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Adaptive Network Middleware
CSC (Communication Service Concierge)

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10.23.03

NTT

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Outline

- **History**
- **What is CSC**
- **Relationship between OSGi and CSC**
  - **Requirements -> OSGi specification**
- **Related activities in NTT and Japan**
  - **Digital Home-Network Forum in Japan**
  - **ECHONET Consortium**

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History

- CSC project was started in 1999.
- CSC is network middleware.
  - Not only for “Gateway” but also “end-to-end communication”.
- CSC uses software component functionalities based on Java technologies; we developed the functionalities by ourselves.
- We found out about OSGi in 2001, and decided to replace our original functionalities with the OSGi framework.
- As a result, OSGi is an important part of our middleware.
- Also, OSGi itself is very useful for NTT’s service handling.

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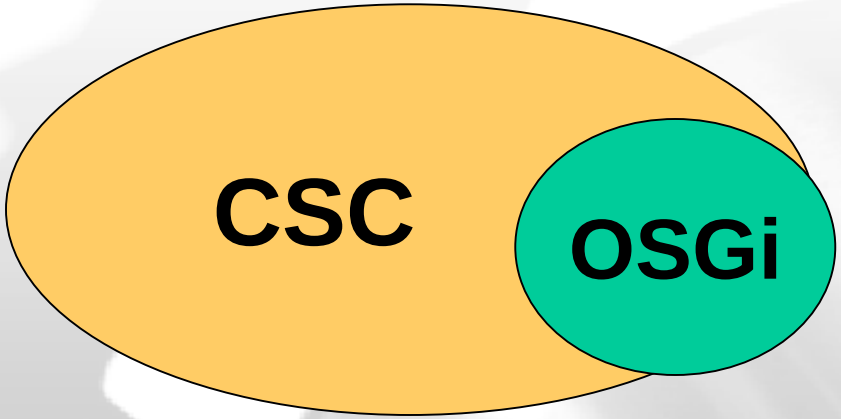
CSC and OSGi framework

CSC internally uses OSGi framework.



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CSC

(Communication Service Concierge)

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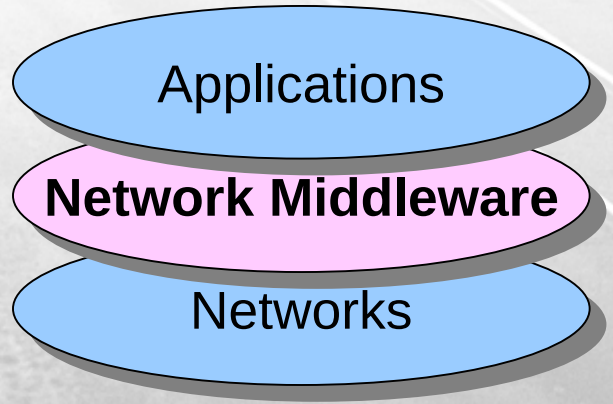
Motivation of CSC development

- Available network technologies are quickly diversifying.
  - Remarkable in the access line (Fiber, ADSL, WLAN, etc.).
  - Suffering from frequent upgrades.
- Application software and user's objective / requirements also do.
- As a result, everything is diversifying.
  - This is causing many network problems.
- NW middleware will adaptively bind these two areas and enable their independent growth.



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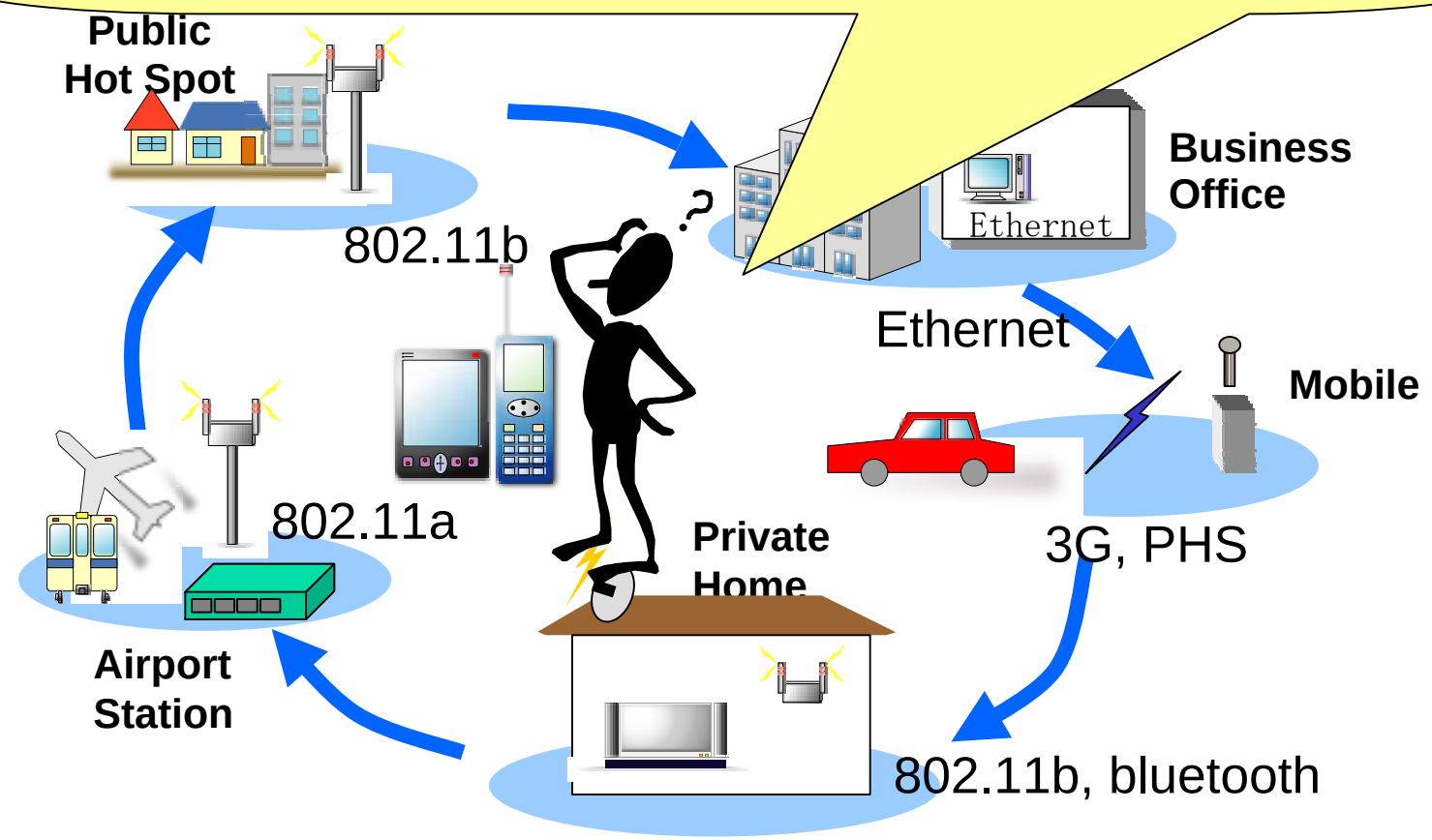
Typical problem 1 : Nomadic Computing

- Available access lines are …? Which one is best?
- Frequent protocol upgrades for new services.



