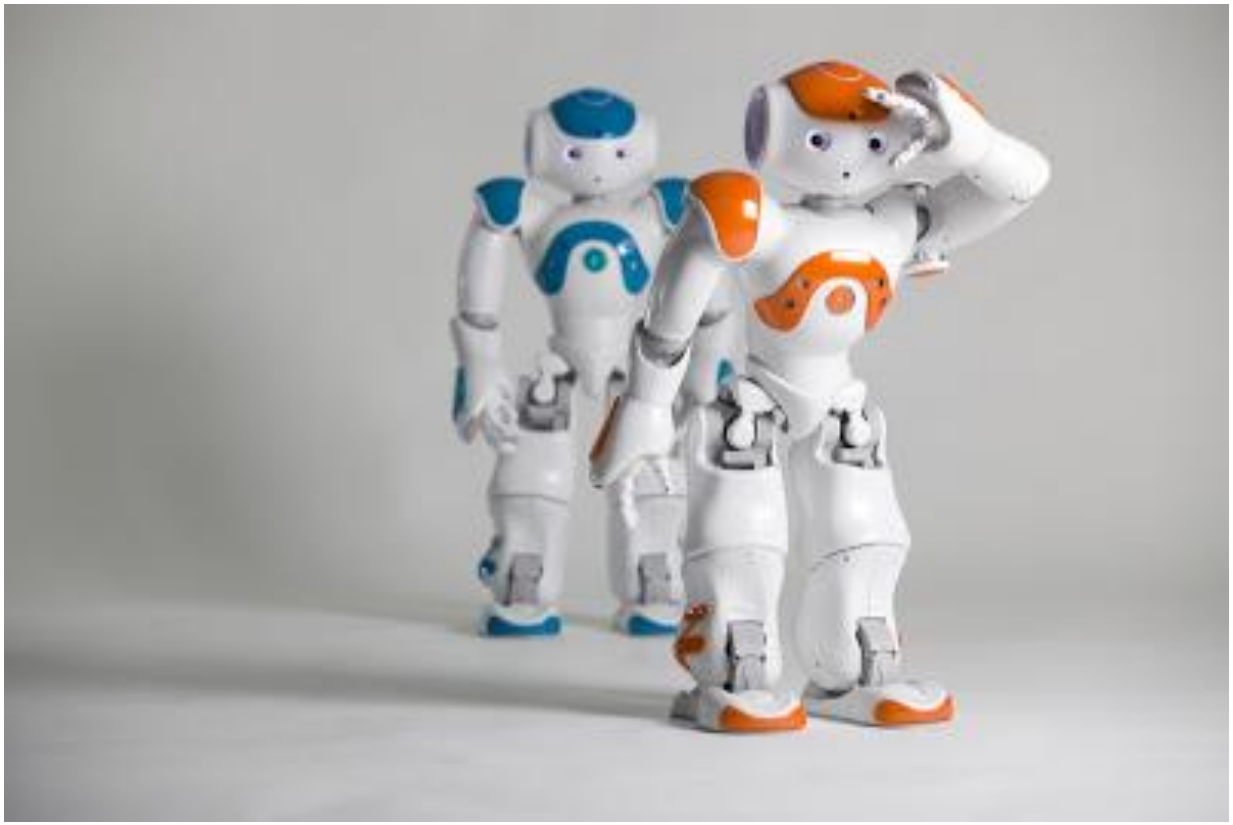
Drones and unmanned flights

https://www.ubuntupit.com/best-drone-and-robot-software-for-linux/

Robots


LINUX
Robotics
Programming
Smarter
Robots
• High-speed, high-capacity results
• Work along on your own robot, or build one from scratch with instructions from the book
• Programs available in Java
• All programming, circuits, and software available FREE through download
TAB
ROBOTICS
D. Jay Newman

