Importance of Open Source SW in Samsung Electronics

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공개 SW Day
서울

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Contents

- Samsung Electronics (SEC) Overview
- Open Source SW in Samsung Electronics (SEC)
- Open Source Contribution to SoC Evolution
- Open Source Base Camps in SEC

Samsung Electronics (SEC) Overview

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Corporate Philosophy

We will devote our people and technology
to create superior products and services
thereby contributing to a better global society.

History

1969
- **Established the company**

1972
- **Started manufacturing B&W TV**

1992
- **Ranked #1 in DRAM**
- **Developed the cellular telephone system**

2002
- **Became market leader in flash memory**
- **Achieved leading share of LCD panel market**

2004
- **Introduced mobile WiMAX technology (World's 1st)**

2006
- **Ranked #1 in TV market**

2007
- **Ranked #2 in global handset market**

2010
- **No.1 revenue in global electronics industry**

Global Top Tier

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Products

Open Source SW
in Samsung Electronics (SEC)

Open Source SW for Products

2008

2005

Proliferation of Open Source & Start Contribution

Adopt Open Source SW

2002

Taste Open Source SW

Images from samsung.com

Taste Open Source SW

- 2002~2003: Started using embedded Linux

- 2004: Applied to some products
  - Home Appliances, Communication devices (PDA)

Open Source SW for Products

2008

2005

Proliferation of Open Source & Start Contribution

Adopt Open Source SW

2002

Taste Open Source SW

10

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Adopt Open Source SW
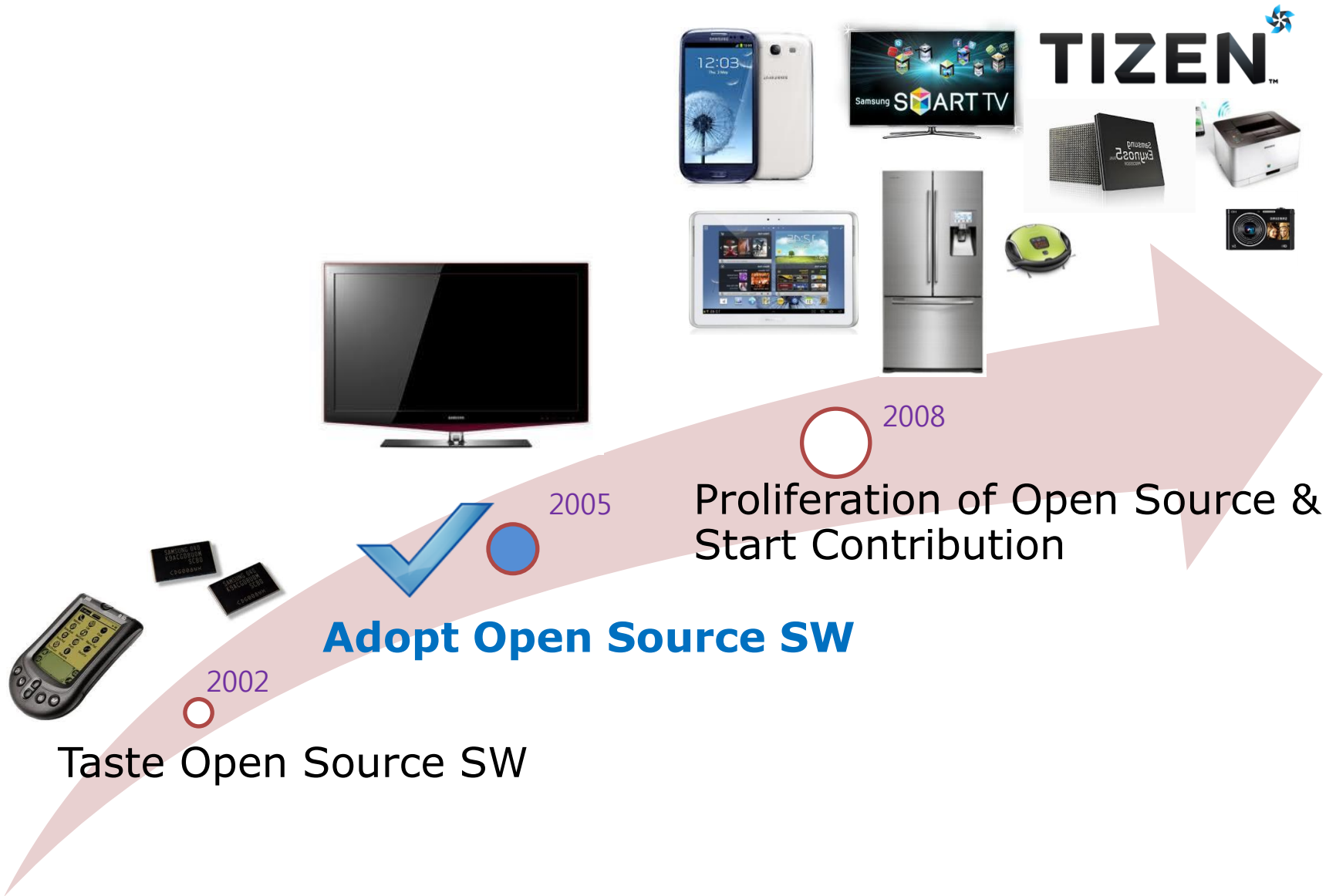
- Needs: Development Environment, Application Eco System
  - RTOS → Linux

- Flat Panel Television Sets, Mass Produced

- Challenges
  - Boot-time

  - Needs for Linux as a common platform
    - Diverging Products & Versions: O(100) TV models / year

$$X \frac{\text{Kernel}}{\text{Versions}} = \frac{\text{Too}}{\text{Many}}$$

Open Source SW for Products

TIZEN

2008

2005 **Proliferation of Open Source &**
Start Contribution

Adopt Open Source SW

2002

Taste Open Source SW

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Proliferation!