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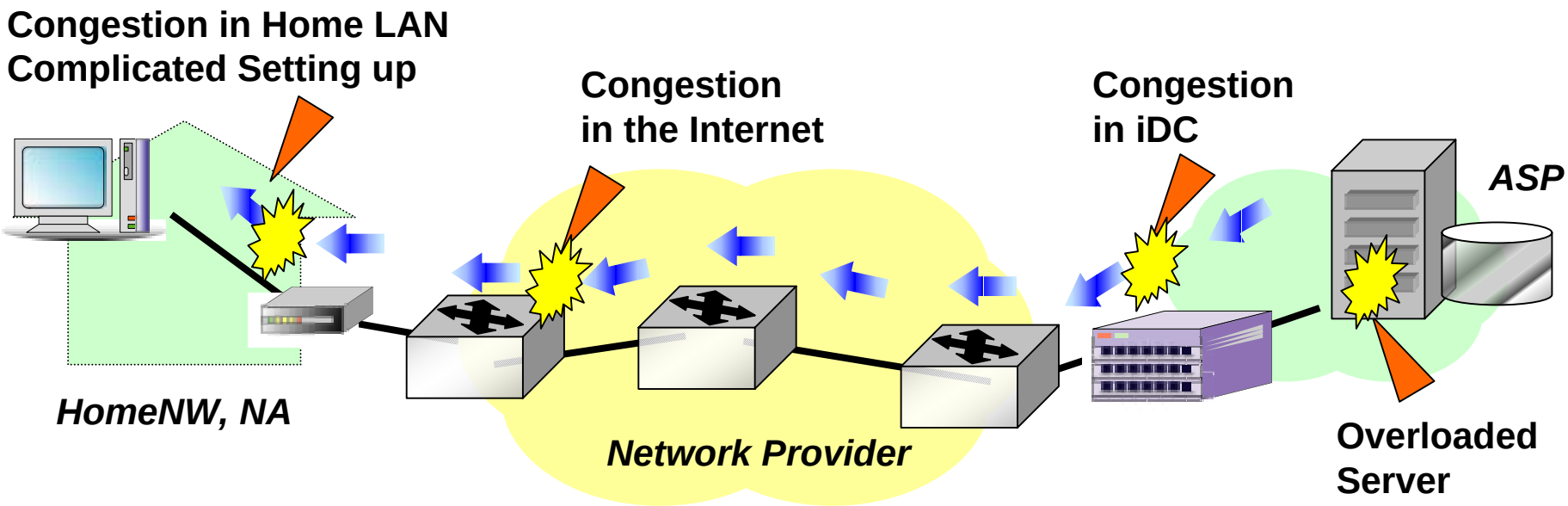
Typical problem 2: video stream transmission

- **Bottlenecks are distributed in end-to-end commun.**
  - **Not only access link.**
- **Heterogeneity of NW and appliances accelerates this trend.**



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Requirements for NW middleware

- ✓ Loosely coupling network technologies and applications to permit their independent evolution
- ✓ Adaptation to rapid change in both network technologies and user requirements
- ✓ Customizability to accommodate diverse user preferences
- ✓ Seamless support of end-to-end of communication
- ✓ OS independent
- ✓ Small processing requirements and footprint

Reasons to select **Java** and **OSGi**

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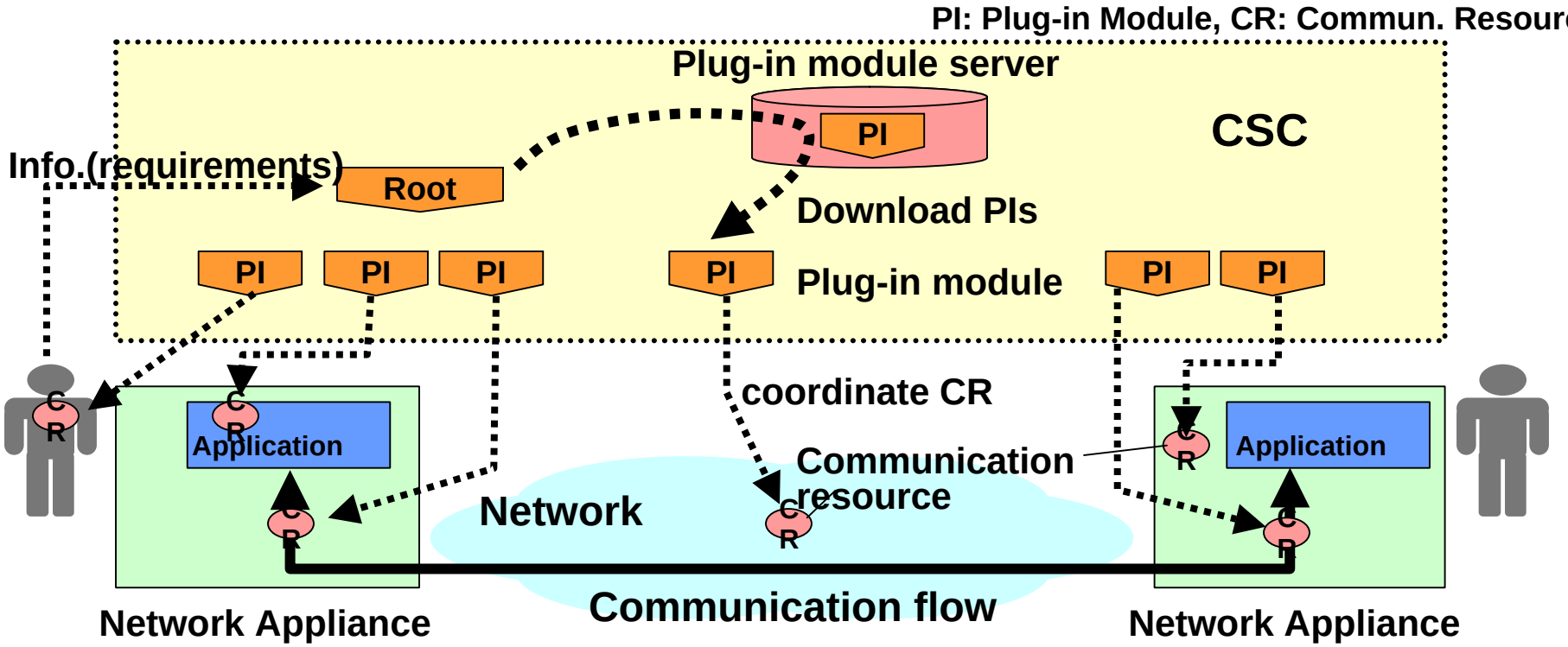
What is CSC?

- Adaptive network middleware for communication.
- Arranges and optimises end-to-end communications by coordinating various kinds of network resources.
- Distributed and user centric network control platform.



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Two Important concepts

- **CSC tries to coordinate communication as outside intervention**
  - **Keep Loosely coupling networks and applications**
  - **CSC is not mandatory**
  - **Keep CSC invisible to the application and networks**
- **Best-effort oriented**
  - **Pursues improvement rather than a rigorous guarantee**
  - **Because, the possibilities of resource coordination are restricted in the Internet**

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CSC design principles

- Component structure
- Plug-in module distribution
- Operating system independent and small footprint
- Security
- Support of existing applications