Robots

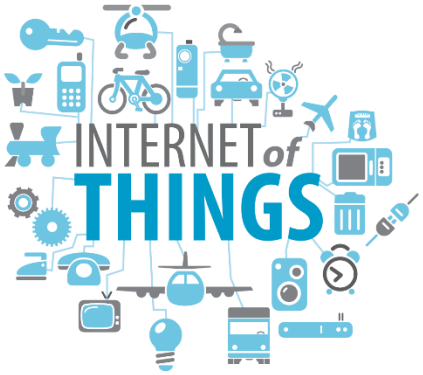


https://www.ubuntuvibes.com/2011/12/meet-nao-next-gen-new-linux-powered.html

Smart Ships

http://www.maritimekr.org/2020/03/30/korea-jumps-into-developing-the-remote-technology-of-ships/

https://sites.google.com/site/theinternetofthingscourse/



3. The New ISO/IEC standards for Linux standard base are to support Internet of Things (IoT)

Internet of Things (IoT)

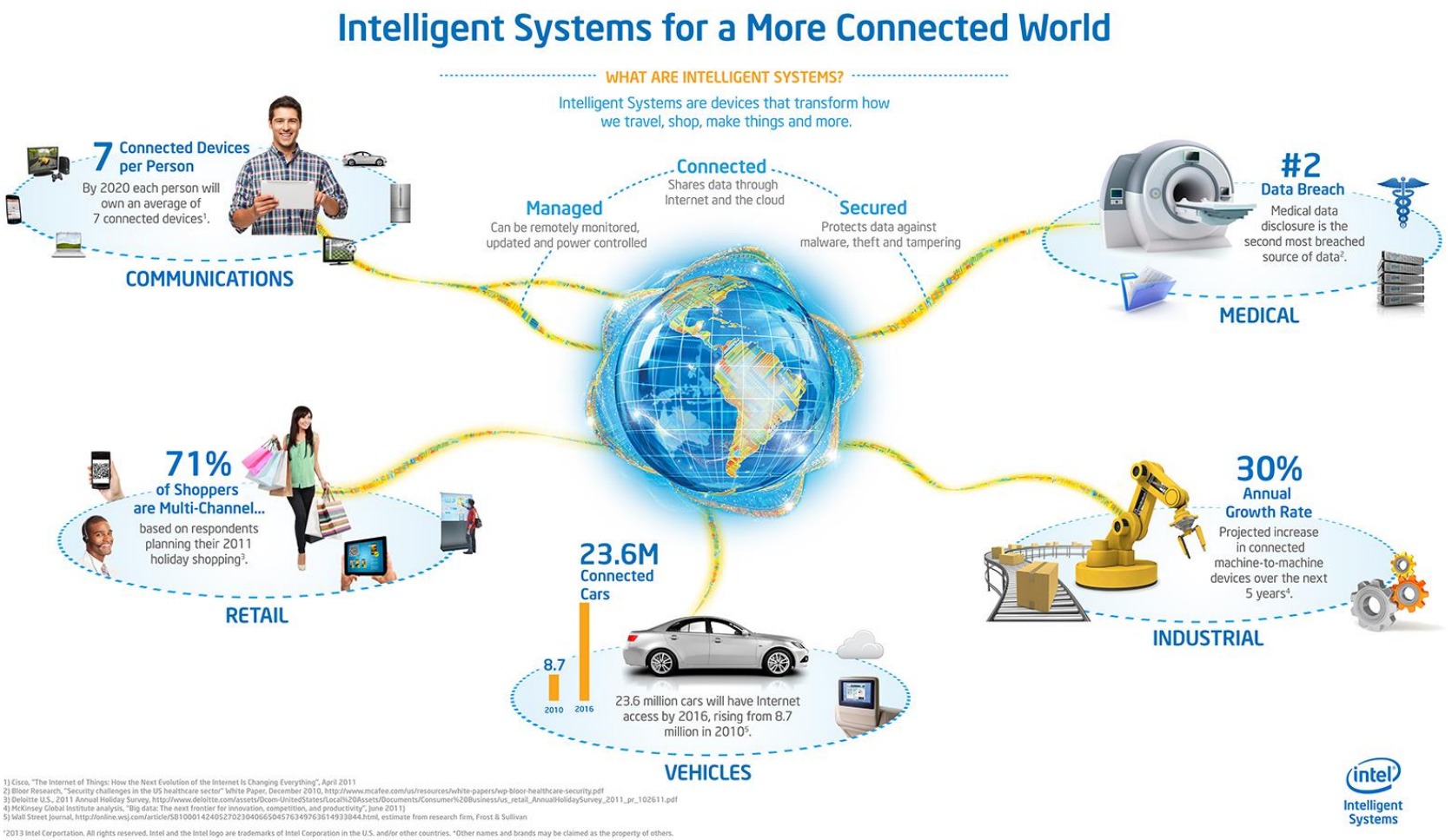
- **The Internet of Things (IoT) refers to uniquely identifiable objects and their virtual representations in an Internet-like structure.**

