Telecom Italia experiences of OSGi application in Home Networking context

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OSGi in Telecom Italia – Home Networking context

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- Prototyping with OSGi: TI ongoing developments
Prototyping with OSGi

**TODAY**
- Home Gateway providing modem/router functionalities

**TOMORROW**
- New Generation Home Gateway with the embedded OSGi framework
OSGi Frameworks in Telecom Italia

TODAY (prototyping, 2-box solution)

Home Gateway

Plug Computer

TOMORROW (products)

New Generation Home Gateway

Home Gateway vendors provide their own OSGi framework, compliant to OSGi-R4 and OSGi-REG.

Equinox, ProSyst mBS, ... OSGi frameworks used for the prototypes
Referenced standards

Telecom Italia is mainly making use of the following standards for:

- Prototyping new implementations, solutions and services based on OSGi.
- Defining internal and external (to vendors) requirements and specifications for tenders

- HGI ([http://www.homegateway.org](http://www.homegateway.org))

  *and, last but not least...*

Referenced standards (Broadband Forum)


  Telecom Italia is actively involved in Broadband Forum as contributor and editor.

  - **TR-069**: CPE WAN Management Protocol
  - **TR-181i2**: Device Data Model for TR-069
  - **TR-157**: Component Objects for CWMP (Software Modules Management)
  - **TR-104**: DSLHomeTM Provisioning Parameters for VoIP CPE
  - **TR-143**: Enabling Network Throughput Performance Tests and Statistical Monitoring
  - **next TR-181**: Device Data Model for TR-069
    - Incoming new release of the document, including new parameters for UPnP and multicast DNS (e.g. Bonjour) protocols management (from Telecom Italia contributions to Broadband Forum), already used for prototypes herein shown in the following slides.
Referenced standards (HGI)

- HGI (http://www.homegateway.org/)

Telecom Italia has been a main contributor in HGI for the elaboration of:

- **HGI-RD008-R3 - HG Requirements for Software Execution Environment**
  - [http://www.homegateway.org/MEMBER/HGIRepository/SF_HGI01142R23.doc](http://www.homegateway.org/MEMBER/HGIRepository/SF_HGI01142R23.doc)
  - Set of requirements for OSGi framework implementation on home gateways, already shared with OSGi community and adopted by HGI as guideline for test event specifications and by operators for RFI related to OSGi enabled HGs
Referenced standards (UPnP Forum)

- **UPnP Forum** ([http://www.upnp.org/](http://www.upnp.org/))

  Telecom Italia is actively involved in UPnP Forum as contributor, editor and implementor (the UPnP needs three reference implementations for any new Device Control Protocol specification, in order to be standardized).

  - **UPnP Device Architecture 1.0**

  - **Device Control Protocols:**
    - **ManageableDevice:**1
      - [http://upnp.org/specs/dm/dm1/](http://upnp.org/specs/dm/dm1/)
    - **ManageableDevice:**2
      - [http://upnp.org/specs/dm/dm2/](http://upnp.org/specs/dm/dm2/)
Referenced standards (OSGi Alliance)


  Telecom Italia is using OSGi to prototype and specify new generation architectures, services and applications.

  - OSGi R4.3 core specification
    - [http://www.osgi.org/javadoc/r4v43/core/](http://www.osgi.org/javadoc/r4v43/core/)

  - OSGi R4.3 residential specification
    - [http://www.osgi.org/javadoc/r4v43/residential/](http://www.osgi.org/javadoc/r4v43/residential/)
UPnP Device Management 2 standardization

Telecom Italia has been highly involved in UPnP Forum as editor and contributor of the following Device Control Protocols:

- ManageableDevice:1 ([http://upnp.org/specs/dm/dm1/](http://upnp.org/specs/dm/dm1/))
- Telephony:1 ([http://upnp.org/specs/phone/phone1/](http://upnp.org/specs/phone/phone1/))

For the standardization of Device Management 2 (the Device Control Protocol: ManageableDevice:2), Telecom Italia has been the implementor (out of three, required by the UPnP standardization process).

The implemented ManageableDevice:2 passed the syntactic tests, as required by the UPnP CTT1.5 (Certification Test Tool).
UPnP Device Management 2 standardization (scenario)

CTT1.5 automatically executes all possible actions (i.e. RPCs) to verify the syntactic correctness of the implementation against the standard specification.

Telecom Italia
UPnP ManageableDevice:2
Linux Ubuntu

UPnP Certification Test Tool 1.5
Microsoft Windows
The original UPnP stack, based on Apache Felix UPnP, has been customized and improved with some bug fixing.
OSGi Remote Software Management

- Telecom Italia OSGi Remote Software Management is compliant to TR-069, TR-157 and OSGi R4.3 (Residential Specification):
  - Remote Installation, Uninstallation and Update of OSGi Bundles.
  - Remote Start, Stop of OSGi Bundle.

- The TR-069 Auto Configuration Server (REGMAN: internally developed and owned by Telecom Italia).

- The TR-069 agent for the communication with the Auto Configuration Server (REGMAN) is based on a customisation of the ProSyst mBS Smart Home.

- Our OSGi prototypes are successfully running on Sheeva Plugs for internal testing.
OSGi Remote Software Management (scenario)

Remote control of Bundles: Install, Uninstall, Upgrade, Start, Stop

REGMAN

Telecom Italia
TR-069 agent

Linux Ubuntu
OSGi Remote Software Management (architecture)

Telecom Italia
TR-069 agent

ProSyst mBS Smart Home
(OSGi R4 – REG)

ProSyst mBS
OSGi Framework

Linux Ubuntu

Makes use of OSGi Configuration Admin Service for customized communication with Telecom Italia ACS
Added value assurance scenario: Home Network Discovery

- Telecom Italia OSGi Home Network Discovery application is compliant to TR-069, TR-181 and OSGi R4.3 (Residential Specification):
  - Discovery of UPnP devices in the Home Network.
  - Discovery of Apple/Bonjour devices in the Home Network.
  - The Auto Configuration Server can query information about discovered devices.
  - Troubleshooting operations can be performed based on the knowledge of the discovered devices.

