



OSGiTM
Alliance

RFC 209 – Network Interface Information Service

Draft

34 Pages

Abstract

This document defines the Java API that provides the information of network interfaces in an OSGi environment. The bundles can get not only information of network interfaces but notification when the configuration of network interfaces to be changed to use this API.

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0.3 Feedback

This document can be downloaded from the OSGi Alliance design repository at <https://github.com/osgi/design>. The public can provide feedback about this document by opening a bug at <https://www.osgi.org/bugzilla/>.

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0.5 Terminology and Document Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY" and "OPTIONAL" in this document are to be interpreted as described in 10.1.

Source code is shown in this typeface.

0.6 Revision History

The last named individual in this history is currently responsible for this document.

| Revision | Date | Comments |
|----------|--------------|---|
| Initial | Nov 18, 2013 | Initial version Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp |
| 0.2 | Feb 10, 2014 | Based on the last meeting, the section 5 has changed. Changed the design to service repository model. Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp |

| Revision | Date | Comments |
|----------|--------------|--|
| 0.3 | Feb 28, 2014 | Based on the last meeting, the following points have been modified. nwif.disprayname is changed to OPTIONAL. Interface name is changed. NwlInfo --> NetworkAdapter, NwlInetAddress --> NetworkAddress IPAddress Type is divided to IPAdresVersion and IPAddressScope. The functionality of configuration is removed. Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp |
| 0.4 | Mar 6, 2014 | Based on the last meeting, the following points have been modified. Update IPAddress Version and Scope. The order of registering (unregistering) NetworkAdapter and NetworkAddress is changed. Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp |
| 0.5 | Mar 14, 2014 | Based on the last conference call, the following points have been modified. Adding new service properties to NetworkAdapter service and NetworkAddress. Some service property names are modified. NetworkAadapterException class is removed. JavaDoc update. Some sentences are modified. Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp |
| 0.6 | Mar 19, 2014 | Fixed some sentences based on the comments from Evgeni. Added Chapter 8 Considered Alternatives section. Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp |
| 0.7 | Apr 9, 2014 | Fixed the packagename (Java doc). Added Chapter 9 Added Security section. Some sentences are modified. Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp |

| Revision | Date | Comments |
|----------|--------------|---|
| 0.8 | Apr 30, 2014 | <p>Based on the last CPEG conference call, the following points have been modified.</p> <p>Remove "service." prefix from service properties key.</p> <p>The constants “LAN” and “WAN” of Network Adapter Type are defined.</p> <p>The description of use case 2 and 3 is modified.</p> <p>All of service properties in NetwoekAdapter are changed to Required.</p> <p>Some sentences correction.</p> <p>Shigekuni Kondo, NTT Corporation, kondo.shigekuni@lab.ntt.co.jp</p> |

1 Introduction

Java standard APIs (i.e. `java.net.NetworkInterface`, `java.net.InetAddress`) provide functions that allow IP network interface information, such as the IP address and MAC address to be obtained.

However, the bundle that wants to get network interface information has to monitor whether the information has changed or not for a certain period of time. Changes in network interface can be pushed to the bundles concerned, the need for polling by bundles can be eliminated.

In addition, some information cannot be obtained via Java standard APIs.

This RFC

defines the Java API that provides the information of network interfaces in an OSGi environment. The bundles can get not only information of network interfaces but notification when the configuration of network interfaces to use this API.

2 Application Domain

There are many bundles that use the IP network to communicate with other networked devices. In particular, since a Residential Gateway (RGW) may have a number of network interfaces, each bundle running on the RGW needs to obtain an IP address and confirm whether the network interface associated with the allocated IP address suits the bundle's requirements or not.

For example, a protocol adapter needs the IP address of a network interface on the wide area network side to communicate with an external server. UPnP device service bundle needs the IP address that can be used to communicate with devices in a local area network.

These bundles can acquire information about the network interface via the following Java standard APIs.

- `java.net.NetworkInterface`
- `java.net.InetAddress`

3 Problem Description

Many application bundles on the RGW provide services on IP networks. For example, a protocol adapter for DMT Admin Service, a http server established by HTTP Service bundle and UPnP device service bundle use IP networks. In those cases, the bundles need to get information about the network interface on the RGW such as IP address, MAC address, network interface name, and so on.

The information about the network interface can be obtained by using Java standard APIs which are `java.net.NetworkInterface` and `java.net.InetAddress`. However, these APIs fail to provide the features needed by the bundles when they use the IP network in the following situations:

[Problem 1] There is no feature that sends a notification when information of the network interface (i.e. IP address) changes during runtime, e.g. the connection status or the assigned IP address.

[Problem 2] There is no feature that can acquire the subnet mask of the network interface.

[Problem 3] Operating System specific bundles must be prepared because some information about network interface depends on the Operating System.

If these functions were available, it would be very useful for bundles that need to use the IP network. However, a standard API does not exist at this time, so it must be prepared for each environment.

3.1 Use Cases

Use case 1

The TR-069 protocol adapter bundle on a RGW needs to communicate with an Auto Configuration Server (ACS). The ACS needs to know the public IP address of the Residential Gateway to send a UDP packet to the protocol adapter bundle for a connection request. In this case, the bundle has to provide the IP address to the ACS when the bundle is started or the IP address has changed.

Use case 2

When an HTTP Service bundle is available, at least one HTTP server is expected to run. When the HTTP server needs to be assigned to a specific network interface, the HTTP Service bundle has to know the information of the network interface. The configurator bundle (For example, management agent) implemented the policy of the execution environment will detect the changes of IP address of the network interface and update the configuration of HTTP Service bundle.