- Importance of Open Source SW in SEC
  - Smart Phones: 213M / Flat-Panel TV: 57M (major products with open source SW, 2012)

- More Samsung Products Shipped with Open Source SW

- Samsung-driven Open Source SW Community Projects

Tizen Platform (2012)
Tizen.org
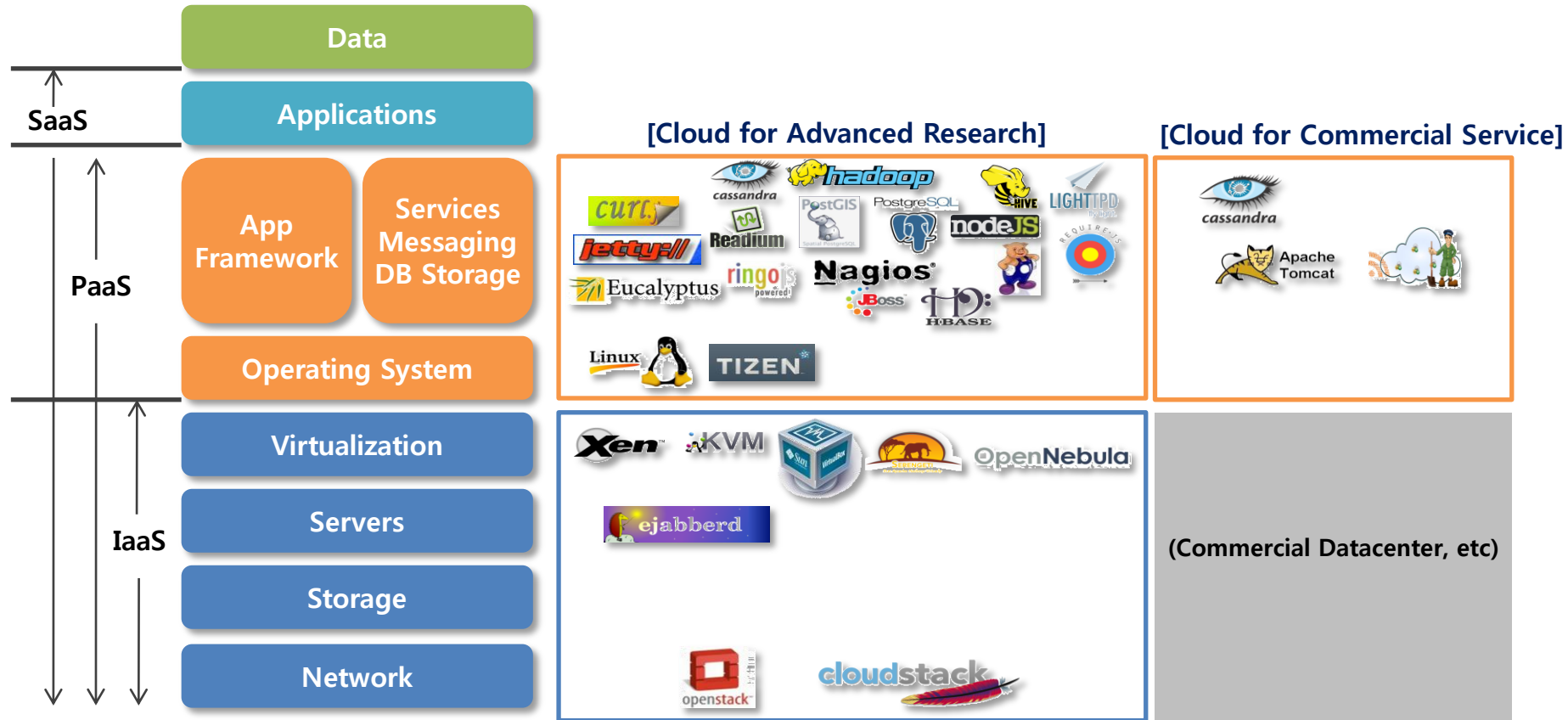
Xen-ARM (2008)
Xen.org/products/xen_arm.html

OpenCL-ARM (2010)
opencl.snu.ac.kr

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Open Source SW for Cloud based Service

● Use of server-side open source SW for SEC's cloud infra & platform

SaaS

PaaS

IaaS

Data

Applications

App Framework

Services Messaging DB Storage

Operating System

Virtualization

Servers

Storage

Network

[Cloud for Advanced Research]

[Cloud for Commercial Service]

(Commercial Datacenter, etc)

Open Source SW for Products

2008

2005

Proliferation of Open Source &
Start Contribution

Adopt Open Source SW

2002

Taste Open Source SW

Images from samsung.com

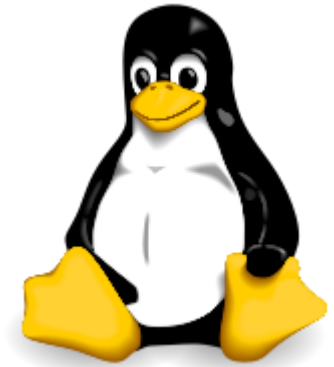© 2013 SAMSUNG Electronics Co.

Contribution of SEC: Linux Kernel

- Top 10 organizations sponsoring Linux Kernel Development
  - Contribution Rank: 23rd (2009) → Top 10 (2012-Now)