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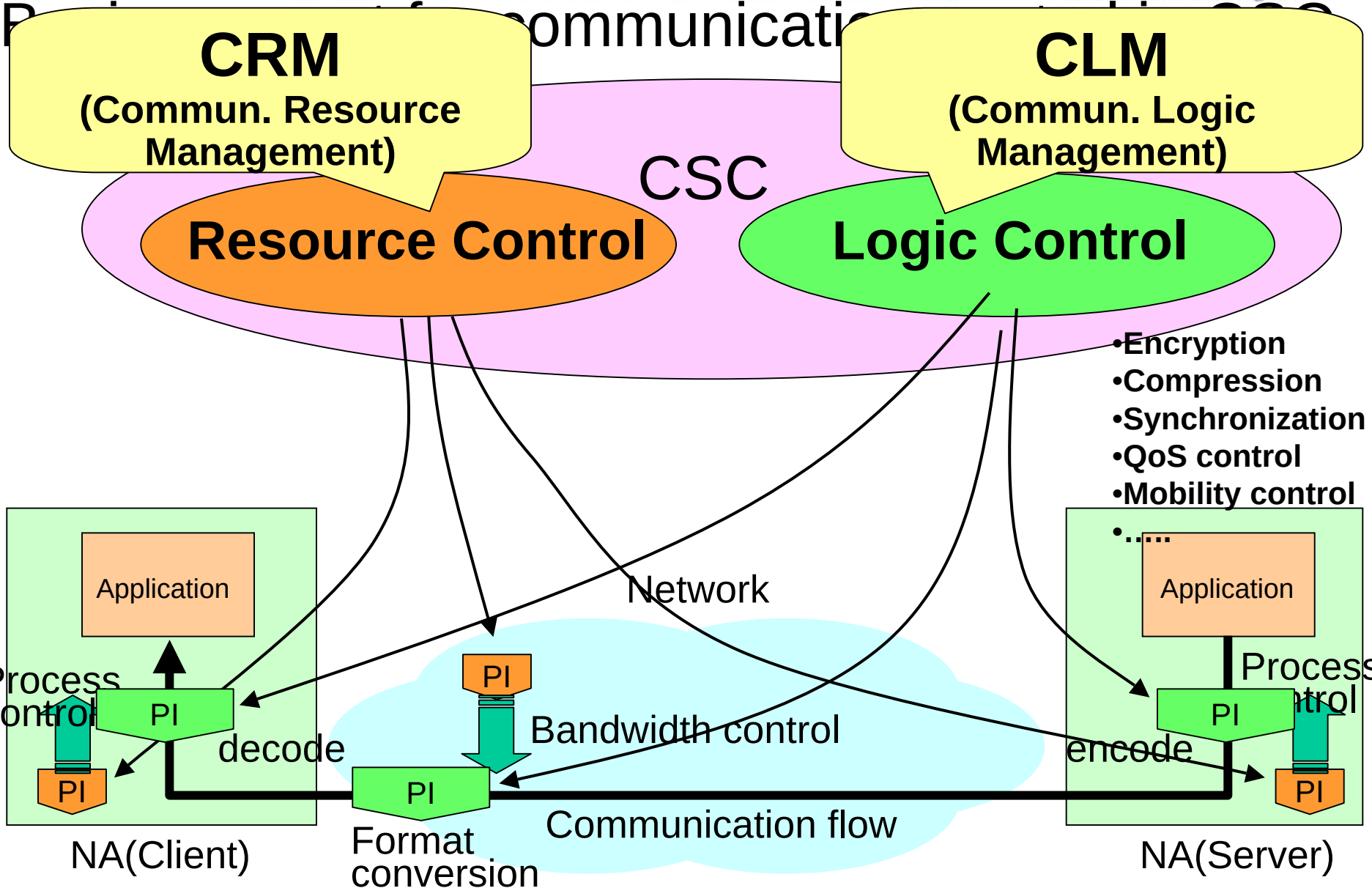
Requirement for communicati



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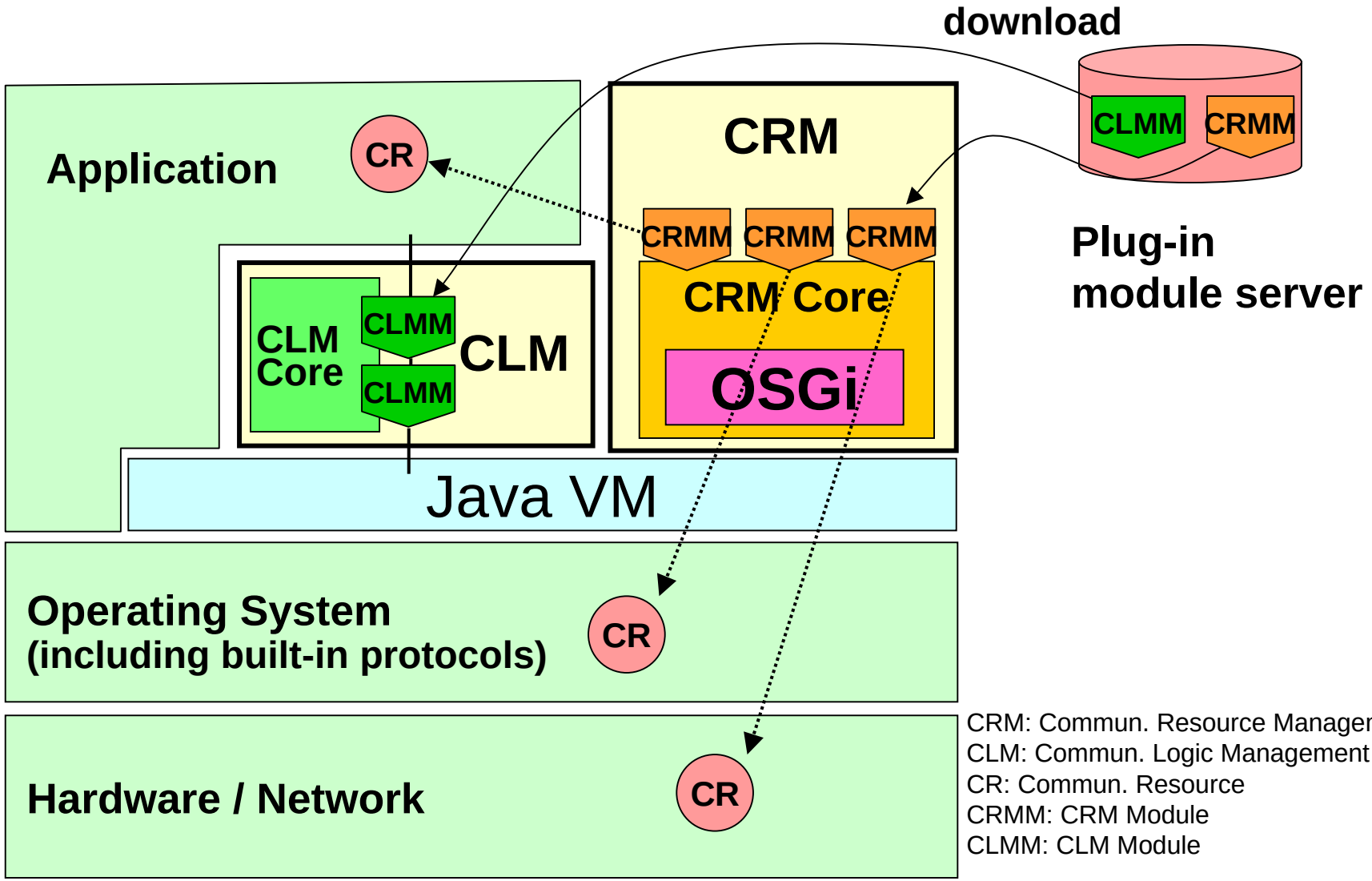
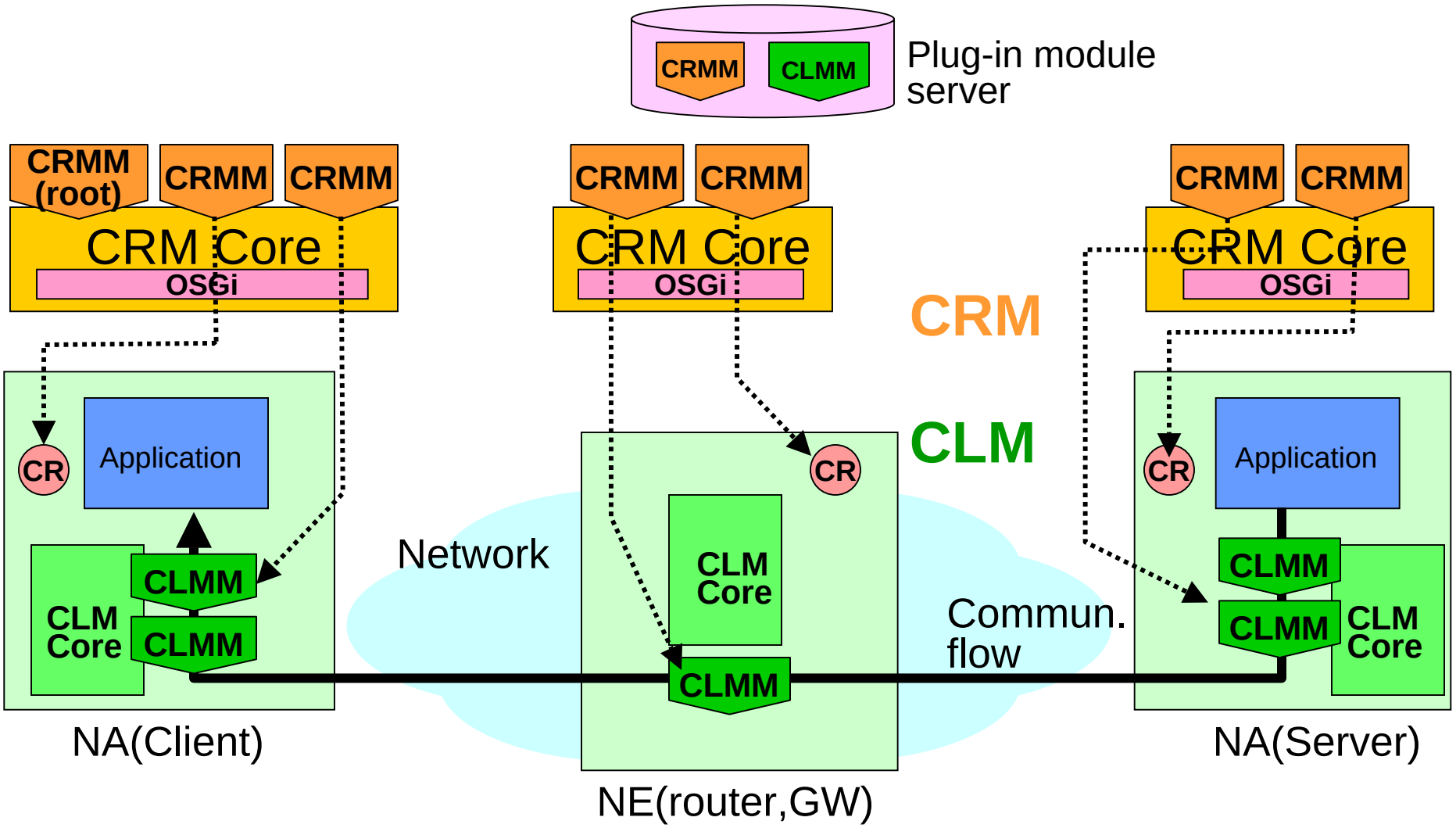
CSC structure and OSGi