Use case 3

The UPnP Device Service bundle needs to create the `DatagramSocket` for receiving and sending M-search messages. In the case of devices such as Residential Gateway, which has multi network interfaces, the UPnP bundle has to create a `DatagramSocket` that is bound to an appropriate local IP address. The configurator bundle (For example, management agent) implemented the policy of the

execution environment will detect the changes of IP address of the network interface and update the configuration of UPnP Device Service bundle.

Use case 4

An application bundle wants to obtain the subnet mask of the IP address to cover the situation in which the bundle needs to execute the Wake-up-On-LAN process.

Use case 5

An application wants to obtain information about available network services, such as available DNS Server, Log Server, NTP Server, or network characteristics, such as domain names, ARP cache timeouts, broadcast address, etc. For this, the local DHCP server can be queried to get those information.

Use case 6

A device running an OSGi framework in an mixed IPv4/IPv6 environment needs to get specific information about the network interface(s) in order to provide, for example, different services for the IPv4 and IPv6 environments.

4 Requirements

[REQ_1] The solution **MUST** provide means to send notifications to interested bundles whenever the information of network interface has changed.(i.e. The bundle is notified the information of IP address change from Network Interface Information Service implemented bundle)

[REQ_2] The solution **MUST** provide an API that can obtain information from a multiple network interfaces. Each network interface can provide information about multiple addresses. (An application bundle needs to know whether the network interface is a LAN interface or a WAN interface.).

[REQ_3] The solution **MUST** provide a mechanism that can provide the network interface information needed regardless of the Operating System type.

[REQ_4] The solution **MUST** provide the means of configuring network interface type. It will be defined for each environment (i.e. “LAN”, “WAN” that is bound to each logical interface) .

[REQ_5] The solution **MUST** provide an API that can obtain the subnet mask of each IP address.

[REQ_6] The solution **MUST** support both IPv4 and IPv6 environments (mixed or separately) and the corresponding characteristics, for example IPv4 and IPv6 addresses, multi-prefixes, multicast etc. .

[REQ_7] The solution **SHOULD** support the retrieval of MAC addresses for network interfaces.

[REQ_8] The solution **MAY** provide an API that allows alteration of network interface configurations.

[REQ_9] The solution **MAY** provide an API that can obtain the capability of network interface. (e.g. the physical type of network interface, list of BOOTP/DHCP command options, DNS server address, Default Gateway address, etc.)

5 Technical Solution

5.1 Introduction

When the IP address is changed, the bundles utilize the IP address information (i.e. Http Service bundle running HTTP Servers) is necessary to detect the fact of the change. When using a standard Java API, such as `java.net.InetAddress` and `java.net.NetworkInterface`, calls to confirm the IP address at regular intervals are required from the bundle itself. Since this is a process common to all bundles that need to detect any change in IP address information, provision of services to notify a change in IP address is very effective.

Therefore an API that provides a change notification feature for each piece of network interface information (including the IP address information) is investigated in this RFC document. In addition, this RFC defines APIs that provide the functionalities to obtain the network interface information and the information of IP address bound to the network interface .

The name of the network interface is dependent on the operating system. To allow the bundle implementation that uses the Network Interface Information Service is unaware of the differences in operating systems, a mechanism of identifying the network interface is necessary in a format that does not depend on the operating system. This is also defined in this RFC.

5.2 Entities

- **Network Interface**
Available and activated network interfaces provided in the execution environment. In this specification, the unit of the network interface is the logical interface, not the physical interface.
- **NetworkAdapter**
The OSGi service that provides information related to the Network Interface. This service provides functionalities corresponding to “`java.net.NetworkInterface`”.
- **NetworkAddress**
The OSGi service that provides information of IP addresses available on the execution environment in which a Network Interface Information Service bundle is running.
- **NetworkAdapterType**
An identifier of the network interface. It is independent of the operating system. The two type of identifier string is specified in this specification. This specification allows that Network Adapter type other than them can be defined by the platform provider in each environment. This identifier is used by user bundle to specify the network interface to be monitored.
- **IPAdressVersion**
An identifier indicating the IP address version (i.e. Ipv4, IPv6). This identifier is defined in this specification. This identifier is used by a user bundle to specify the network interface to be monitored.

- **IPAdressScope**
An identifier indicating the scope of IP address (i.e. GLOBAL, PRIVATE). This identifier is defined in this specification. This identifier is used by a user bundle to specify the network interface to be monitored.