Top 10 Companies

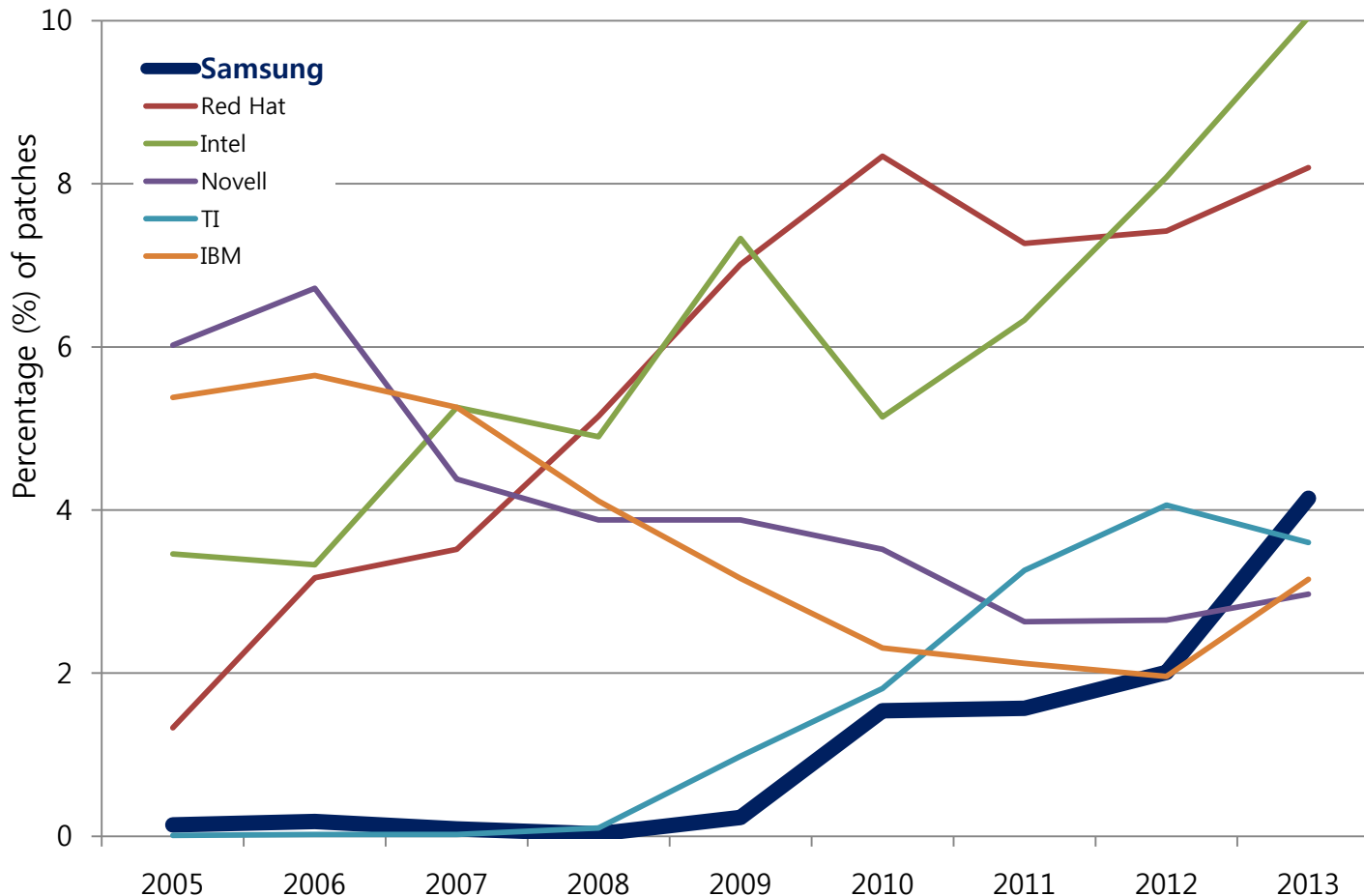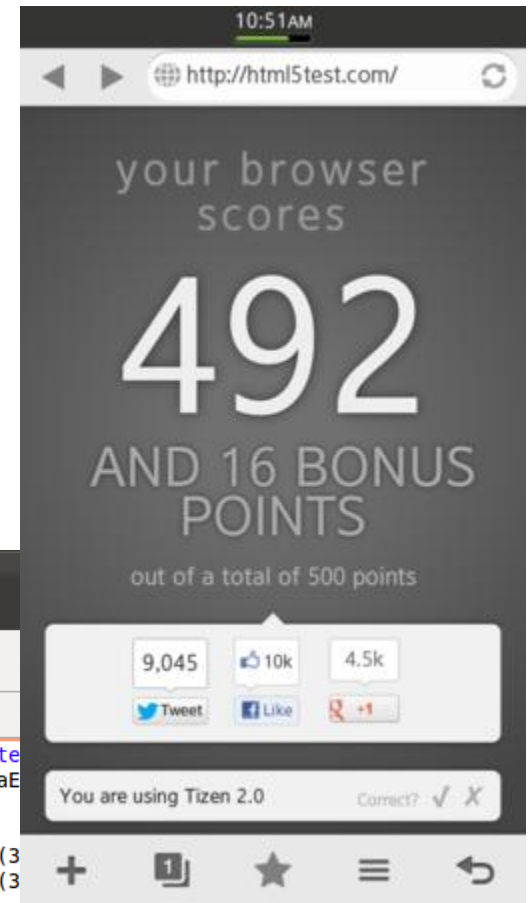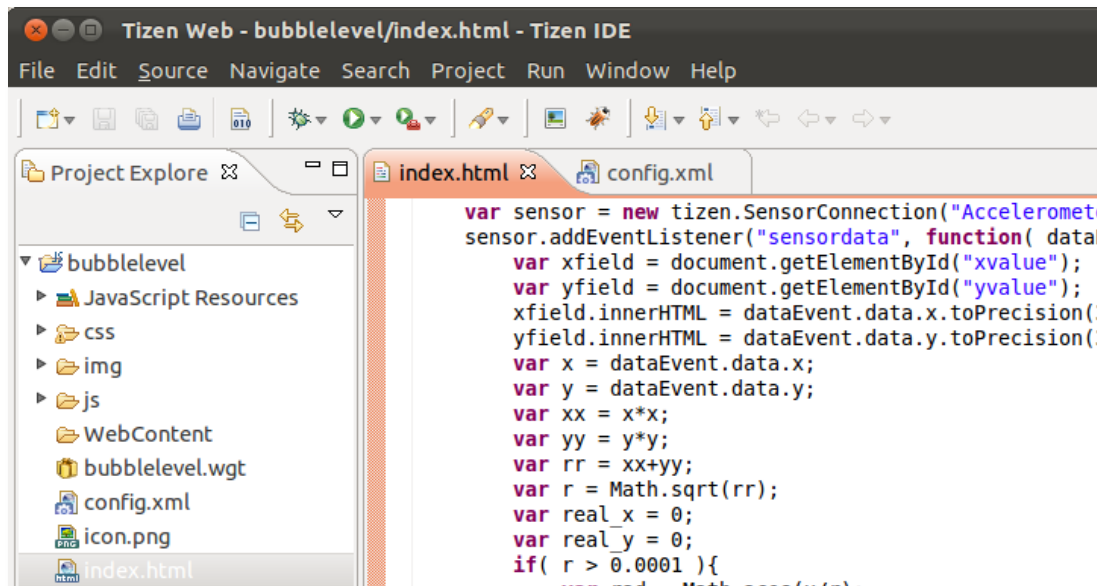| Top 10 Companies |
|---|
| Intel |
| Redhat |
| Linaro |
| **Samsung** |
| TI |
| IBM |
| Novell |
| Broadcom |
| LinBit |
| Google |