- **Smart Devices + Virtual Representations**

Internet of Things (IoT)

- **Internet of things is connecting smart things through Internet and making them available through Internet.**
- **"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**

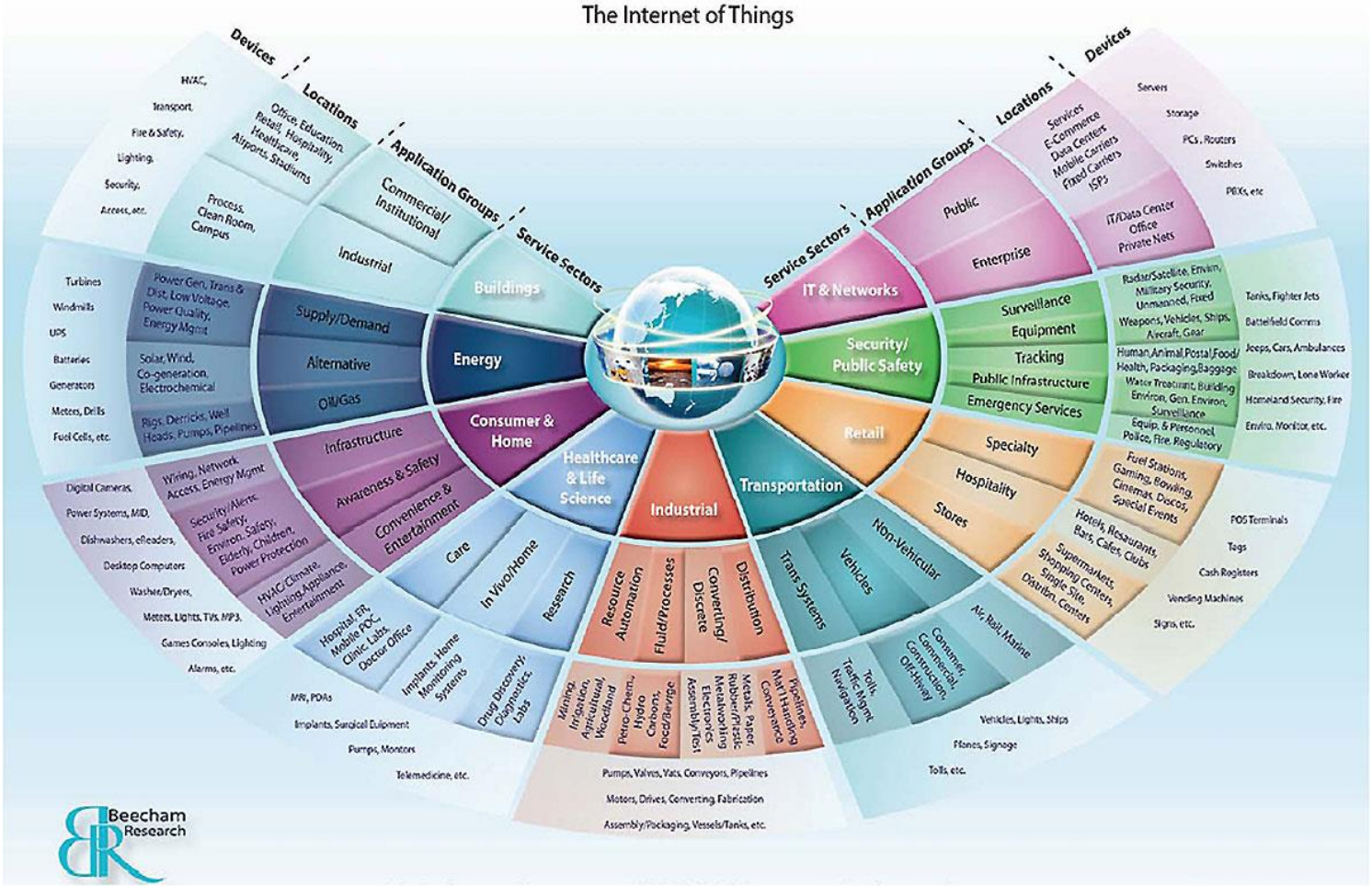
IoT by Intel


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