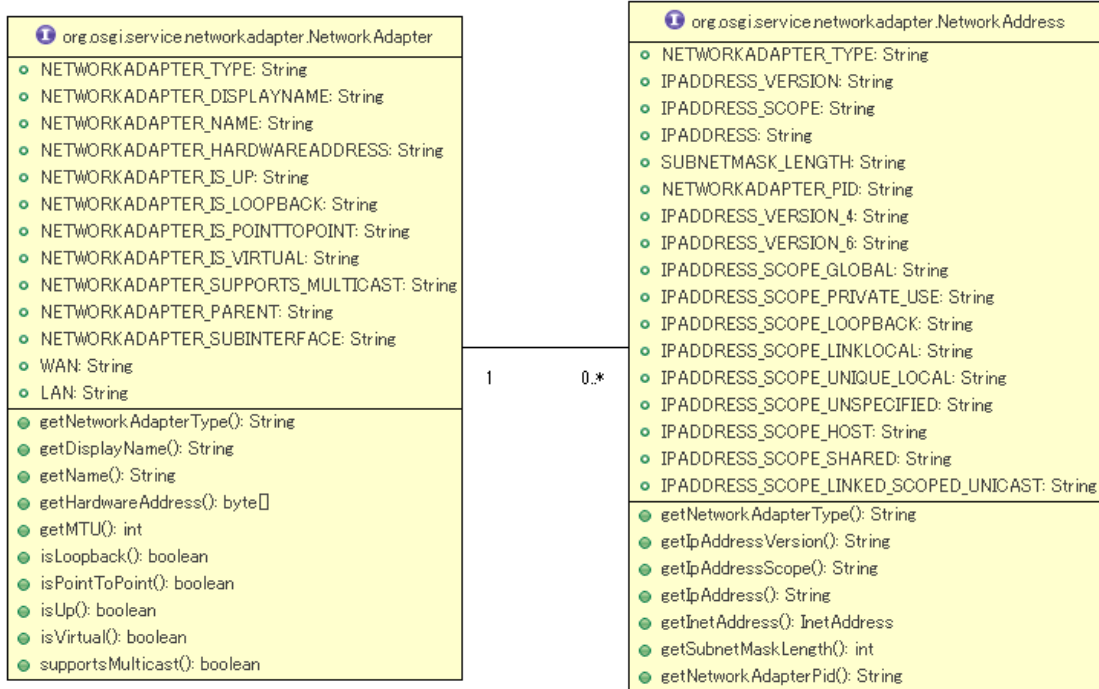


Fig.1 Class structure of Network Interface Information Service

<Network Interface Information Bundle>

To register two kinds of services.

NetworkAdapter service provides network interface information, this bundle registers each logical interface as OSGi service.

NetworkAddress service provides each IP address information, this bundle registers each IP address as OSGi service.

NetworkAddress service is associated with specific NetworkAdapter service.

When information of network interface is changed, service properties of NetworkAdapter service and NetworkAddress service will be modified.

<User bundle>

Tracking necessary NetworkAdapter service and NetworkAddress service (using filter). This bundle is notified of a change in network interface information via Service Event.

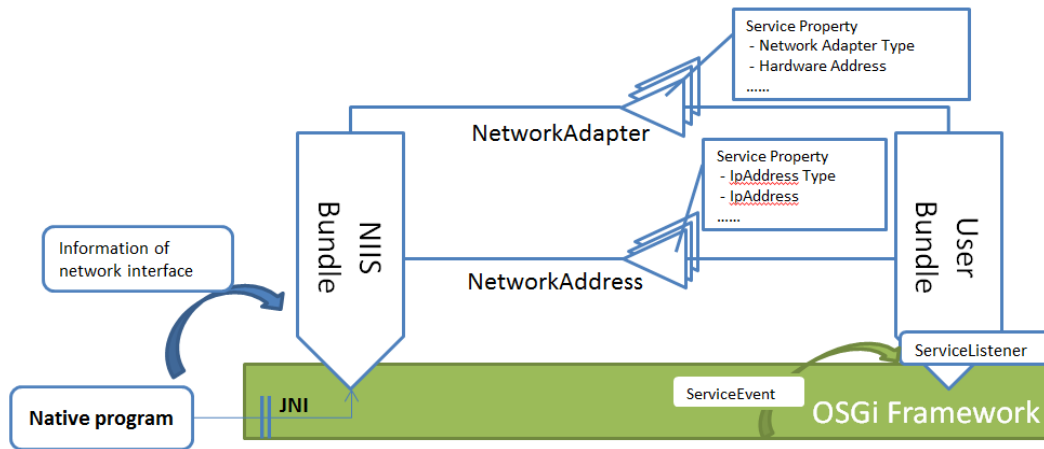


Fig.2 Overview of Network Interface Information Service

5.3 NetworkAdapter Service

NetworkAdapter is an interface that provides information about single network interfaces provided by the execution environment. If multiple network interfaces are present, NetworkAdapter Services that correspond to each network interface must be registered.

NetworkAdapter service is registered with the service repository with service properties as shown in the following table.

Table 1. Service properties of NetworkAdapter Service

| The key of service property | Description |
|--------------------------------|--|
| networkAdapter.type | Required property. Network interface type is set to a value. |
| networkAdapter.hardwareAddress | Required property. Hardware address (MAC address) is set to a value. This property can also be obtained from <code>getHardwareAddress()</code> . |
| networkAdapter.name | Required property. Network interface name is set to a value. This property can also be obtained from <code>getName()</code> . |
| networkAdapter.displayName | Required property. Network interface display name is set to a value. This property can also be obtained from <code>getDisplayName()</code> . |

| | |
|----------------------------------|---|
| networkAdapter.isUp | Required property. The value is true when a network interface is up and running, otherwise it is false. |
| networkAdapter.isLoopback | Required property. The value is true when a network interface is a loopback interface, otherwise it is false. |
| networkAdapter.isPointToPoint | Required property. The value is true when a network interface is a point to point interface, otherwise it is false. |
| networkAdapter.isVirtual | Required property. The value is true when a network interface is a virtual interface, otherwise it is false. |
| networkAdapter.supportsMulticast | Required property. The value is true when a network interface supports multicasting, otherwise it is false. |
| networkAdapter.parent | Required property. Service PID of the NetworkAdapter service which is parent of this NetworkAdapter is specified. |
| networkAdapter.subInterface | Required property. Service PID of the NetworkAdapter service which is subinterface of this NetworkAdapter is specified. |

When a network interface becomes available, NetworkAdapter service associated with the network interface is registered with the service repository. If the network interface becomes unavailable, the corresponding NetworkAdapter service is unregistered.