- Korea Linux Forum 2012, "Linux and Open Source in Samsung"
- KPS statistics results with kernel.org
- Image from Wikipedia

Contribution of SEC: Tizen Platform & SDK

- Tizen 1.0 Released, Apr 2012
- Tizen 2.2 Released, July 2013
  - ~ O(10,000,000) SLOC

Contribution of SEC: Xen-ARM Hypervisor
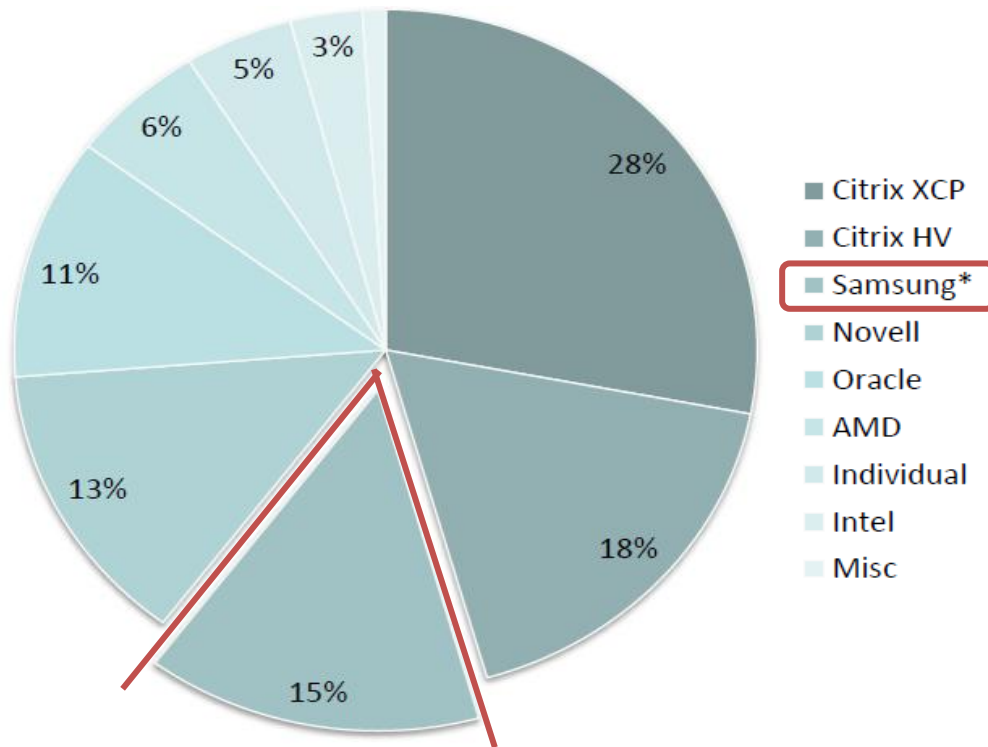
Toward Soft Driven Company

Xen-ARM Open Source Community

- Xen-ARM with Para-virtualization(First Release, 2008)

- http://wiki.xensource.com/xenwiki/XenARM

Pie chart:
- Citrix XCP 28%
- Citrix HV 18%
- Samsung* 15%
- Novell 13%
- Oracle 11%
- AMD 6%
- Individual 5%
- Intel 3%
- Misc

Source from xen.org at Xen Summit 2011 Asia

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Open Source Contribution to SoC Evolution

Computing Paradigm
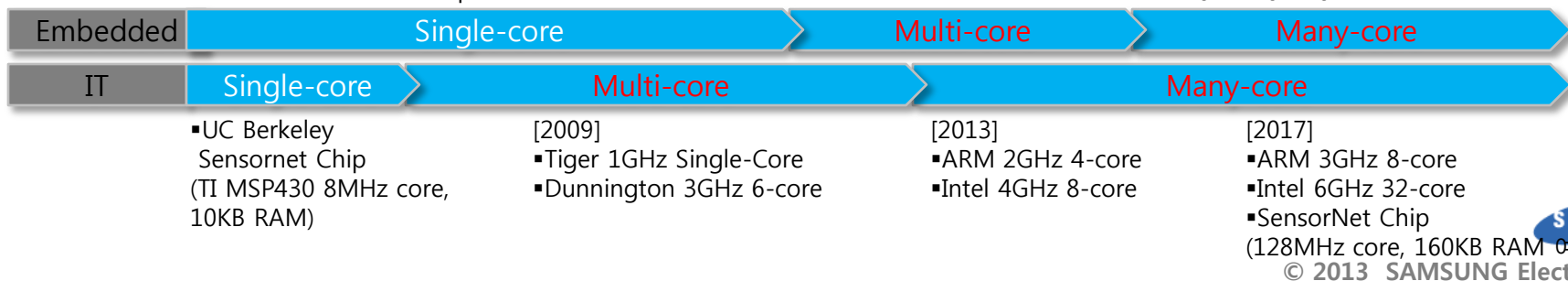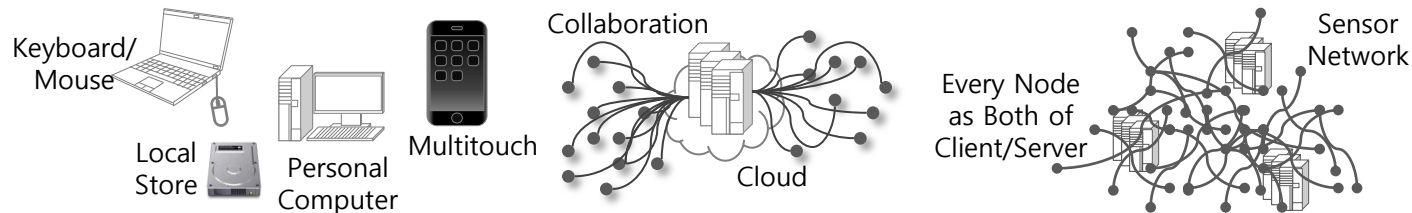
- Software 복잡도 증가의 가속화가 Hardware 발전을 Lead?
- Moore's Law의 의미?