2013 Intel Corportation. All rights reserved. Intel and the Intel logo are trademarks of Intel Corporation in the U.S. and/or other countries. *Other names and brands may be claimed as the property of others.
intel
Intelligent Systems

IoT by Intel

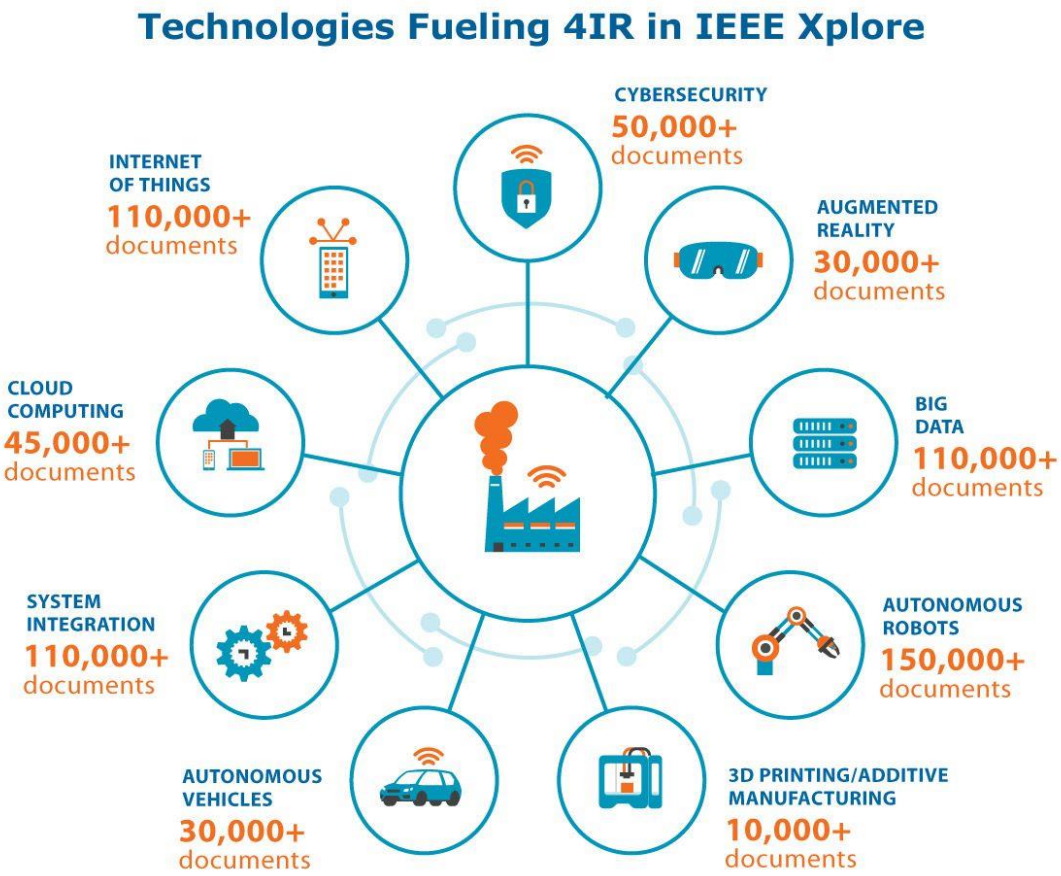
The figure: https://www.intel.co.kr/content/www/kr/ko/policy/policy-internet-of-things-iot.html