When the attribute values of the network interface are set to the service property changes, NetworkAdapter service is updated. NetworkAdapter interface provides a method corresponding to `java.net.NetworkInterface` in order to provide information on the associated network interface. However, this interface method does not support the Static method. In addition, because `NetworkInterface` object or `InetAddress` object is registered in the service repository as NetworkAdapter and NetworkAddress, the NetworkAdapter interface does not provide a method to get those objects. NetworkAdapter provides a method to retrieve the value of an attribute of a network interface.

Table 2. Investigation of the method to be adopted based on Java standard API

| Method in <code>java.net.NetworkInterface</code> | Adoption status |
|--|---|
| <code>getByInetAddress(InetAddress)</code> | Not adopted in this interface because NetworkAdapter service is registered. |
| <code>getByName(String)</code> | Not adopted in this interface because NetworkAdapter service is registered. |
| <code>getDisplayName()</code> | Adopted in this interface. |
| <code>getHardwareAddress()</code> | Adopted in this interface. |
| <code>getInetAddresses()</code> | Not adopted in this interface because <code>InetAddress</code> object is provided |

| | |
|-------------------------|---|
| | by NetworkAddress service. |
| getInterfaceAddresses() | Not adopted in this interface because InetAddress object is provided by NetworkAddress service. |
| getMTU() | Adopted in this interface. |
| getName() | Adopted in this interface. |
| getNetworkInterfaces() | Not adopted in this interface because NetworkAdapter service is registered. |
| getParent() | Not adopted in this interface because NetworkAdapter service is registered. |
| getSubInterfaces() | Not adopted in this interface because NetworkAdapter service is registered. |
| isLoopback() | Adopted in this interface as service property. |
| isPointToPoint() | Adopted in this interface as service property. |
| isUp() | Adopted in this interface as service property. |
| isVirtual() | Adopted in this interface as service property. |
| supportsMulticast() | Adopted in this interface as service property. |

5.4 NetworkAddress Service

NetworkAddress interface provides information of IP addresses available in which execution environment on a Network Interface Information Service bundle is running.

NetworkAddress service is registered with the service repository together with service properties as shown in the following table.

Table 3. Service properties of NetworkAddress Service

| The key of service property | Description |
|-----------------------------|--|
| networkAdapter.type | Required property. Network interface type is set to a value. |
| ipAddress.version | Required property. IP address version is set to a value. |
| ipAddress.scope | Required property. IP address scope is set to a value. |

| | |
|--------------------|---|
| ipAddress | Required property. IP address String is set to a value. |
| subnetmask.length | Required property. subnet mask length of the required properties IPv4, or IPv6 prefix length is set to a value. |
| networkAdapter.pid | Required property. Service ID of the NetworkAdapter service corresponding to the network interface binding this IP address is set to a value. |

NetworkAddress service is registered with the service repository for each available IP address.

When associated IP addresses are deleted, or the network interface to which the IP address is bound becomes unavailable, the NetworkAddress service is unregistered. When the associated IP address changes, NetworkAddress service is updated. The user bundle can detect the change of IP address by monitoring the registration or unregistering, updating of NetworkAddress service.

Because IP addresses are bound to the network interface, if any, Service PID of the associated NetworkAdapter service and its network interface type are set to service property.

NetworkAdapter service **MUST** be registered after the all associated NetworkAddress services are registered. On the other hand, when unregistering services, after associated NetworkAdapter service is unregistered, NetworkAddress of all related services are unregistered..

5.5 Network adapter type, IP address version and IP address scope

5.5.1 Network adapter type

Identifying the network interface is possible by using the network interface name.

However, since the network interface name is an identifier that is dependent on the operating system, if network interface name is used as identifier, user bundles must be implemented to be aware of the operating system. Therefore, in this specification, “network interface type” which is independent of the operating system, is used to identify the network interface. The network interface type string of “LAN” and “WAN” are defined in this specification. This specification allows that Network Adapter type other than “LAN” and “WAN” can be defined by the platform provider in each environment. It may be provided by the platform provider on which Network Interface Information Service bundle is running. Network interface type “LAN” indicates the network interface connects to a local area network. Network interface type “WAN” indicates the network interface connects to an external network (i.e. Internet). If a bundle wants to obtain the information of the network interface connected to the Internet, the bundle is able to get it by obtaining NetworkAdapter service which sets "SERVICE_NETWORKADAPTER_TYPE = WAN" to service property from the service repository.

Table 4. Network Adapter Type

| Network Interface Type | Description |
|------------------------|--|
| LAN | The network interface to connect to a local area network. |
| WAN | The network interface to connect to an external network (i.e. Internet). |

5.5.2 IP address version and IP address scope

This specification defines “IP address version” and “IP address scope” as IP address version and IP address scope to be narrowed down the IP address by user bundle as follows.

Table 5. IP Address Version

| IP Address Version | Description |
|--------------------|--|
| IPV4 | IP address version which means IPv4 address. |
| IPV6 | IP address version which means IPv6 address. |

Table 6. IP Address Scope (T.B.D)

| IP Address Scope | Description |
|------------------|---|
| GLOBAL | IP address scope which means global address. |
| PRIVATE_USE | IP address scope which means private address. |
| LOOPBACK | IP address scope which means loopback address. |
| LINKLOCAL | IP address scope which means linklocal address. |
| UNIQUE_LOCAL | IP address scope which means unique-local address. |
| UNSPECIFIED | IP address scope which means the absence of an address. |

If a bundle which wants to check for an IP address of the IPv4 global, the bundle is able to confirm by obtaining NetworkAddress service which sets "SERVICE_IPADDRESS_VERSION = IPV4" and "SERVICE_IPADDRESS_SCOPE = GLOBAL" to service property from service repository.

6 Data Transfer Objects

This RFC will not provide Data Transfer Objects.