Computing 방식의 변화

Closed Centralized Correct Info. Stationary Single-core
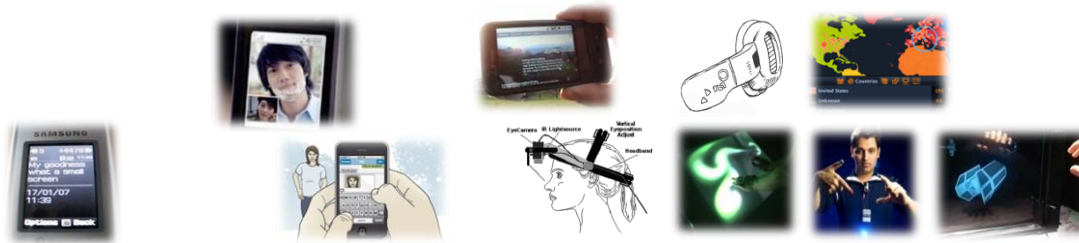
Open Distributed Correct+Timely Info. Mobile Multi-core/ Many-core

- Keyboard/Mouse
- Voice Call, SMS
- Centeralized/Concentrated
- Known Comm. Entities

- Multitouch
- Video Call, MMS

- Augmented Reality ▪Gesture ▪Interactive 3D UI
- Eye-Tracking ▪Manytouch ▪Realtime Web
- Distributed/Scattered
- Unknown/Utrusted Comm. Entities

Keyboard/ Mouse

Local Store

Personal Computer

Multitouch

Collaboration

Cloud

Every Node as Both of Client/Server

Sensor Network

Embedded	Single-core	Multi-core	Many-core
IT	Single-core	Multi-core	Many-core

- UC Berkeley Sensornet Chip (TI MSP430 8MHz core, 10KB RAM)

[2009]
- Tiger 1GHz Single-Core
- Dunnington 3GHz 6-core

[2013]
- ARM 2GHz 4-core
- Intel 4GHz 8-core

[2017]
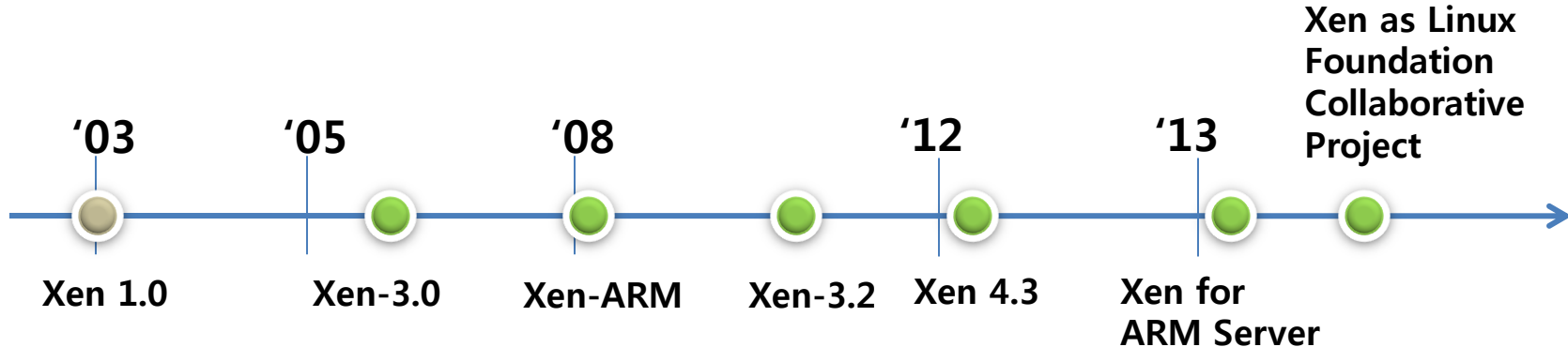- ARM 3GHz 8-core
- Intel 6GHz 32-core
- SensorNet Chip (128MHz core, 160KB RAM 예상)