Cisco & Beecham Research



4. The New ISO/IEC standards for Linux standard base are to support the 4th Industrial Revolution.

The 4th Industrial Revolution



https://innovate.ieee.org/innovation-spotlight-ieee-fueling-fourth-industrial-revolution/

5.1 The New ISO/IEC standards for Linux standard base are to support Smart Home.

Smart Home

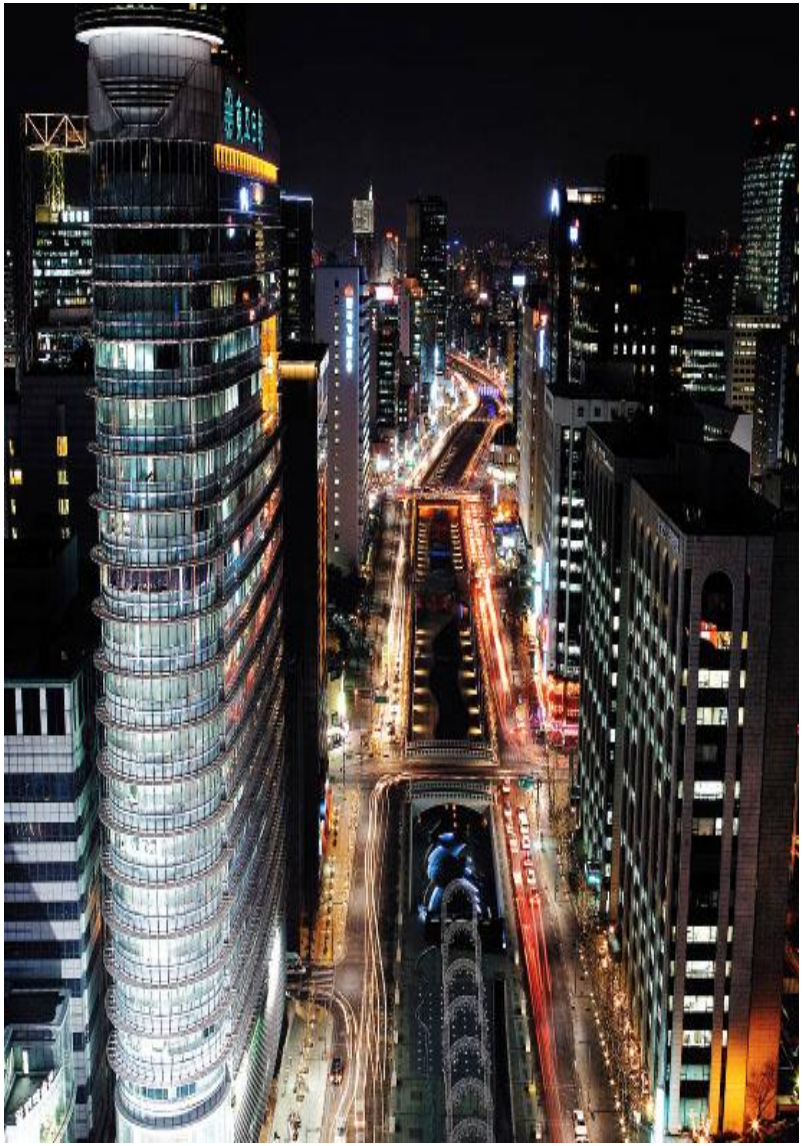
5.2 The New ISO/IEC standards for Linux standard base are to support Smart Buildings

Smart Building

HVAC(Heating, Ventilation, & Air Conditioning)