7 Javadoc

OSGi Javadoc

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| Package Summary | | Page |
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| org.osgi.service.networkadapter | | 19 |

Package org.osgi.service.networkadapter

| Interface Summary | | Page |
|----------------------------------|--|------|
| NetworkAdapter | This interface represents network interface information. | 20 |
| NetworkAddresses | This interface represents an IP address information. | 27 |

Interface NetworkAdapter

org.osgi.service.networkadapter

public interface **NetworkAdapter**

This interface represents network interface information. Network interface information service is set the following information as service property.

1. [NETWORKADAPTER_TYPE](#) : Network Adapter Type
2. [NETWORKADAPTER_DISPLAYNAME](#) : Network Interface Display Name
3. [NETWORKADAPTER_NAME](#) : Network Interface Name
4. [NETWORKADAPTER_HARDWAREADDRESS](#) : Hardware Address
5. [NETWORKADAPTER_IS_UP](#) : Running status of Network Interface
6. [NETWORKADAPTER_IS_LOOPBACK](#) : To check loopback interface
7. [NETWORKADAPTER_IS_POINTTOPOINT](#) : To check point to point interface
8. [NETWORKADAPTER_IS_VIRTUAL](#) : To check virtual interface
9. [NETWORKADAPTER_SUPPORTS_MULTICAST](#) : To check supports multicasting
10. [NETWORKADAPTER_PARENT](#) : The PID of parent Network Interface
11. [NETWORKADAPTER_SUBINTERFACE](#) : The PID of sub Network Interface

| Field Summary | | Page |
|---------------|--|------|
| String | LAN The string of networkadapter type which means the network interface to connect to a local area network. | 23 |
| String | NETWORKADAPTER_DISPLAYNAME The key string of "networkAdapter.displayName" service property. | 21 |
| String | NETWORKADAPTER_HARDWAREADDRESS The key string of "networkAdapter.hardwareAddress" service property. | 22 |
| String | NETWORKADAPTER_IS_LOOPBACK The key string of "networkAdapter.isLoopback" service property. | 22 |
| String | NETWORKADAPTER_IS_POINTTOPOINT The key string of "networkAdapter.isPointToPoint" service property. | 22 |
| String | NETWORKADAPTER_IS_UP The key string of "networkAdapter.isUp" service property. | 22 |
| String | NETWORKADAPTER_IS_VIRTUAL The key string of "networkAdapter.isVirtual" service property. | 22 |
| String | NETWORKADAPTER_NAME The key string of "networkAdapter.name" service property. | 21 |
| String | NETWORKADAPTER_PARENT The key string of "networkAdapter.parent" service property. | 23 |
| String | NETWORKADAPTER_SUBINTERFACE The key string of "networkAdapter.subInterface" service property. | 23 |
| String | NETWORKADAPTER_SUPPORTS_MULTICAST The key string of "networkAdapter.supportsMulticast" service property. | 22 |
| String | NETWORKADAPTER_TYPE The key string of "networkAdapter.type" service property. | 21 |
| String | WAN The string of networkadapter type which means the network interface to connect to an external network (i.e. | 23 |

| Method Summary | | Pag e |
|----------------|--|----------|
| String | getDisplayName() Returns the network interface display name of "networkAdapter.displayName" service property value. | 23 |
| byte[] | getHardwareAddress() Returns the MAC address of "networkAdapter.hardwareAddress" service property value. | 24 |
| int | getMTU() Returns the Maximum Transmission Unit (MTU) of this interface. | 24 |
| String | getName() Returns the network interface name of "networkAdapter.name" service property value. | 24 |
| String | getNetworkAdapterType() Returns the network interface type of "networkAdapter.type" service property value. | 23 |
| boolean | isLoopback() Returns whether a network interface is a loopback interface. | 24 |
| boolean | isPointToPoint() Returns whether a network interface is a point to point interface. | 25 |
| boolean | isUp() Returns whether a network interface is up and running. | 25 |
| boolean | isVirtual() Returns whether this interface is a virtual interface (also called subinterface). | 25 |
| boolean | supportsMulticast() Returns whether a network interface supports multicasting or not. | 25 |

Field Detail

NETWORKADAPTER_TYPE

```
public static final String NETWORKADAPTER_TYPE = "networkAdapter.type"
```

The Network key string Interface of "networkAdapter.type" service property. specified.

NETWORKADAPTER_DISPLAYNAME

```
public static final String NETWORKADAPTER_DISPLAYNAME = "networkAdapter.displayName"
```

The Network key string Interface of "networkAdapter.displayName" service property. specified.

NETWORKADAPTER_NAME

```
public static final String NETWORKADAPTER_NAME = "networkAdapter.name"
```

The Network key string Interface of "networkAdapter.name" service property. specified.

NETWORKADAPTER_HARDWAREADDRESS

```
public static final String NETWORKADAPTER_HARDWAREADDRESS = "networkAdapter.hardwareAddress"
```

The key string of "networkAdapter.hardwareAddress" service property.
Hardware Address is specified.

NETWORKADAPTER_IS_UP

```
public static final String NETWORKADAPTER_IS_UP = "networkAdapter.isUp"
```

The key string of "networkAdapter.isUp" service property.
The value is true when a network interface is up and running, otherwise it is false.

NETWORKADAPTER_IS_LOOPBACK

```
public static final String NETWORKADAPTER_IS_LOOPBACK = "networkAdapter.isLoopback"
```

The key string of "networkAdapter.isLoopback" service property.
The value is true when a network interface is a loopback interface, otherwise it is false.