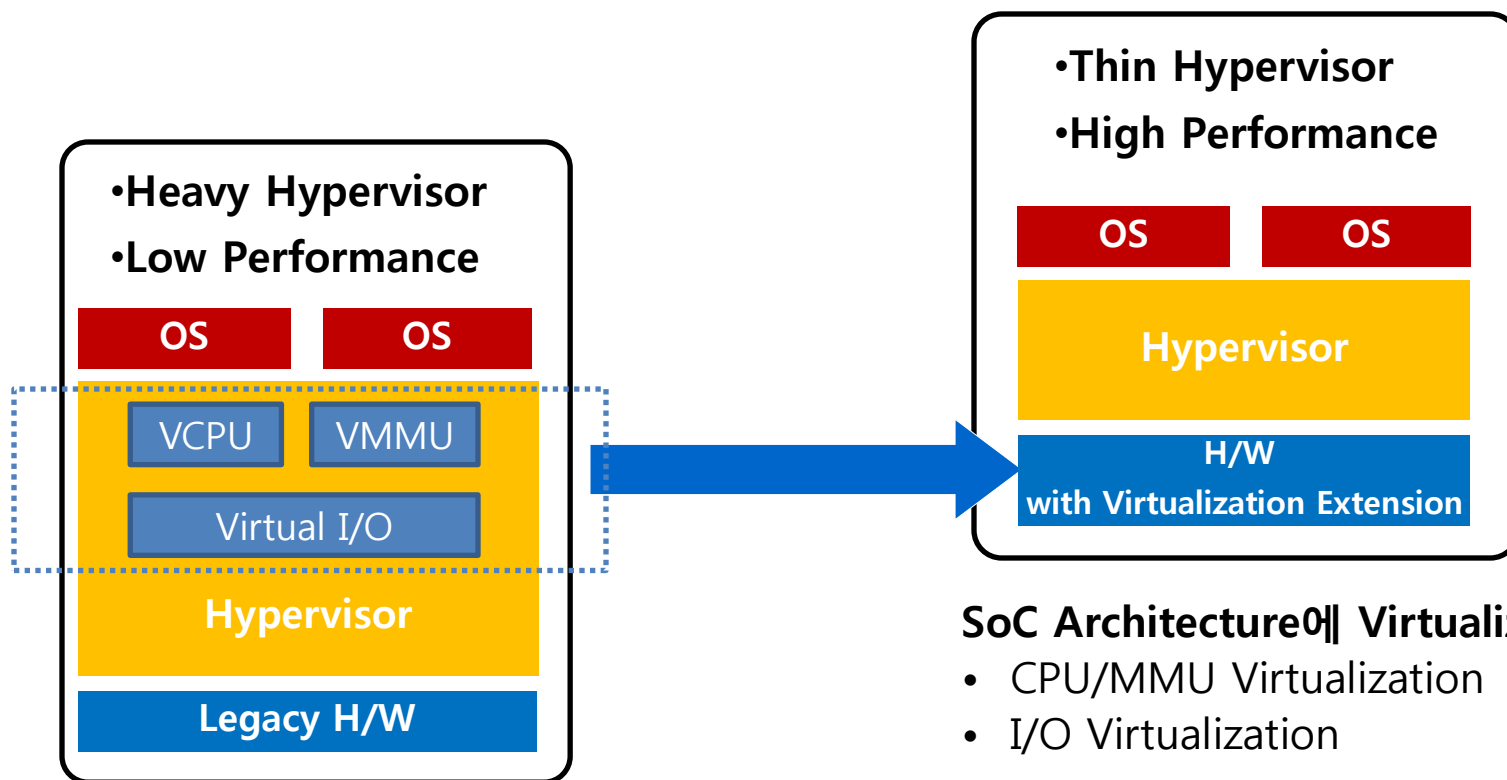# (Case Study) Xen Model: Community Overview

- **Xen Open Source Community Project**
  - Cambridge University에서 태동
  - X86, PPC, ARM등 지원
  - 2013.4.15 Linux Foundation의 Project.

- **Xen Hypervisor Release History**

'03   '05   '08   '12   '13   **Xen as Linux Foundation Collaborative Project**

Xen 1.0   **Xen-3.0**   **Xen-ARM**   **Xen-3.2**   **Xen 4.3**   **Xen for ARM Server**

(Case Study) Xen Model: Evolution (1/2)

Left box:

- **Heavy Hypervisor**
- **Low Performance**

OS	OS

VCPU VMMU

Virtual I/O

Hypervisor

Legacy H/W

Right box:

- **Thin Hypervisor**
- **High Performance**

OS	OS

Hypervisor

**H/W
with Virtualization Extension**

SoC Architecture에 Virtualization 요구 반영

- CPU/MMU Virtualization
- I/O Virtualization

(Case Study) Xen Model: Evolution (2/2)

I/O Virtualization Overhead 감소 →

CPU/MMU Virtualization Overhead 감소 →

Xen-1.0 (PV)	Xen-3.0 (HVM)		Xen-ARM (PV) Mobile향	Xen-3.2 (Directed I/O)		Xen-4.3 (ARM) Server향

2003	2005	2006	2007	2008	2009	2012	2014?

Intel VT-x, AMD-v

CPU Virtualization Overhead 감소

EPT, NPT

MMU Virtualization Overhead 감소

Intel VT-d

Device Pass-through 를 통한 I/O 성능 개선
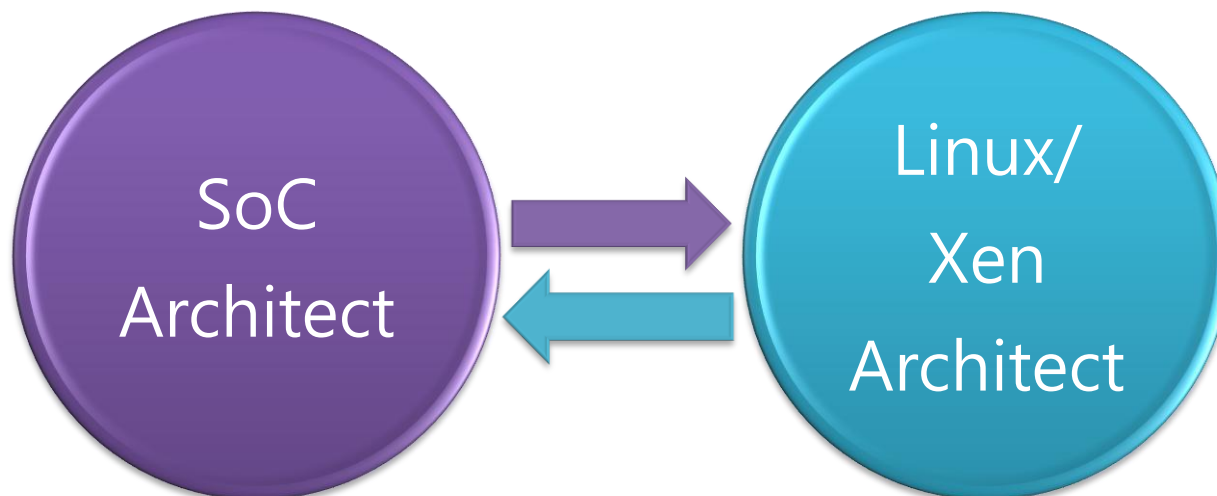
ARM VTE, GICv2, MMU400

