Management Architecture and Distribution Framework for Home Network Services

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Agenda

• Home Network Services
  – Examples of Home Network Services
  – Current Problems

• Our Solutions (Research Activities)
  – Service Management and Distribution Framework
    • CSC : Communication Service Concierge
    • SAP : Service Aggregation Platform
  – Home Service Application Examples
    • HSH : Home Service Harmony

• Conclusions
Background

• Development and Spread of Home Network Services
  – Explosive Growth of Broadband Access and Internet Services
  – Networked Home Appliances and Devices

What is our “Role” as a Network Service Provider / Carrier?

Providing NOT ONLY “Network Infrastructure”
BUT ALSO “Service Infrastructure”
Home Network Services

• Increasing the number of networked appliances and devices
  – Audio and Visual (PVR, TV etc.)
  – Sensor and Monitoring Devices (Networked Camera etc.)

• Proliferating of alliances and standards related to home network services
  – DLNA: Digital Living Network Alliance
  – UOPF: Ubiquitous Open Platform Forum
  – ECHONET/LONWORKS/Home Plug etc.

• Varying the kinds of home services associated with networks
  – Legacy Telecom - AV home networking
  – Internet-access - Home Automation
  – VoIP, TV Phone - Home Security
  – Networked Sensors (e.g. Check gas meter)
Service Environments for Home Networks

Crossover for various Services and Standards:

Service Providers/Operators
- Users
- Vendors
- Housing
- TELCO
- Broadcast
- Healthcare
- ISPs

Networking Tech. Standards
- DLNA
- UPnP
- SIP
- IP
- ECHONET
- LonTalk
- WiFi
- IEEE1394
- Bluetooth
- Ethernet
- HomePlug
- Zigbee

Devices/Appliances
- PC
- AV
- Telco
- White Good
- Sensors, etc.
Home network services are provided independently from the aspect of devices, service frameworks and providers.

End user must access each HSPs server.
Problems and Solutions

• Problems
  – Heterogeneous network architecture and networked home appliances.
  – Various HSPs provide services using their own service platforms.

• Solutions
  – Build service aggregation platform that can provide a uniform service distribution framework.
  – Coordinate technologies for heterogeneous services for home networks.
Service Aggregation and Coordination

**Service Aggregation Platform & Service Coordination**
Construct a service distribution and management framework for end-users and HSPs. Home services and appliances will communicate with each other.

*One-stop-access*
- Single sign-on
- Accounting aggregation

Shared Operation Center

Internet

Single gateway box
(+ Media converters)

HSPs

Metering

AV

PC

Telecom

Automation

Security

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Overview of Service Aggregation Platform

Shared Operation Center for Multiple HSPs and End-users
- Provide various service management functions for end-users and HSPs

One Stop Access Service
- Single sign-on
- Accounting aggregation ...

Service Aggregation Platform

Data center

HSP management

End user management

Plug-in server

Service gateway

Internet

CSC/OSGi

Service A (AV)

Service B (Security)

Single Service Gateway
- Service functions are provided using plug-in software modules
Concepts of Service Aggregation Platform

- Multiple home services on a single gateway box.
  - HSPs can share service gateways and various home devices.

- Services distributed as software modules.
  - Service software modules, that can monitor/control home appliances, devices and sensors, are distributed and installed in a gateway box.

- Management system shared with multiple HSPs.
  - Service management system is shared with HSPs.

- One-stop-access for end users.
  - Provides some useful functions, such as single sign-on and accounting aggregation.
Important Security Issues

!! Security !!
- Software modules should be installed and executed safely.

!! Security !!
- Plug-in modules must be controlled by trusted HSPs to ensure safety.
Software Architecture in Gateway Box

Service program is downloaded, installed and executed as a set of software modules (plug-in).

Adoption of OSGi framework with CSC security enhancement

OSGi : (http://www.osgi.org/) Java-based middleware
Supports handling of downloadable software modules and life-cycle management.

CSC : Java-based middleware based on OSGi
Provides security enhancement and distributed computing.

Software-based open architecture
Security Enhancements by CSC

### PKI Authentication Mechanism

- **Plug-in Server**
- **Service Manager**
- **CERT.**
- **Ciphered channel**
- **Signature by the author or distributor**

### Security Interface 1

- Prevent communication between untrusted service manager (data center).
- Create ciphered channel.
- SSL mutual authentication

### Security Interface 2

- Prevent execution of suspicious plug-in modules.
- Digital signature

### Security Interface 3

- Restrict plug-in access to hard/soft resources and other services.
- **Detail ACL (access control list)**

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Create ciphered channel.
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Restrict plug-in access to hard/soft resources and other services.
→ Detail ACL (access control list)
One-stop-access for end users

http://service/

Single URL  Single Sign-on  Service Menu

S.A.P.
User
aki
Password
****

S.A.P.
1. Video
2. Security

S.A.P.
HSP-A
Program
VCR

S.A.P.
HSP-B
Lock
Unlock

Service A (AV)
Service B (Security)

CSC/OSGi

HSP management
End user management
Plug-in server

Data center

Internet
HSH : Home Service Harmony
- Provides convenient and sophisticated home services by combining the various functions of home appliances.
Automatically control home appliances and provide various services based on user contexts and profiles.

**Weather is improving**
- Open Curtains
- Turn off Lights
- OFF

**Watch a video**
- Close Curtains
- Control dimmer

**Important call**
- Mute
- Phone rings

**Other calls**
- Insert message on TV screen
- Connect call to answering system
- Continue to watch
HSH : Service Operation Architecture

- Abstraction of functions and status of home appliances and networked devices as “resource objects”.
- Key components such as device (resource) drivers, protocol handlers and service algorithms are provided and distributed as plug-in modules managed by CSC/OSGi middleware.

Service Coordination
- Based on environmental information and user context

Resource Assignment
- Mapping resources to services

Resource Objects
- Provide resource information and driver functions

Service Distribution FW
- Abstraction

CSC / OSGi

Actual user services
Conclusions

- **Service aggregation platform**
  - Provides service distribution and management infrastructures.
  - One-stop-access interface for users.

- **Software-based open architecture for GW box**
  - Using OSGi middleware and CSC security enhancements

- **Home service coordination**
  - Coordinate and manage heterogeneous home services by HSH
Discussion

Interaction between Network Management and Home Service Management

User (Subscriber) Identification / Authentication
eg. User identification based on subscriber management.

Service Mapping
eg. Mapping between services of network side and home side. (QoS, Security etc.)

Session Information
eg. Home network services are initiated using SIP service.

Carrier's software plug-in module may be the key …

NW Carrier / ISP
SIP server for VoIP
Internet
C
HGW