NETWORKADAPTER_IS_POINTTOPOINT

```
public static final String NETWORKADAPTER_IS_POINTTOPOINT = "networkAdapter.isPointToPoint"
```

The key string of "networkAdapter.isPointToPoint" service property.
The value is true when a network interface is a point to point interface, otherwise it is false.

NETWORKADAPTER_IS_VIRTUAL

```
public static final String NETWORKADAPTER_IS_VIRTUAL = "networkAdapter.isVirtual"
```

The key string of "networkAdapter.isVirtual" service property.
The value is true when a network interface is a virtual interface, otherwise it is false.

NETWORKADAPTER_SUPPORTS_MULTICAST

```
public static final String NETWORKADAPTER_SUPPORTS_MULTICAST = "networkAdapter.supportsMulticast"
```

The key string of "networkAdapter.supportsMulticast" service property.
The value is true when a network interface supports multicasting, otherwise it is false.

NETWORKADAPTER_PARENT

```
public static final String NETWORKADAPTER_PARENT = "networkAdapter.parent"
```

The key string of "networkAdapter.parent" service property.
Service PID of the NetworkAdapter service which is parent of this NetworkAdapter is specified.

NETWORKADAPTER_SUBINTERFACE

```
public static final String NETWORKADAPTER_SUBINTERFACE = "networkAdapter.subInterface"
```

The key string of "networkAdapter.subInterface" service property.
Service PID of the NetworkAdapter service which is subinterface of this NetworkAdapter is specified.

WAN

```
public static final String WAN = "WAN"
```

The string of networkadapter type which means the network interface to connect to an external network (i.e. Internet).

LAN

```
public static final String LAN = "LAN"
```

The string of networkadapter type which means the network interface to connect to a local area network.

Method Detail

getNetworkAdapterType

```
String getNetworkAdapterType()
```

Returns the network interface type of "networkAdapter.type" service property value.

Returns:
Network Interface Type

getDisplayname

```
String getDisplayName()
```

Returns the network interface display name of "networkAdapter.displayname" service property value.

Returns:
Network Interface Display Name

getName

String **getName()**

Returns the network interface name of "networkAdapter.name" service property value.

Returns:
Network Interface Name

getHardwareAddress

byte[] **getHardwareAddress()**

Returns the MAC address of "networkAdapter.hardwareAddress" service property value.

Returns:
Hardware Address

getMTU

int **getMTU()**
throws SocketException

Returns the Maximum Transmission Unit (MTU) of this interface.

Returns:
The value of the MTU for that interface.

Throws:
SocketException - If an I/O error occurs.

isLoopback

boolean **isLoopback()**
throws SocketException

Returns whether a network interface is a loopback interface.

Returns:
true if the interface is a loopback interface.

Throws:
SocketException - If an I/O error occurs.

isPointToPoint

```
boolean isPointToPoint()  
    throws SocketException
```

Returns whether a network interface is a point to point interface.

Returns:
true if the interface is a point to point interface.

Throws:
SocketException - If an I/O error occurs.

isUp

```
boolean isUp()  
    throws SocketException
```

Returns whether a network interface is up and running.

Returns:
true if the interface is up and running.

Throws:
SocketException - If an I/O error occurs.

isVirtual

```
boolean isVirtual()
```

Returns whether this interface is a virtual interface (also called subinterface). Virtual interfaces are, on some systems, interfaces created as a child of a physical interface and given different settings (like address or MTU). Usually the name of the interface will be the name of the parent followed by a colon (:) and a number identifying the child since there can be several virtual interfaces attached to a single physical interface.

Returns:
true if this interface is a virtual interface.

supportsMulticast

```
boolean supportsMulticast()  
    throws SocketException
```

Returns whether a network interface supports multicasting or not.

Returns:

true if the interface supports Multicasting.

Throws:

SocketException - If an I/O error occurs.

Interface NetworkAddress

org.osgi.service.networkadapter

public interface **NetworkAddress**

This interface represents an IP address information. IP address information service is set the following information as service property.

1. [NETWORKADAPTER_TYPE](#) : Network Interface Type
2. [IPADDRESS_VERSION](#) : IP Address Version
3. [IPADDRESS_SCOPE](#) : IP Address Scope
4. [IPADDRESS](#) : IP Address
5. [SUBNETMASK_LENGTH](#) : Subnet Mask Length(IPv4) or Prefix Length(IPv6)
6. [NETWORKADAPTER_PID](#) : Service PID of the NetworkAdapter service to which this service belongs

| Field Summary | | Page |
|---------------|--|------|
| String | IPADDRESS The key string of "ipAddress" service property. | 28 |
| String | IPADDRESS_SCOPE The key string of "ipAddress.scope" service property. | 28 |
| String | IPADDRESS_SCOPE_GLOBAL The string of IP address scope which means global address. | 29 |
| String | IPADDRESS_SCOPE_HOST The string of IP address scope which means "This host on this network". | 30 |
| String | IPADDRESS_SCOPE_LINKED_SCOPED_UNICAST The string of IP address scope which means "Linked-Scoped Unicast". | 30 |
| String | IPADDRESS_SCOPE_LINKLOCAL The string of IP address scope which means "Link Local". | 30 |
| String | IPADDRESS_SCOPE_LOOPBACK The string of IP address scope which means "Loopback". | 29 |
| String | IPADDRESS_SCOPE_PRIVATE_USE The string of IP address scope which means "Private-Use Networks". | 29 |
| String | IPADDRESS_SCOPE_SHARED The string of IP address scope which means "Shared Address Space". | 30 |
| String | IPADDRESS_SCOPE_UNIQUE_LOCAL The string of IP address scope which means "Unique-Local". | 30 |
| String | IPADDRESS_SCOPE_UNSPECIFIED The string of IP address scope which means "Unspecified Address". | 30 |
| String | IPADDRESS_VERSION The key string of "ipAddress.version" service property. | 28 |
| String | IPADDRESS_VERSION_4 The string of IP address version which means IP address version 4. | 29 |
| String | IPADDRESS_VERSION_6 The string of IP address version which means IP address version 6. | 29 |
| String | NETWORKADAPTER_PID The key string of "networkAdapter.id" service property. | 29 |
| String | NETWORKADAPTER_TYPE The key string of "networkAdapter.type" service property. | 28 |