- The TR-181 data model has been extended including UPnP details and Bonjour information will be published in the next release of TR-181 thanks to Telecom Italia contribution.

- The TR-181 data model for discovered devices has been realized extending the OSGi DMT.

- The TR-069 agent (for the communication with the Auto Configuration Server) is based on a customization of the ProSyst mBS Smart Home.

- Our OSGi prototypes are successfully running on SheevaPlugs for internal testing.
The application collects information on the LAN about UPnP, Bonjour,..., services which are able to announce themselves.
Home Network Discovery (scenario, WAN side)

Data model used:
- TR-181 plus extension including:
  - UPnP details
  - Bonjour information

Information about LAN devices are read by the Telecom Italia ACS for troubleshooting purposes

REGMAN

TR-069

Telecom Italia
TR-069 agent

Telecom Italia
Home Network Discovery

Linux Ubuntu
Home Network Discovery (architecture)

Customized ACS communication

UPnP and Bonjour protocols listeners

Data model extensions using OSGi Dmt Admin Service

Declarative Services

Telecom Italia TR-069 agent

Telecom Italia Home Network Discovery

Telecom Italia UPnP (OSGi R4 – REG)

ProSyst mBS Smart Home (OSGi R4 – REG)

ProSyst mBS OSGi Framework

Linux Ubuntu
Home Gateway Management

- This is a work-in-progress.

- Application will be compliant to TR-181, TR-104 and UPnP DeviceManagement:2:
  - LAN management of the Home Gateway, using the Configuration Management Service defined in UPnP Manageable Device.
  - Discovery and configuration of the datamodel: subset of TR-181 and TR-104 data models.
Home Gateway Management (scenario)

Configuration capabilities with UPnP Configuration Management Service

Telecom Italia UPnP ManageableDevice:2

Linux

Manages the configuration of the Home Gateway

Telecom Italia UPnP Control Point

Manager Operating System

UPnP
Home Gateway Management (architecture)

Telecom Italia UPnP ManageableDevice:2

Telecom Italia UPnP (OSGi R4 – REG)

OSGi Framework

Linux

Telecom Italia Data Model Module

TR-181, TR-104 information internally collected from the software-firmware of the Home Gateway
Diagnostic in the Home Network

- This is a work-in-progress.
- Application will be compliant to TR-069, TR-143 and UPnP DeviceManagement:2:
  - LAN diagnostics (e.g. bandwidth tests) of the Home Gateway, using the Basic Management Service defined in UPnP Manageable Device.
  - Discovery and configuration of the implemented subset of TR-143.
Diagnostic in the Home Network (scenario, LAN side)

**Diagnostic capabilities with UPnP Basic Management Service**

- **Telecom Italia UPnP ManageableDevice:2**
- **Linux**

**Controls diagnostic tests (e.g.: bandwidth tests)**

- **Telecom Italia UPnP Control Point**
- **Manager Operating System**
Diagnostic in the Home Network (scenario, WAN side)

Information about diagnostic tests results are read by the Telecom Italia ACS using the TR-143 data model.
Diagnostic in the Home Network (architecture)

- **Customized ACS communication**
- **Interface to Control Point**
- **Diagnostic capabilities**
- **TR-143 data model extensions using OSGi Dmt Admin Service**

**Diagram:**
- **Telecom Italia TR-069 agent**
- **Telecom Italia ManageableDevice:2**
- **Telecom Italia UPnP (OSGi R4 – REG)**
- **OSGi Framework**
- **Linux**

**Note:**
- **Telecom Italia Group**
This is a work-in-progress.

DLNA (as a first application of UPnP in the industry) is specifying, in the

The TC Diagnostics Task Force, will specify DLNA guidelines to define
capabilities useful in troubleshooting and resolving problems experienced by end users. The scope of the task force is:

- Define a Diagnostics architecture.
- Select protocol to be used in transmission of diagnostics information. This includes identification of selection criteria.
- Identify parameters and test capabilities that will be included in DLNA guidelines
  - Basic information regarding the device
  - List of supported diagnostics-related capabilities
  - Simple diagnostics tests, which may include IP connectivity, DNS support, and throughput

The guidelines will be based on the UPnP Device Management, using the following services:

- Basic Management Service
- Configuration Management Service
To control the Manageable Devices, using:
• Basic Management Service
• Configuration Management Service

DLNA Diagnostics (scenario)

DLNA Devices in the Home Network

UPnP

UPnP/DLNA devices

DLNA Devices having diagnostics capabilities, implement the UPnP DM services:
• Basic Management Service
• Configuration Management Service

Telecom Italia
UPnP ManageableDevice:2
Control Point

Linux
DLNA Diagnostics (architecture)

- Telecom Italia
- UPnP ManageableDevice:2
- Control Point

- Telecom Italia UPnP (OSGi R4 – REG)

- OSGi Framework

- Linux
Telecom Italia smart home scenarios based on OSGi framework

- Telecom Italia is also developing lab demos and reference implementations based on the 2-box solution, in order to support a number of smart home scenarios such as:
  - Added value assurance (home network discovery and diagnostics, remote troubleshooting).
  - Home Energy Management (monitoring and control of appliances)
  - E-health (remote monitoring)
  - Home/Cloud synchronization (for content local and remote access and sharing)
  - Home automation/ Automated Assisted Living
  - ...and new use cases will come soon
Thank you

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