CRM: Commun. Resource Management
CLM: Commun. Logic Management
CR: Commun. Resource
CRMM: CRM Module
CLMM: CLM Module

CSC architecture overview



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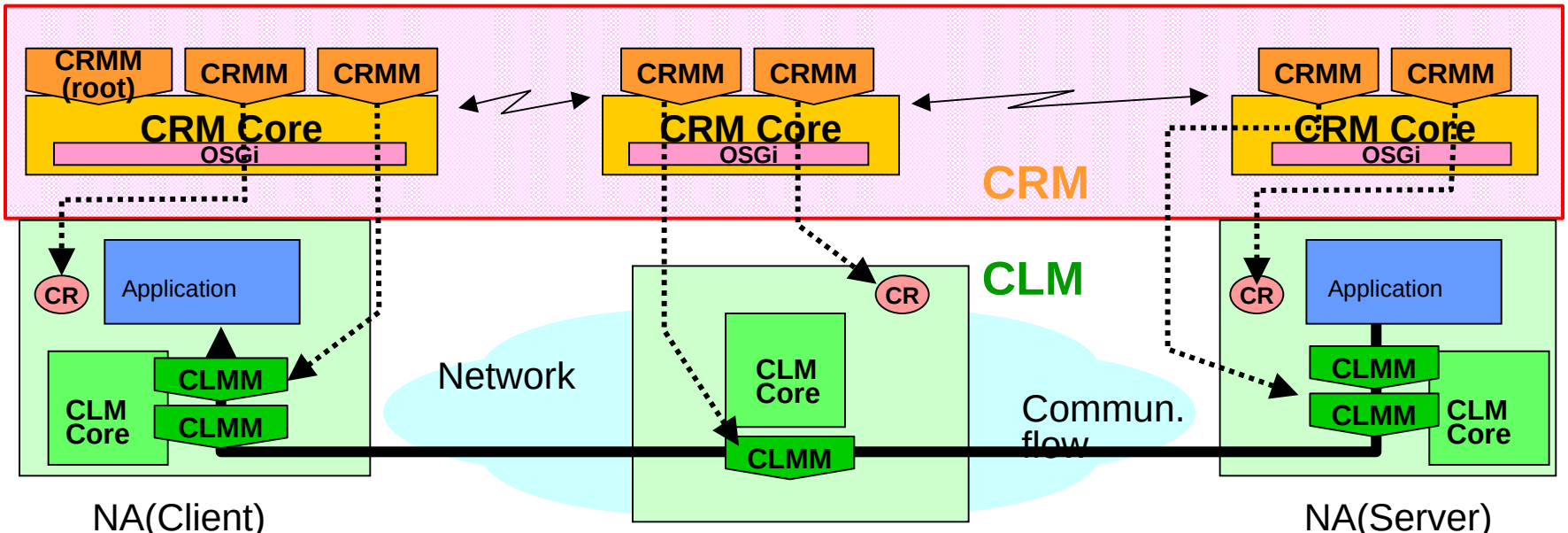
CRM: Communication Resource Management

- Framework to coordinate the resources distributed along the end-to-end
- CRM Core formulates the distributed object environment
- CRM modules have semantics of resource control
- Security functionalities are key issues
- OSGi is utilized in CRM Core



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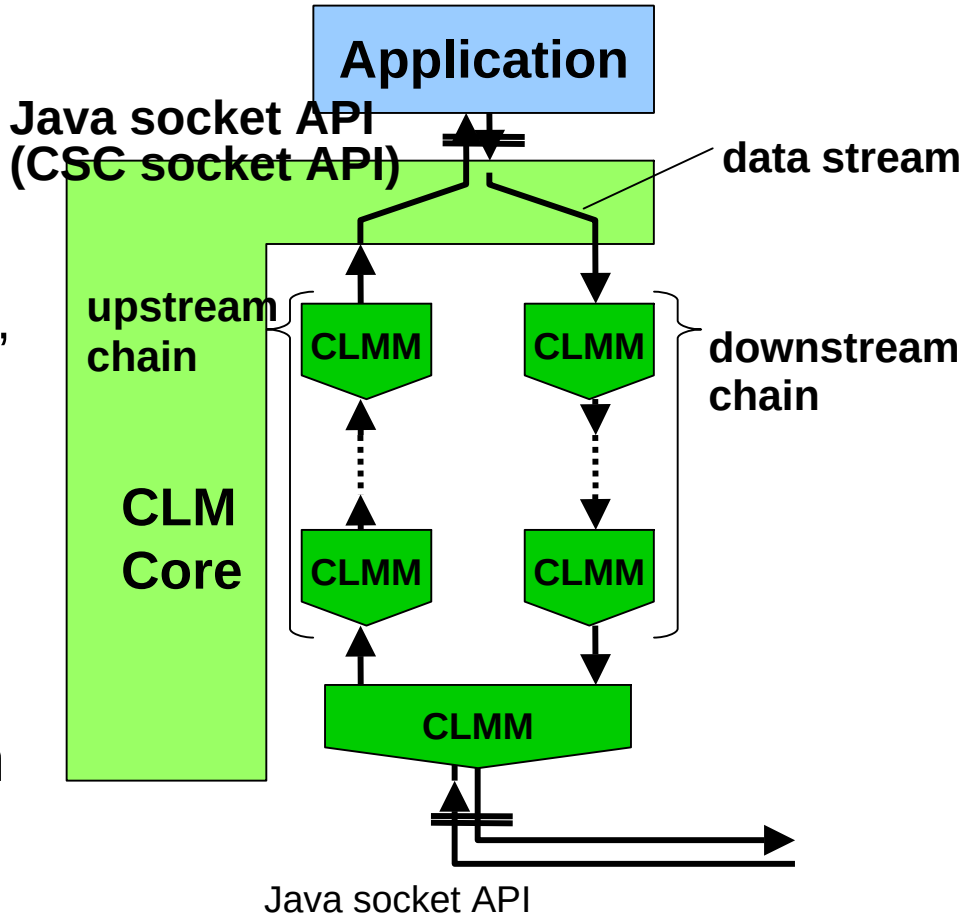
CLM: Communication Logic Management