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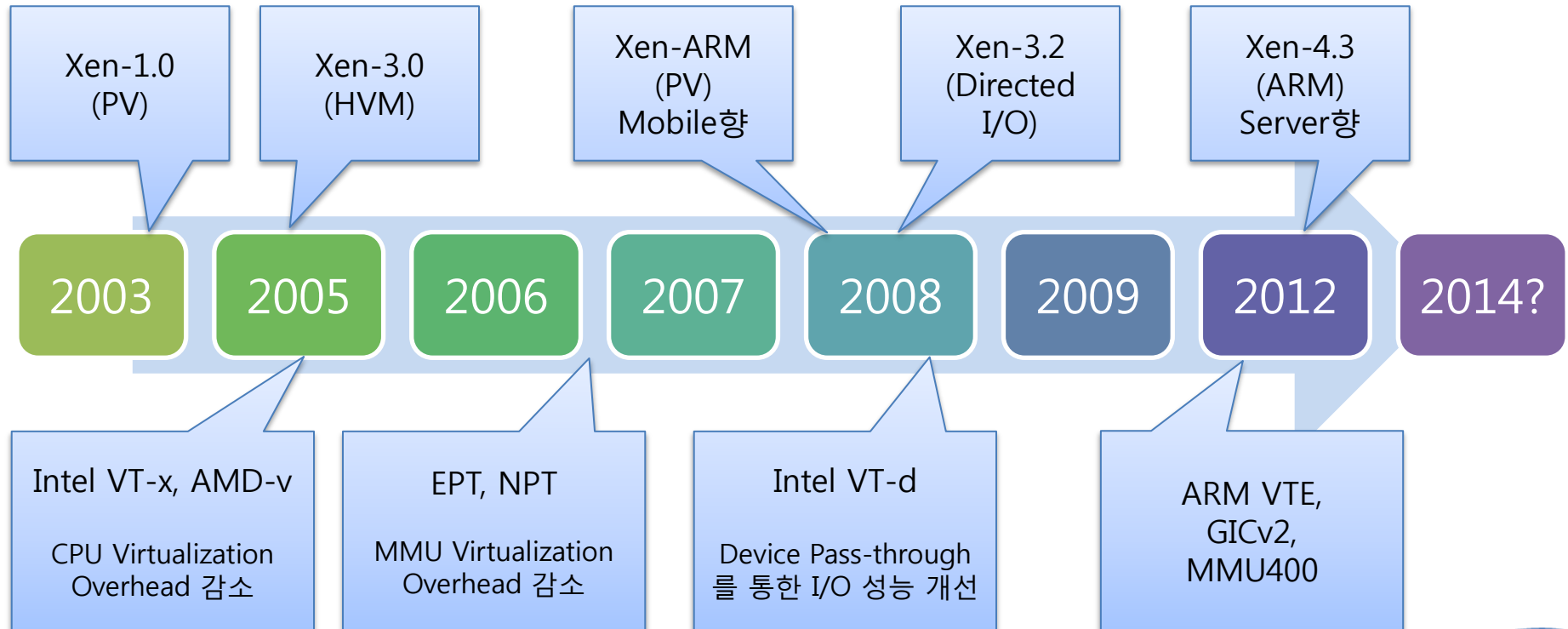
(Case Study) Xen Model: Partners Collaboration

- 봄/가을 매년 2회씩 Xen Summit 개최:
  - Xen, Linux, Tools, Processor, Set에 관련된 개발자 참여 유도

- Xen Summit의 Requirements Session:
  - 신규 Feature 수집/ Xen mainline 반영 사항 공유

- 참여 회사들의 균형있는 Xen Summit 개최 기회 장려:

제안
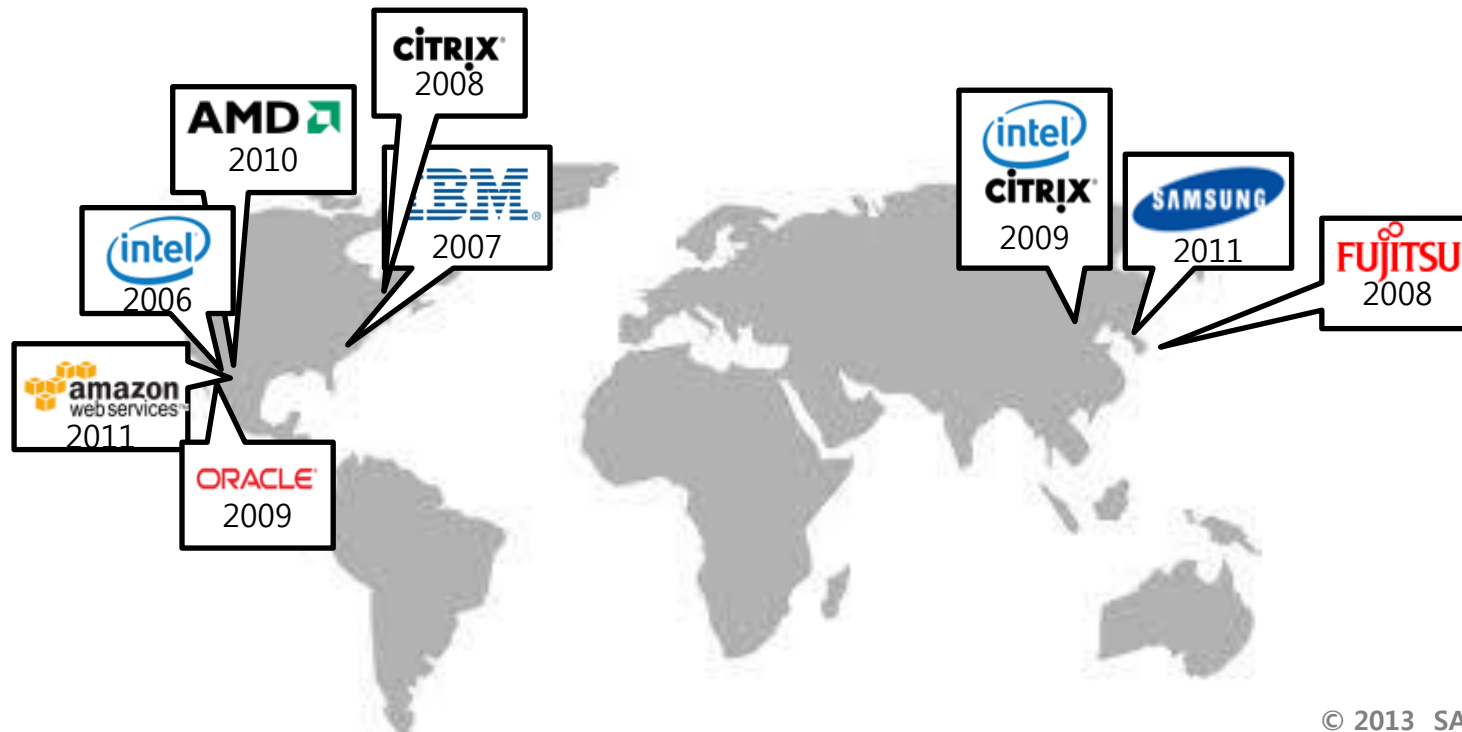
- SoC Architect와 Linux/ Xen Architect의 교류 활성화
- Requirements 공유 체계 강화

