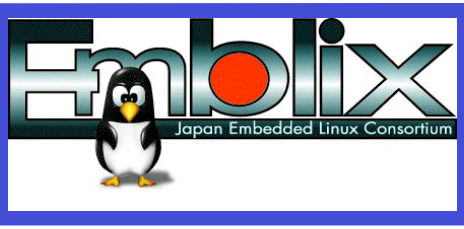
Embedded Systems in Japan and Embedded Linux



Japan Embedded Linux Consortium

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Content

- Current Status in Japan
- Introduction of Emblix
- What are important in embedded area ?

Current Status in Japan

- Currently, most of embedded systems in Japan has adopted ITRON-based RTOS.
- The development for cellular phones and A/V home appliances has serious problems to increase the development cost for software.
- Many companies start to consider to adopt Linux for their embedded systems. Matsushita and Sony has decided to adopt Linux as a main their RTOS.

Embedded Linux Products

Sharp Zaurus series

Sony CoCoon Channel Server

Philips iPronto Remote Control

Panasonic Broadnow Broadband Set-top box

IBM/Citizen WatchPad

Motorola A760 Mobile Phone

Panasonic broadband terminal phone

Terapin mine Media Jukebox

NEC AX-10 Home AV Server

Kerbango Internet Radio

Techsan TS20000 MHP Set-top box

TiVo

MasterIA Beagle PDA GPRS Phone

Zultys ZIP 4X4 VoIP phone

Advanced Communications ECCLE5000 MPEG 4 Set-top Box

Hippo300 Internet Phone

Software Infrastructure for Future Embedded Systems

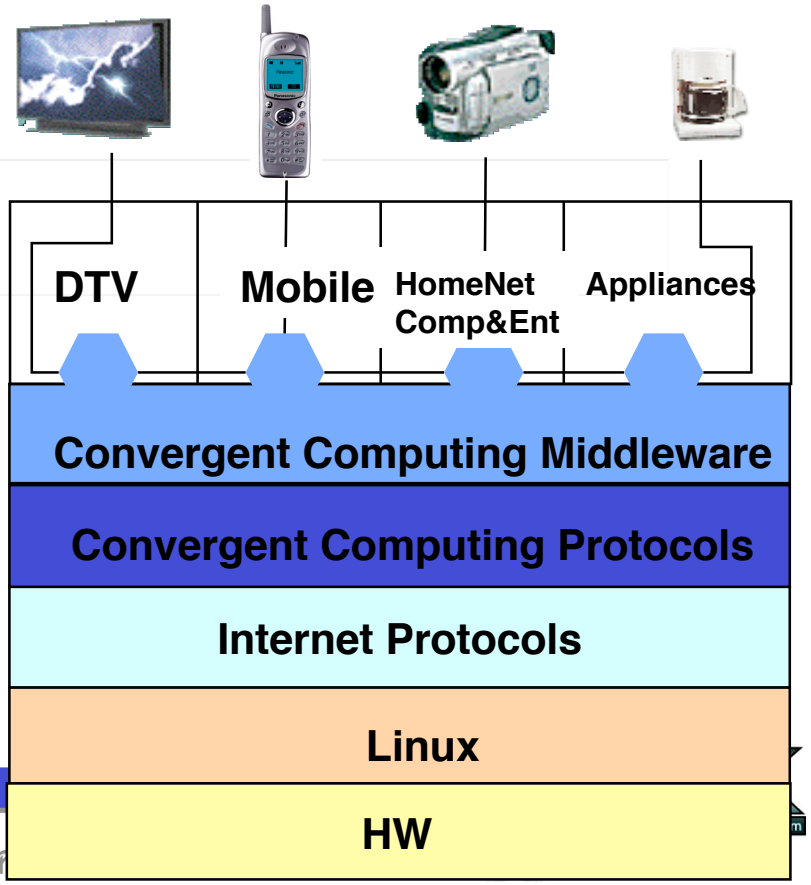
- Autonomic
- Transparent
- Spontaneous
- Pervasive

Middleware & Protocols

- Hide the complexities and heterogeneity in a convergent world
  - Different hardware, OS, protocols, networks
- Enable the creation of novel services and applications

Operating System

- Hide the complexities and heterogeneity in
  - Different hardware and networks
- Enable the reuse in various network protocols, middleware and applications.
- Provides support for various hardware platforms.



Why Emblix ?

- Embedded systems have become very complicated.
- ITRON is not suitable for complicated embedded systems.
- Embedded Linux is one of choices for future embedded systems.
- But, we need to exchange information to solve various problems.
- Emblix has been started from June of 2000.

Role of Emblix

- Promoting Embedded Linux in Japan
  - Education, Information Exchange
  - Open Source, License….
- Standard activities for Peripheral Technologies about Embedded Linux
  - Working Group
  - Open specification, open source if possible.
- Collaboration with other Linux based Activities, Embedded/Real-Time Activities.
- Collaboration with Academic Activities