- Control the communication data directly
- CLM module examples
  - encryption, compression, QoS monitoring, shaping, policing, synchronization, packet filtering, dynamic transcoding
- Uses socket abstraction for the API to the applications
- Data is processed sequentially in each CLMM in the chain



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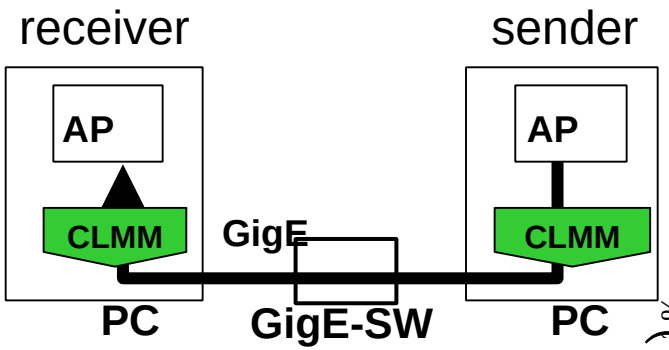
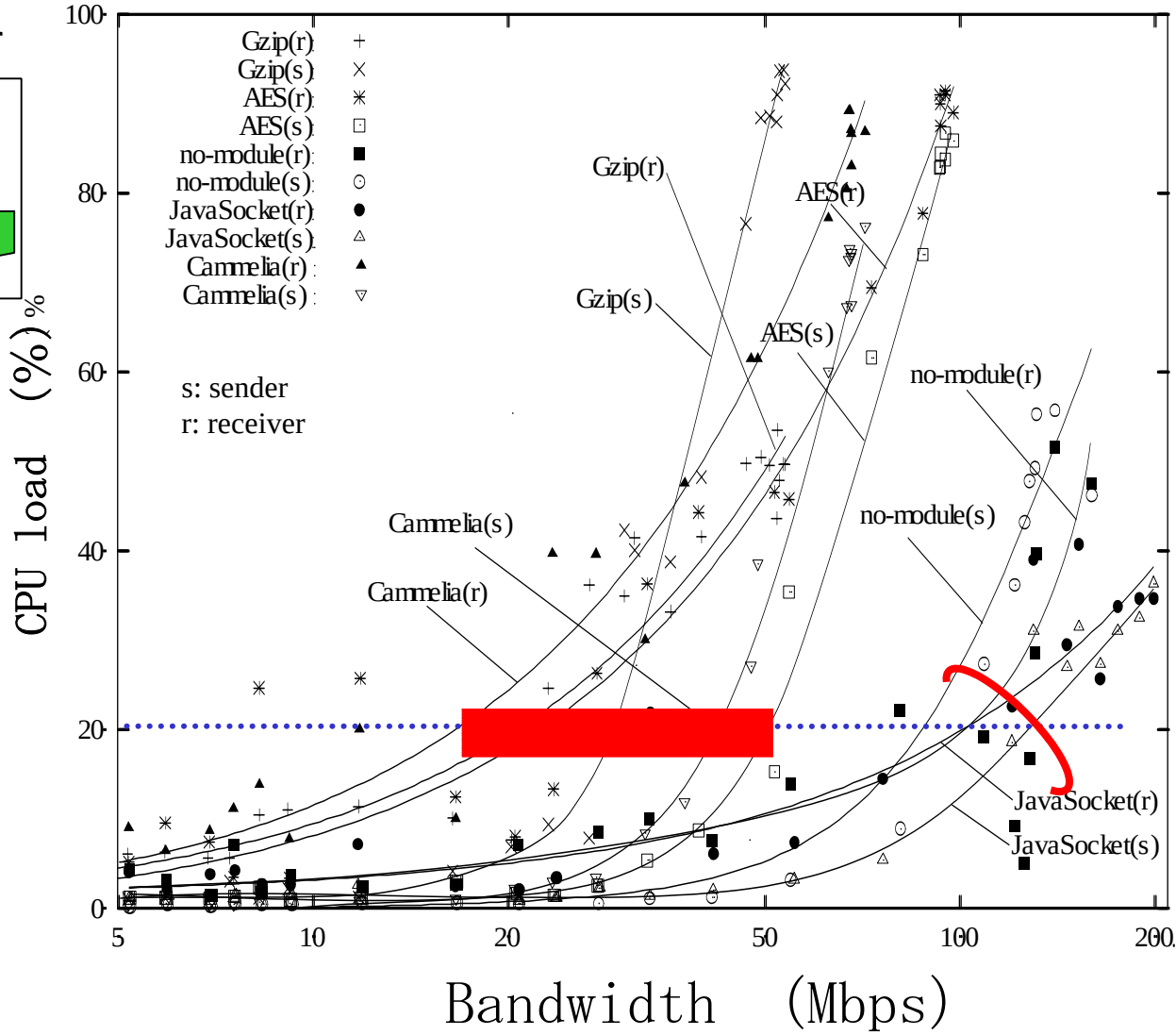
Performance evaluation of CLM



PC Spec

Pentium4, 2.4 GHz, memory 1GB

OS: Windows XP Pro.



Test CLM modules

(1) Compression (Gzip)

(2) Cipher

- AES
- Camellia

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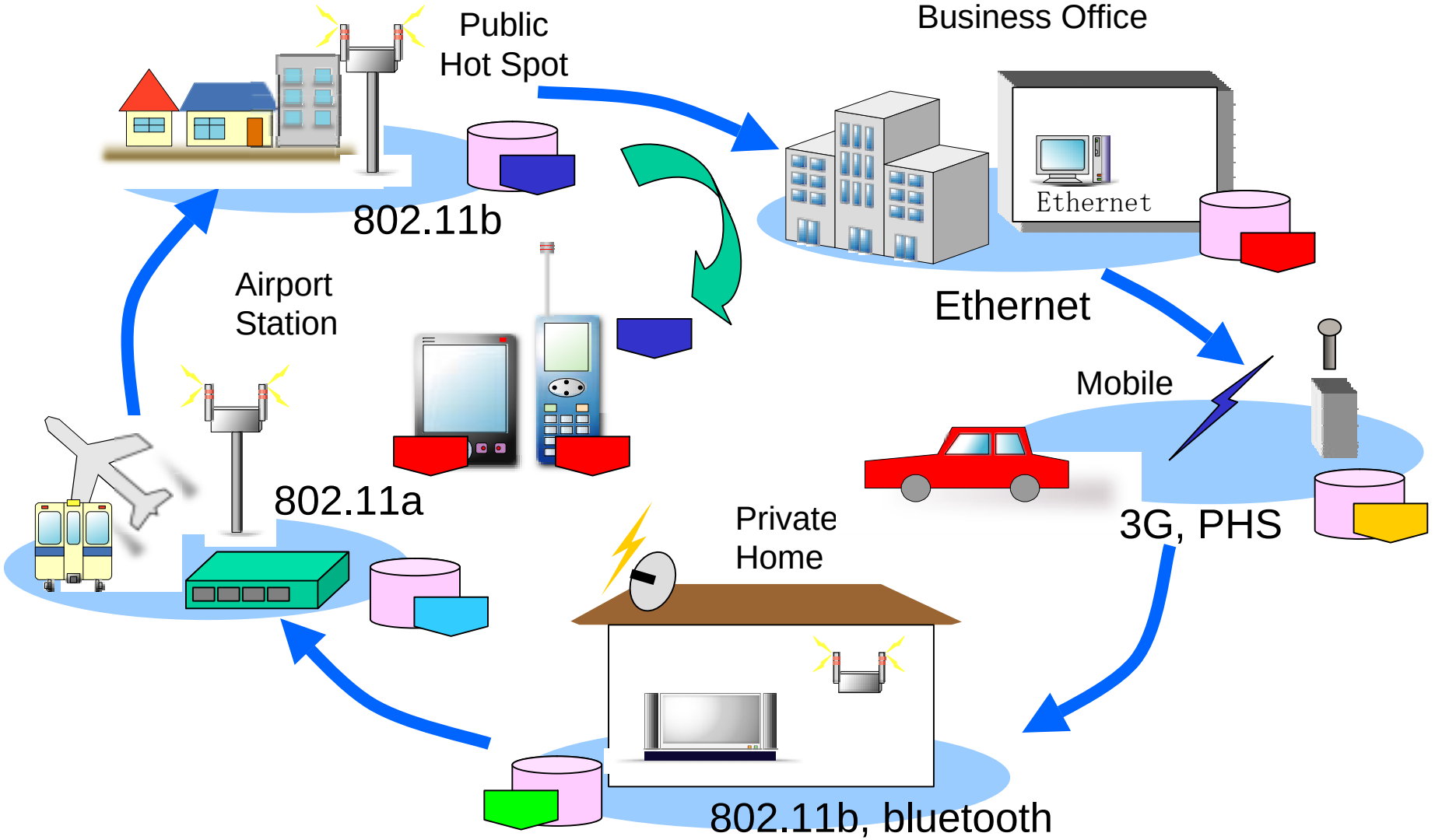
Example 1: Nomadic Appliance