5.3 The New ISO/IEC standards for Linux standard base are to support Smart City

Smart City

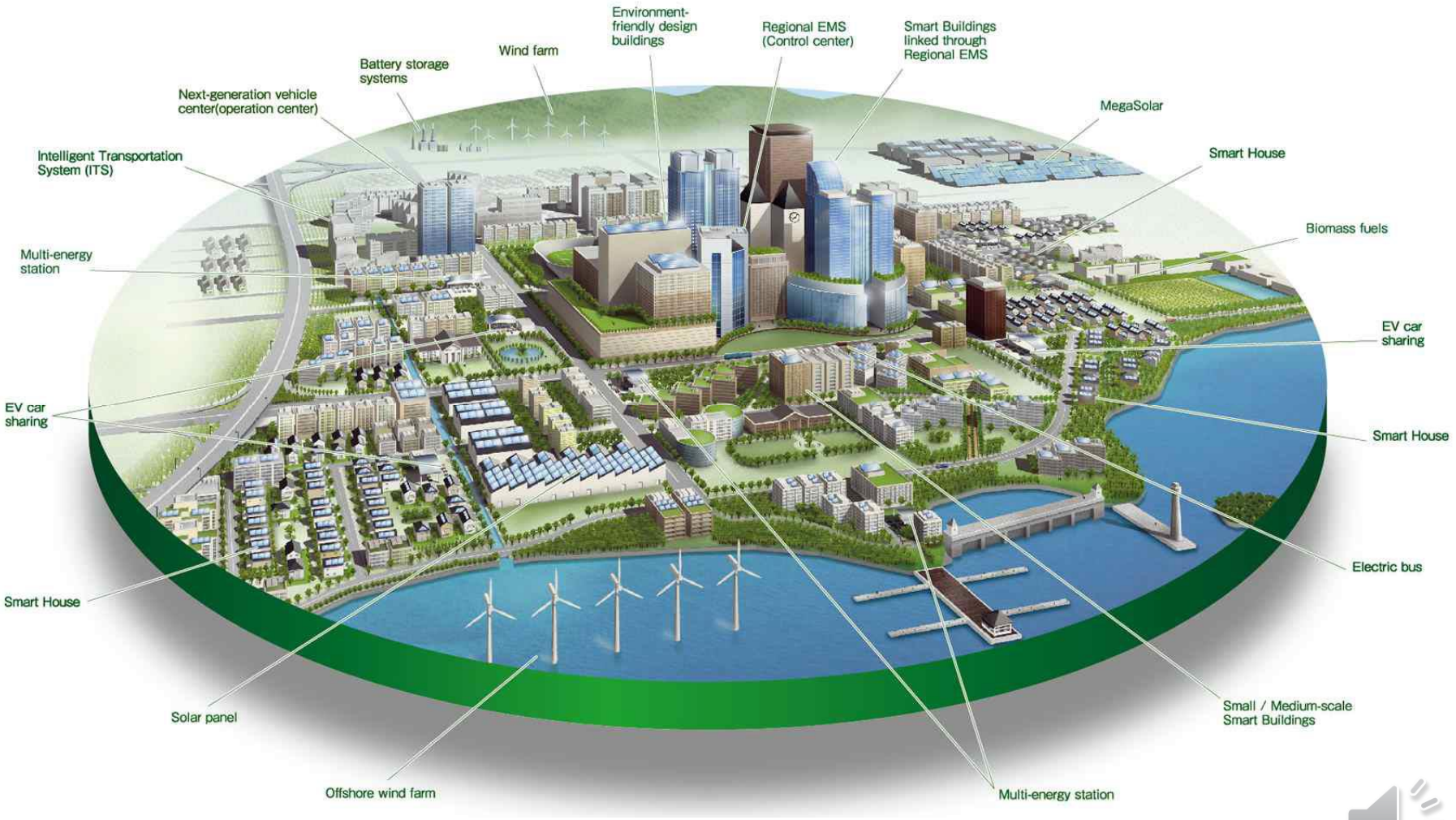


- **is a future city,**
- **converges ICT & City,**
- **allows the citizens to use the services anytime, anywhere and with any accessing devices**
- **and includes smart factories.**