| | | |
|--------|--|----|
| String | SUBNETMASK_LENGTH The key string of "subnetmask.length" service property. | 29 |
|--------|--|----|

| Method Summary | | Page |
|----------------|--|------|
| InetAddress | getInetAddress() Returns the InetAddress object of this IP address. | 31 |
| String | getIpAddress() Returns the IP address of "ipaddress" service property value. | 31 |
| String | getIpAddressScope() Returns the IP address scope of "ipaddress.scope" service property value. | 31 |
| String | getIpAddressVersion() Returns the IP address version of "ipaddress.version" service property value. | 31 |
| String | getNetworkAdapterPid() Returns the "networkadapter.pid" service property value. | 32 |
| String | getNetworkAdapterType() Returns the network interface type of "networkAdapter.type" service property value. | 31 |
| int | getSubnetMaskLength() Returns the "subnetmask.length" service property value. | 32 |

Field Detail

NETWORKADAPTER_TYPE

```
public static final String NETWORKADAPTER_TYPE = "networkAdapter.type"
```

The key string of "networkAdapter.type" service property.
Network Interface Type is specified.

IPADDRESS_VERSION

```
public static final String IPADDRESS_VERSION = "ipAddress.version"
```

The key string of "ipAddress.version" service property.
IP Address Type is specified.

IPADDRESS_SCOPE

```
public static final String IPADDRESS_SCOPE = "ipAddress.scope"
```

The key string of "ipAddress.scope" service property.
IP Address Type is specified.

IPADDRESS

```
public static final String IPADDRESS = "ipAddress"
```

The key string of "ipAddress" service property.
IP Address is specified.

SUBNETMASK_LENGTH

```
public static final String SUBNETMASK_LENGTH = "subnetmask.length"
```

The key string of "subnetmask.length" service property.
Subnet Mask Length(IPv4) or Prefix Length(IPv6) is specified.

NETWORKADAPTER_PID

```
public static final String NETWORKADAPTER_PID = "networkAdapter.pid"
```

The key string of "networkAdapter.id" service property.
Service PID of the interface information service to which it belongs is specified.

IPADDRESS_VERSION_4

```
public static final String IPADDRESS_VERSION_4 = "IPv4"
```

The string of IP address version which means IP address version 4.

IPADDRESS_VERSION_6

```
public static final String IPADDRESS_VERSION_6 = "IPv6"
```

The string of IP address version which means IP address version 6.

IPADDRESS_SCOPE_GLOBAL

```
public static final String IPADDRESS_SCOPE_GLOBAL = "GLOBAL"
```

The string of IP address scope which means global address.
The global address is defined as the address other than the address defined in the RFC6890.

IPADDRESS_SCOPE_PRIVATE_USE

```
public static final String IPADDRESS_SCOPE_PRIVATE_USE = "PRIVATE_USE"
```

The string of IP address scope which means "Private-Use Networks".
See RFC6890 for the definition of "Private-Use Networks".

IPADDRESS_SCOPE_LOOPBACK

```
public static final String IPADDRESS_SCOPE_LOOPBACK = "LOOPBACK"
```

| | | | | | | | | |
|-----|---------|----|-----|---------|------------|-------|-------|-------------|
| The | string | of | IP | address | scope | which | means | "Loopback". |
| See | RFC6890 | | for | the | definition | | of | "Loopback". |

IPADDRESS_SCOPE_LINKLOCAL

public static final String **IPADDRESS_SCOPE_LINKLOCAL** = "LINKLOCAL"

| | | | | | | | | | |
|-----|---------|----|-----|---------|------------|-------|-------|-------|---------|
| The | string | of | IP | address | scope | which | means | "Link | Local". |
| See | RFC6890 | | for | the | definition | | of | "Link | Local". |

IPADDRESS_SCOPE_UNIQUE_LOCAL

public static final String **IPADDRESS_SCOPE_UNIQUE_LOCAL** = "UNIQUE_LOCAL"

| | | | | | | | | |
|-----|---------|----|-----|---------|------------|-------|-------|-----------------|
| The | string | of | IP | address | scope | which | means | "Unique-Local". |
| See | RFC6890 | | for | the | definition | | of | "Unique-Local". |

IPADDRESS_SCOPE_UNSPECIFIED

public static final String **IPADDRESS_SCOPE_UNSPECIFIED** = "UNSPECIFIED"

| | | | | | | | | | |
|-----|---------|----|-----|---------|------------|-------|-------|--------------|-----------|
| The | string | of | IP | address | scope | which | means | "Unspecified | Address". |
| See | RFC6890 | | for | the | definition | | of | "Unspecified | Address". |

IPADDRESS_SCOPE_HOST

public static final String **IPADDRESS_SCOPE_HOST** = "HOST"

| | | | | | | | | | | | | |
|-----|---------|----|-----|---------|------------|-------|-------|-------|------|------|-----------|-----------|
| The | string | of | IP | address | scope | which | means | "This | host | on | this | network". |
| See | RFC6890 | | for | the | definition | of | "This | host | on | this | network". | |

IPADDRESS_SCOPE_SHARED

public static final String **IPADDRESS_SCOPE_SHARED** = "SHARED"

| | | | | | | | | | | |
|-----|---------|----|-----|---------|------------|-------|---------|---------|---------|---------|
| The | string | of | IP | address | scope | which | means | "Shared | Address | Space". |
| See | RFC6890 | | for | the | definition | of | "Shared | Address | Space". | |

IPADDRESS_SCOPE_LINKED_SCOPED_UNICAST

public static final String **IPADDRESS_SCOPE_LINKED_SCOPED_UNICAST** = "LINKED_SCOPED_UNICAST"

The string of IP address scope which means "Linked-Scoped Unicast".
See RFC6890 for the definition of "Linked-Scoped Unicast".