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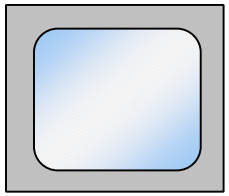
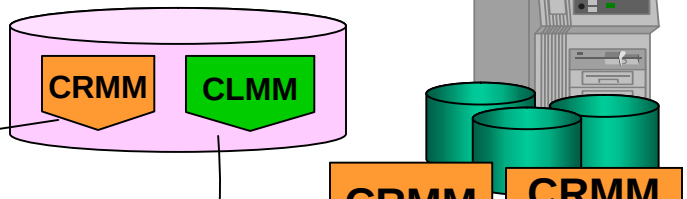
Example2: ASP



Plug-in module server



download

CRMM

CRM Core

Push the modules to subscribers

download

CRMM

CRMM (root)

CRM Core

Application

CLM Core

CLMM

Network

Application

CLMM

CLM Core

subscriber

E.g. Decryption

E.g. Encryption

ASP

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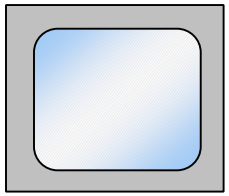
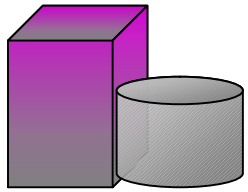
Example 3: QoS control for video stream transmission



NW resource control (packet priority)

Change video source quality



CRMM (root) CRMM CRMM CRMM CRMM

CRM Core CRM Core CRM Core

Application Application

CR CR

Observe transmission quality

CLM Core CLMM CLMM CLM Core

PC,Internet TV, etc

bottleneck

NE(router)

Server

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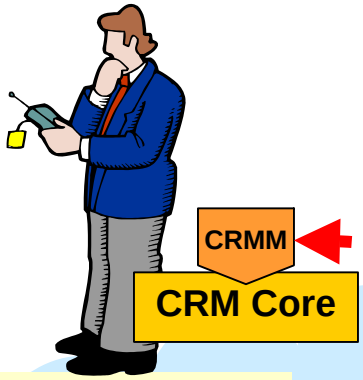
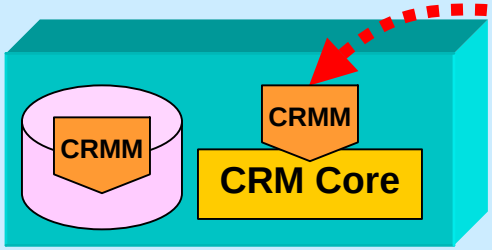
Example 4: Home Security / Automation

Target:

Power Mgt., Security, Healthcare, Remote Mgt., Home Automation, Telematics, …

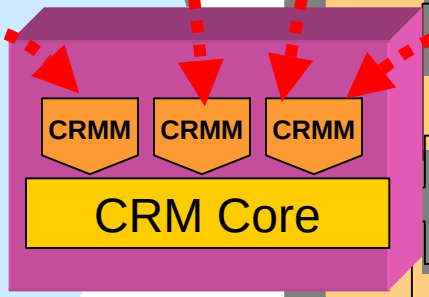


•Remote control
•Alarm

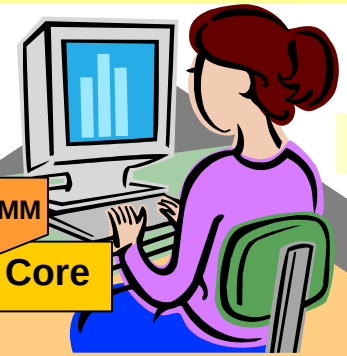


Data center

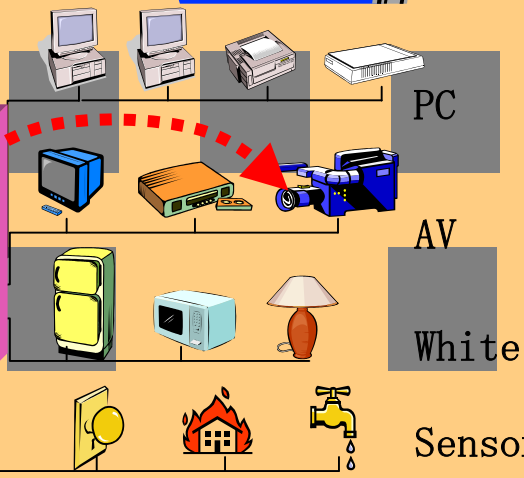
•Module download
•Remote management

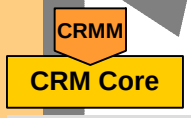


HGW



•Home Control





Some appliances support CSC

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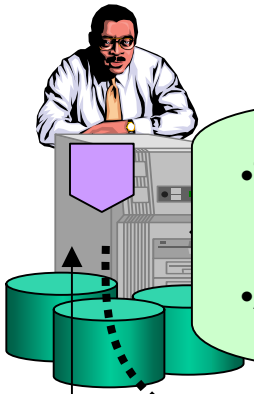
Plug-in Module Providers

ASP (Application Service Provider)

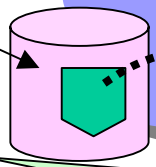


Vendors

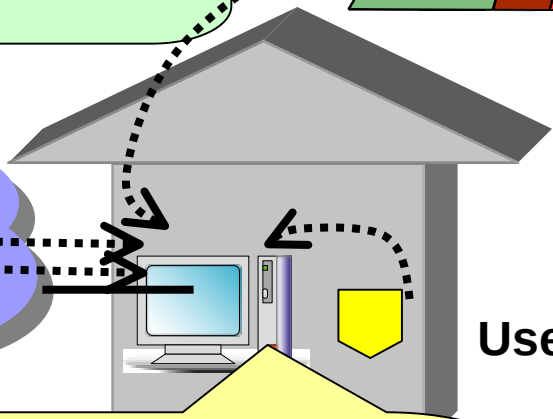
- Time to market service provisioning
  - E.g. Special Encryption for secure transaction
- Automatic configuration of user appliance