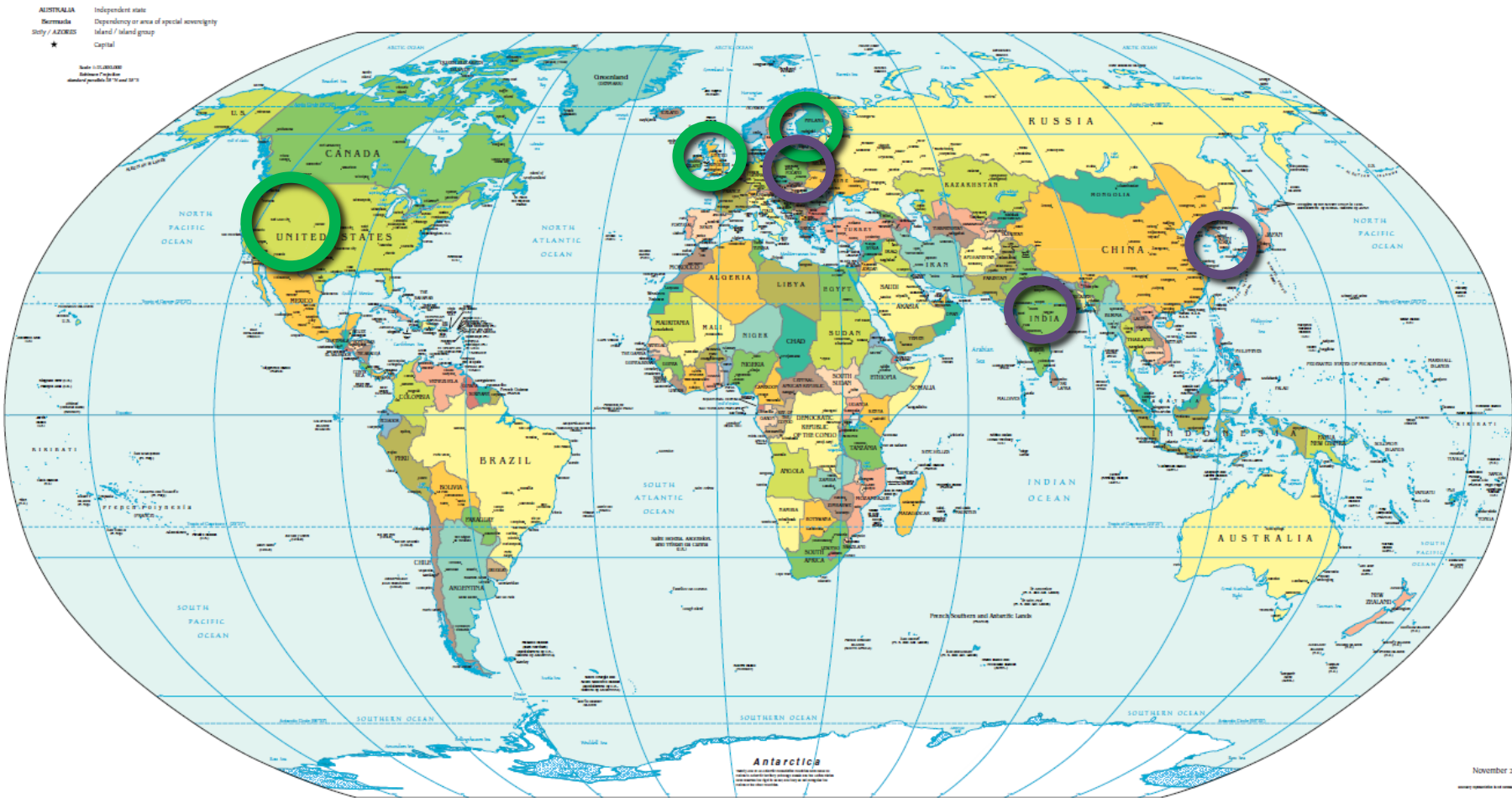# Open Source Base Camps in SEC

Major Open Source SW Areas of SEC

Status	Major Project
Many maintainers & committers	Linux Kernel
	EFL
	Android
	Chromium
	Webkit
	Xen
Significant contributions	U-Boot
	Boost
	LLVM
	X window
	Bluez
	Obexd
	Cairo
	. . .

Open Source Labs & Teams in SEC

○ Open Source Labs

○ Teams with significant open source contribution

Map image from Wikipedia (http://en.wikipedia.org/wiki/File:CIA_WorldFactBook-Political_world.pdf)

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Thank You !