Method Detail

getNetworkAdapterType

String **getNetworkAdapterType()**

Returns the network interface type of "networkAdapter.type" service property value.

Returns:
Network Interface Type

getIpAddressVersion

String **getIpAddressVersion()**

Returns the IP address version of "ipaddress.version" service property value.

Returns:
IP Address Version

getIpAddressScope

String **getIpAddressScope()**

Returns the IP address scope of "ipaddress.scope" service property value.

Returns:
IP Address Scope

getIpAddress

String **getIpAddress()**

Returns the IP address of "ipaddress" service property value.

Returns:
IP Address string

getInetAddress

InetAddress **getInetAddress()**

Returns the InetAddress object of this IP address.
Returned object is created from "ipaddress" service property value.

Returns:
InetAddress

getSubnetMaskLength

`int getSubnetMaskLength()`

Returns the "subnetmask.length" service property value.

Returns:
Subnet Mask Length(IPv4) or Prefix Length(IPv6)

getNetworkAdapterPid

`String getNetworkAdapterPid()`

Returns the "networkadapter.pid" service property value.

Returns:
Service ID of the interface information service to which it belongs

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8 Considered Alternatives

8.1 Whiteboard pattern model

<NwInfo Bundle>

Provides (exports) Listener service interface, and gets the Listener services provided from user bundle. When information of a network interface is changed, this bundle prepares list of network interface information and calls back the Listener services. This bundle will provide a filter mechanism. User bundle can get only the information necessary to use the functionality.

<User bundle>

Registers a Listener service, and waits for notification of network interface information.

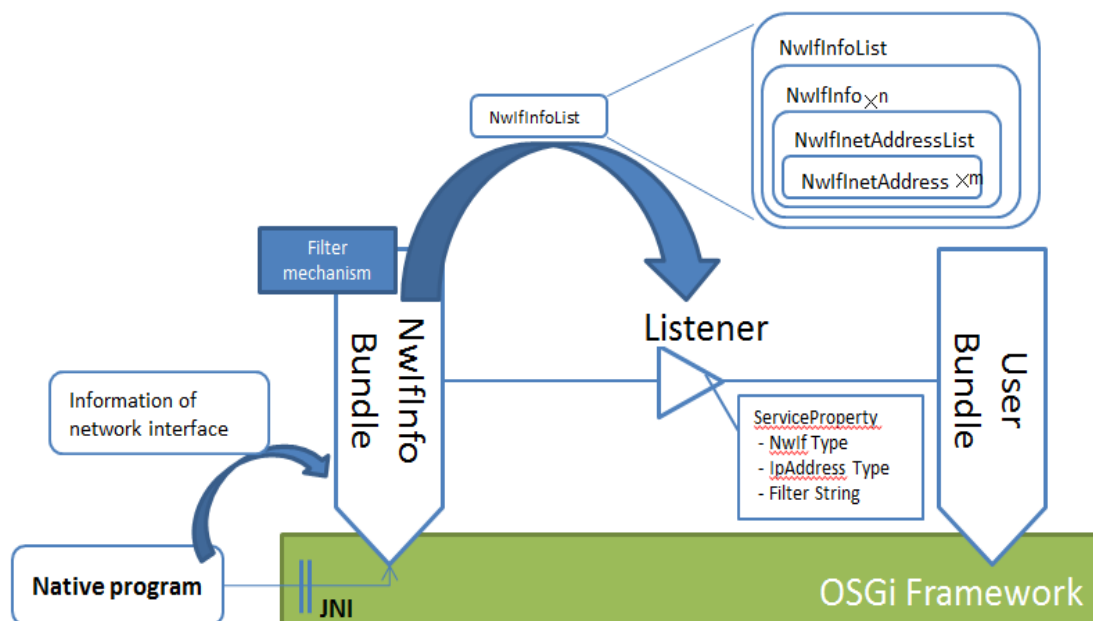


Fig. 3 Overview of Network Interface Information Service
(Whiteboard pattern model)

9 Security Considerations

The user bundles that want to know information of one or more Network Interfaces should be assigned `ServicePermission[NetworkAdapter, GET]` and `ServicePermission[NetworkAddress, GET]`.

Filter Based Permissions can also be utilized for assigning `ServicePermission`. If the platform provider wants to control a bundle's access to the service, the following example of `ServicePermission` can be set.

```
ServicePermission["&(objectClass=org.osgi.service.networkadapter.NetworkAdapter)(networkAdapter.type=LAN)", GET]
```

```
ServicePermission["&(objectClass=org.osgi.service.networkadapter.NetworkAddress)(networkAdapter.type=LAN)(ipAddress.version=IPV4)(ipAddress.scope=PRIVATE_USE)", GET]
```

10 Document Support

10.1 References

- [1]. Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, RFC2119, March 1997.
- [2]. Software Requirements & Specifications. Michael Jackson. ISBN 0-201-87712-0

10.2 Author's Address

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10.3 Acronyms and Abbreviations

10.4 End of Document