- Application/Hardware quick implementation by reusing CSC modules

Plug-in Module



Communication Network



User

Network Provider

- Service arrangement
  - Increase User satisfaction
  - Fast provisioning
  - Efficient NW resource allocation
  - Unattended service provisioning

- Automatic configuration of communication appliances
- No Technical knowledge or experience
- Easy upgrade to new internet services

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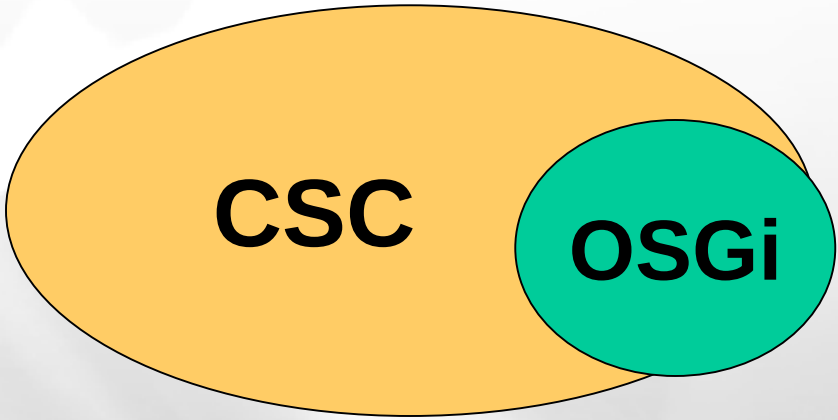
Relationship between CSC and OSGi

- **CSC (Communication Service Concierge)**
  - Adaptive and distributed network middleware for "end-to-end" communication.
  - Proprietary NTT product
  - Internally uses OSGi Framework (CRM)



- **OSGi (Open Service Gateway Initiative)**
  - Gateway oriented centralized control model.
  - Standardized specification in OSGi alliance.

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Requirements to OSGi Specification

- **Security Functions**
  - Bundle mgt. on remote framework with security.
    - Authentication between frameworks and/or bundles.
  - Bundle with digital signature(s).
  - Need to simplify the complicated security framework for framework security by Java Security and bundle security by PermissionAdmin.
- **Service call between remote bundles**
  - Service export/use between bundles running on other frameworks.
  - Should be completely the same as those in local bundles.

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Related activities in NTT Lab. and Japan (1)

Digital Home-network Forum in Japan

Establishment

- 1999.7 as a private forum
- 66 companies or organizations (2003.8)

Charter

- Design networks for IT and Network appliances at home.
- Define a Digital Home-network System that well uses communications and broadcasting services
- Promote standardization of system components and development of new technologies

Scope

Application / Total Architecture / Home Gateway / Middleware / Hardware, Links / Cabling and Construction

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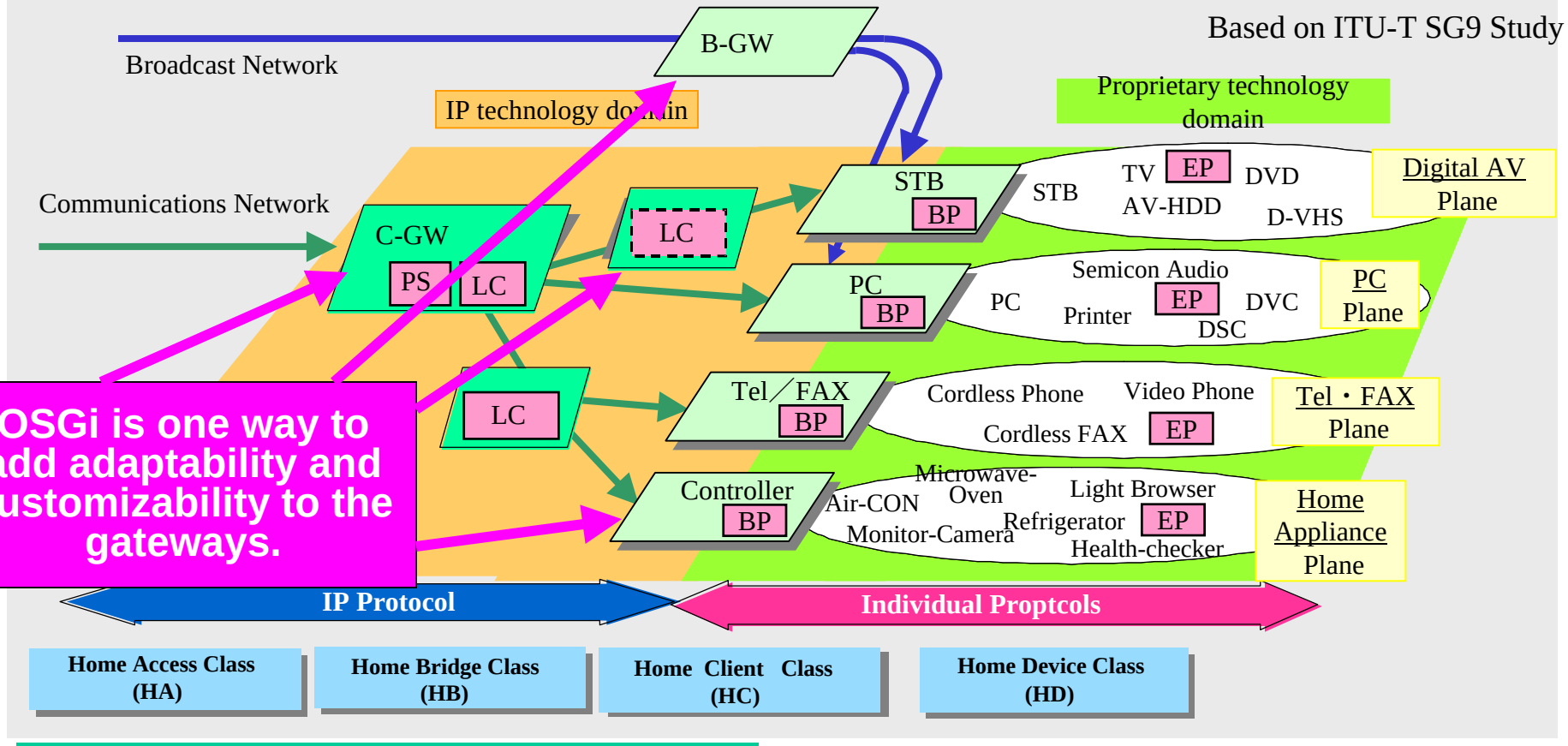
Systems Architecture of the Forum



◆ **Class of System Component**

HA (Home Access): Home Gateway
HB (Home Bridge): Intelligent Hub
HC (Home Client): IP Consumer Electrics
HD (Home Device): Consumer Eclectics

◆ **Logical Element**

PS (portal Services)
LC (Layer-1/2 Converter)
BP (Boundary Point)
EP (End Point)

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Related activities in NTT Lab. and Japan (2) :

EHONET Consortium (http://www.echonet.gr.jp)

- **Establishment**
  - 1997 established.
  - 106 companies or organizations (2003.4).
- **Charter**
  - Define multiple layer protocol structure and control object that allow interconnection to the devices/services using different protocols (incl. non-IP protocols).
  - Designed for detached homes, collective housing, shops, and small office buildings.
  - Open APIs and protocols
- **Scope**
  - energy conservation, home security, home health care, white goods networking,…