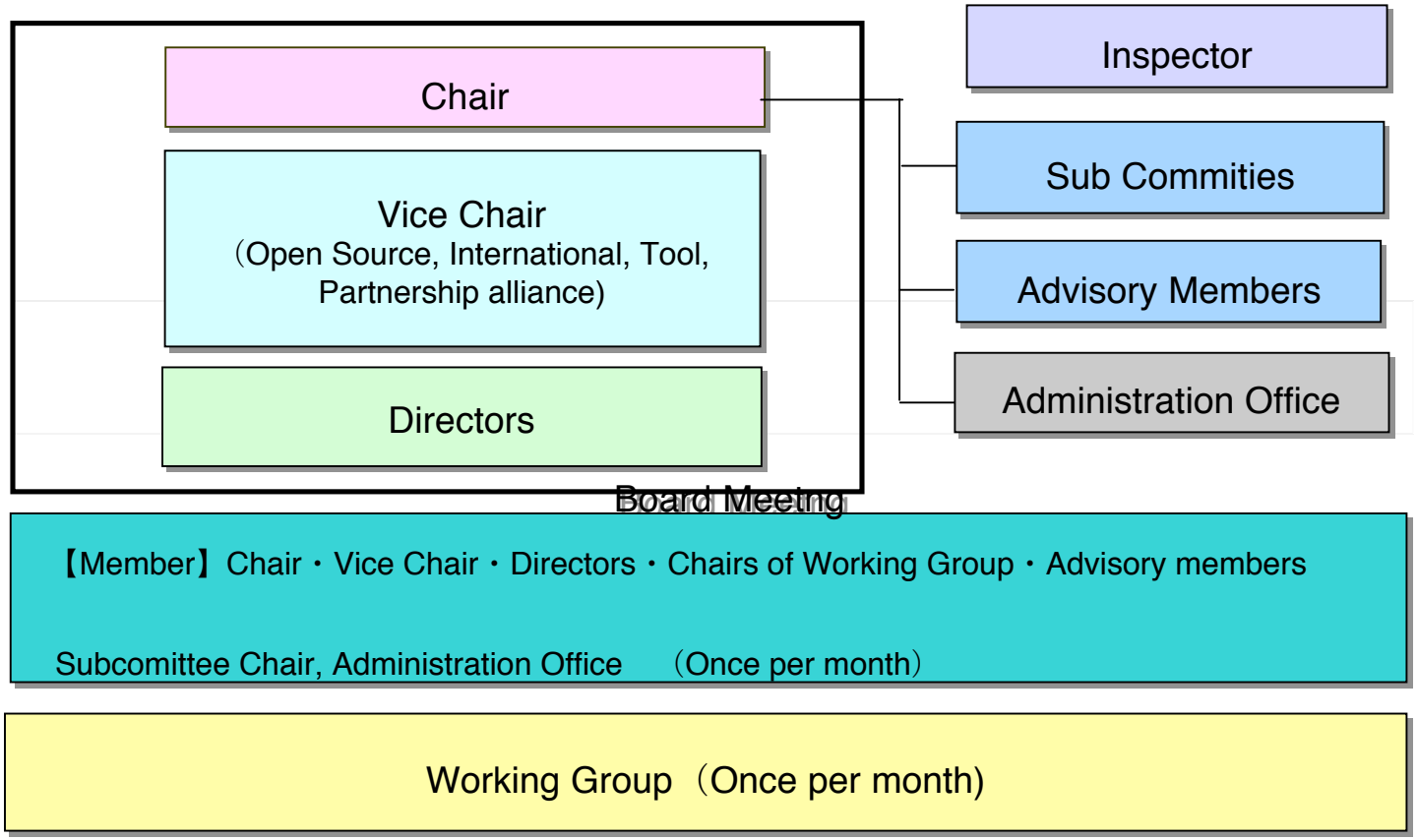
Emblix Members

- Industries, Universities, Individuals in Japan
- 2003 October, 104 members

University, Research Lab.	5%
Software Vender	30%
Solution Providers	20%
Semiconductor Vender	15%
Set Maker	30%

Panasonic, Sony, Nokia Japan, Fujitsu, NEC, Toshiba, IBM…

Emblix Organization



Emblix Activities

- Tool Working Group
  - Development Environment Standard Specification
  - ICE Implementation Specification for Embedded Linux
  - OMF Access Utilities, Integration of Language Environment and Test Environment
- Hybrid Architecture Working Group
  - Linux on ITRON Specification
- Real-Time Working Group
- Regal Sub Committee
  - Open Source Issues, License Issues, Seminars
- Technical Seminars
- Planned New Working Group
  - Resource Management (New Scheduler, QOS)
  - I/O Architecture (Hardware/Software CoDesign)
  - Kernel Architecture (Discussing for New Operating Systems)

Other Activities

- CE Linux forum
  - Started by Sony and Matsushita
  - For CE devices
  - Various working groups
    - Power Management (PMWG)
    - Bootup Time (BTWG)
    - Real-Time (RTWG)
    - System Size (SZWG)
    - Audio Video and Graphics (AVGWG)
- Will publish specifications and their reference implementation.

What are important ?

- Divergence
- Memory size
- Scalability of Specification
- Battery Management API
- QOS API

Divergence

- Many platforms..
  - Many CPUs: Binary interface ? Object Formats?
  - Many middlewares: Depends on products. Various requirements.
  - Many Applications: CE, Mobile phones, automotives, control systems, toys, games,

Memory Size

- Some products remove unused libraries to reduce memory size.
- Some products remove unused kernel functions to reduce memory size.
- Fine grained configurability is important for supporting embedded systems because memory cost is very serious for several products.

Scalability of Specification

- Subsetting of Linux is important for supporting small scaled operating systems, but to ensure an application's portability.
- Scalability is required from the diversity in embedded system's requirements.
- POSIX, ELC's platform specification.

Battery Management

- There are many algorithms for battery management.
- The battery management framework should support these algorithms to select the most suitable one for the product.
- CE Linux forum is aggressively working the issue.

QOS Management

- Accounting CPU Usages
  - For real-time, security
  - Ensure not to exceed a process's specified CPU capacity.
- Controlling real-time scheduler
  - Increasing fairness in scheduler.
  - Especially, for multimedia applications.

Conclusion

- Embedded Systems Communities consider that standardization is important.
- We have a variety of requirements, and we are currently extending various aspects of embedded Linux.
- Embedded Linux is very important for future Linux evolution.

Thank you!