Smart Cities

Conference will focus on Scotland's part in the smarter cities revolution

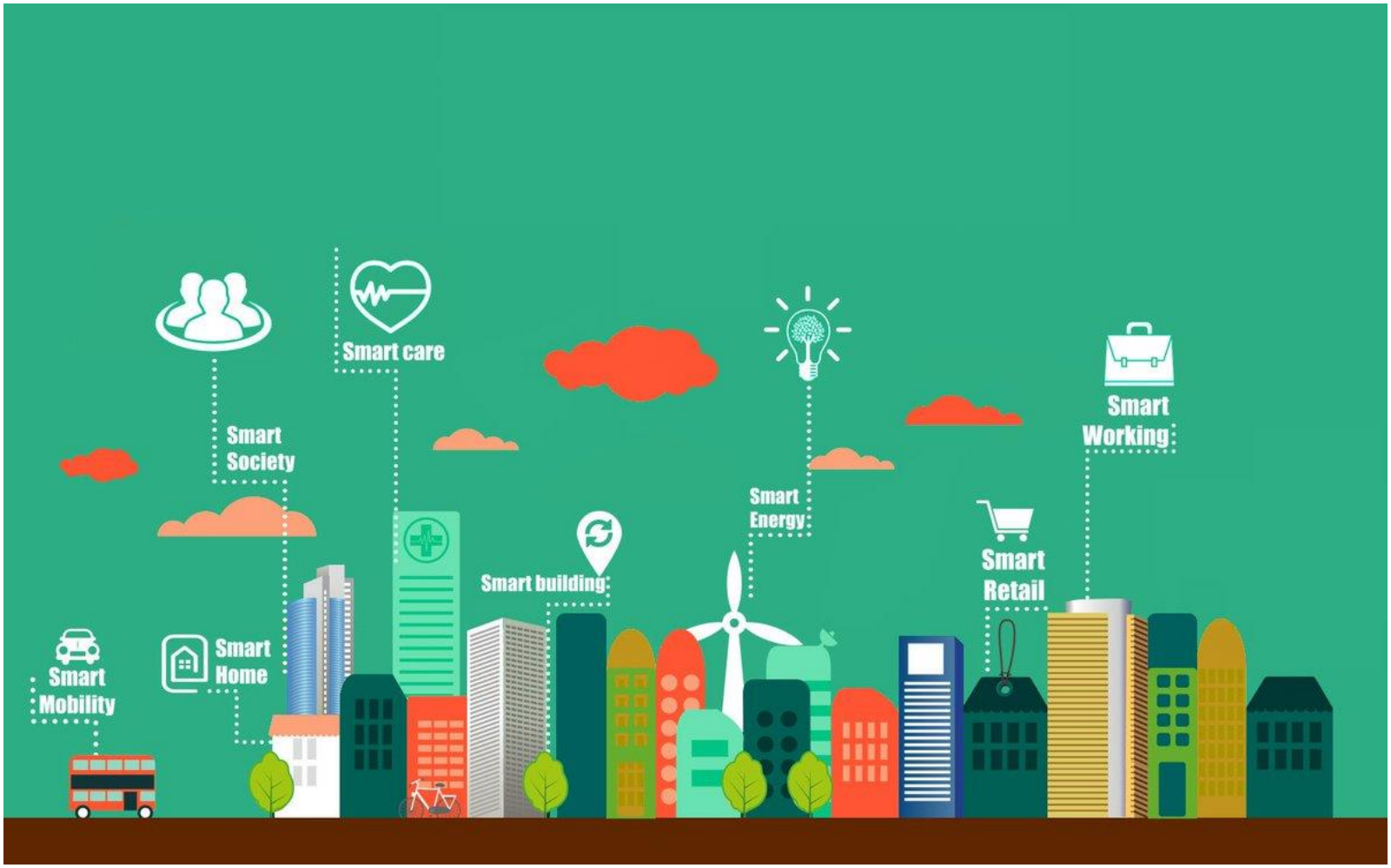
Posted on: January 8th, 2014 by Will Peakin



Smart Cities

6. The New ISO/IEC standards for Linux standard base are to support smart society

Smart Society



Conclusion

The ISO/IEC Standards for Linux Standard Base are to support the following.

1. Cloud Computing
2. Smart Devices : Embedded system.
3. Internet of Things (Everything).
4. Mobile Computing and Mobile Systems
5. The 4th Industrial Revolution
6. Smart Society
   - ❖ Smart Home, Smart Building, Smart City

- ywlee@uos.ac.kr Professor Young W. Lee