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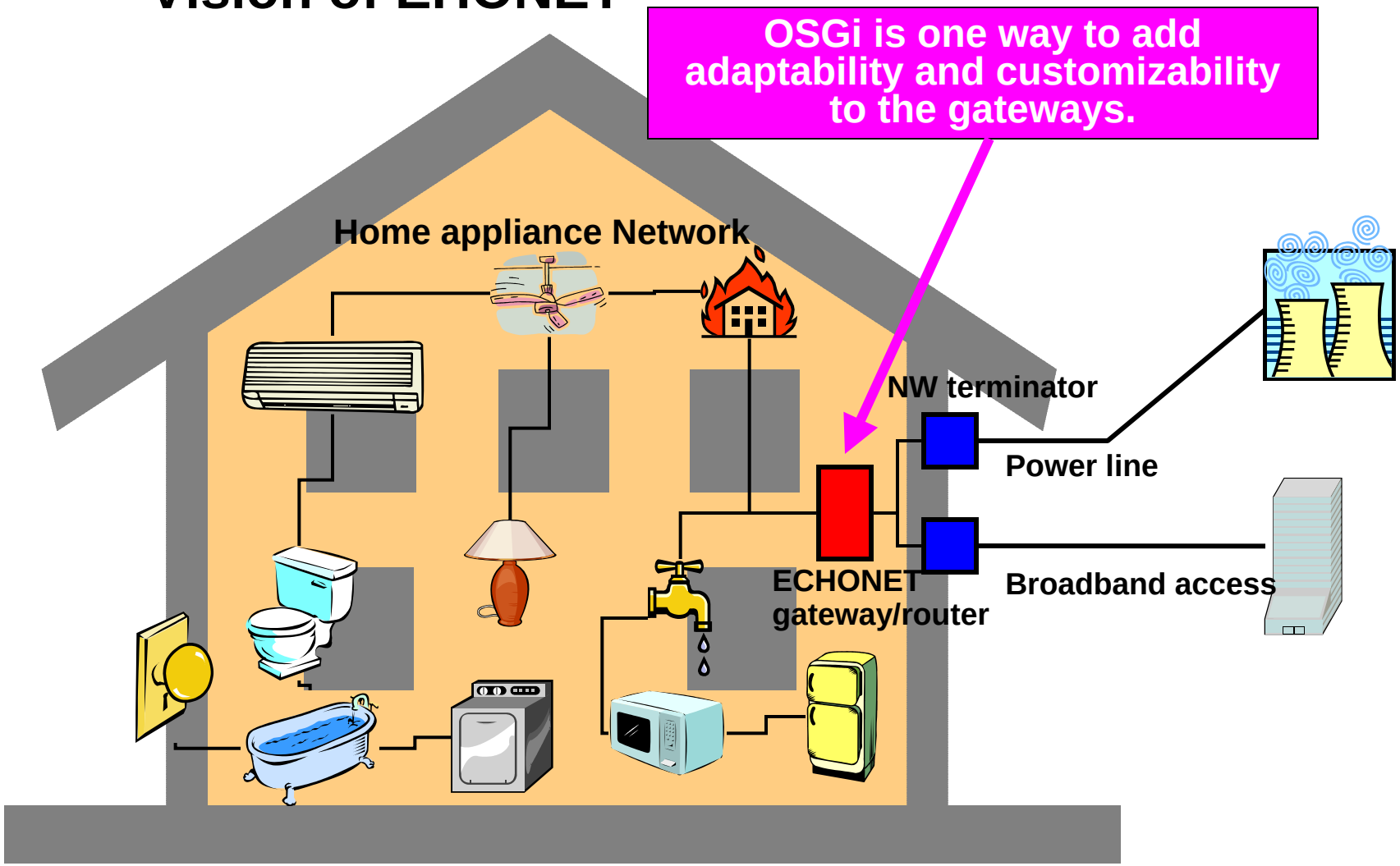
Related activities in NTT Lab. and Japan :

Vision of EHONET



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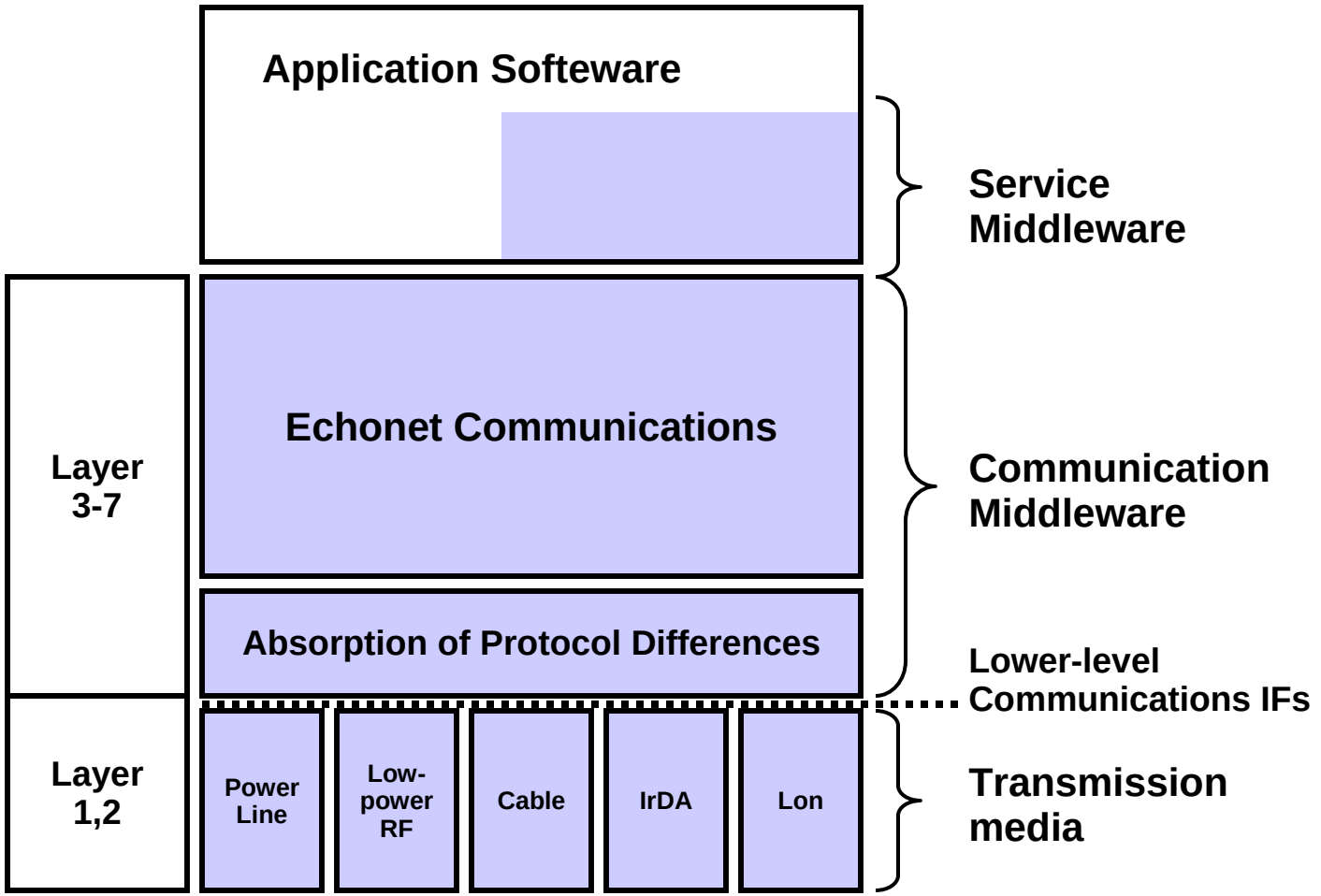
Related activities in NTT Lab. and Japan :

Scope of EHONET development



Conclusion

- NTT has developed adaptive middleware CSC for smart communications.
- OSGi is an important part of CSC.
- CSC is seeking to become a de facto standard or open specification.
- Also, OSGi itself is very useful for NTT's service handling.
- Reference
  - H. Maeomichi et. al, "A QoS Management Framework based on COP oriented Communication Resource Coordination," ACM/IFIP/USENIX Middleware 2003. (http://www.cs.wustl.edu/~corsaro/papers/RM2003/p23-hiroyuki.pdf)
  - A. Tsutsui et. al, "An Adaptive Communication Middleware for Network Service Coordination," IEEE CCNC 2004.

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Thank you
Questions?

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