

Network Manager
4.2

*Network Manager Discovery
Collectors
Developer Guide
1.7*



Note: Before using this information and the product it supports, read the information in “Notices” on page 105.

This edition applies to 4.2 of IBM Tivoli Network Manager and to all subsequent releases and modifications until otherwise indicated in new editions.

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About this Guide

This guide provides the general information necessary to enable the development of Network Manager Collectors. It is externally supported by additional Java and Perl Collector support library documentation.

IMPORTANT: Starting from ITNM v4.2 FP24, Java collectors use gRPC (Google Remote Procedure Call) instead of XML-RPC for communication with Network Manager. This provides improved performance, type safety, and security. Perl collectors continue to use XML-RPC.

The guide breaks down into the following sections:

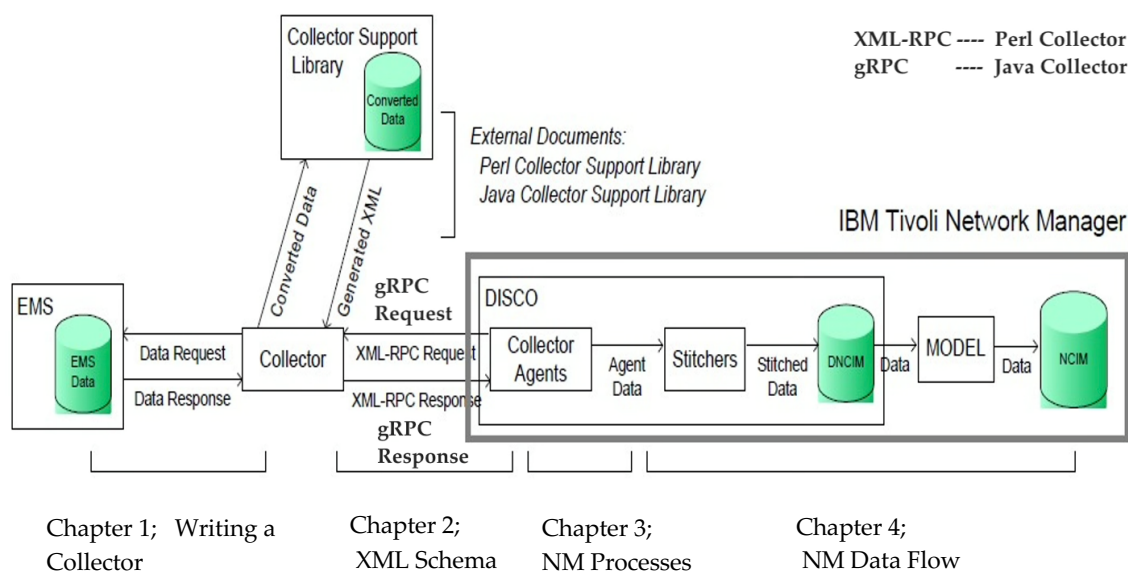
Chapter 1: Collector Overview introduces Collectors and how they fit in with the rest of Network Manager (high level).

Chapter 2: XML Schema & gRPC/XML-RPC Method Reference provides reference information for the collector XML schema (in the rest of this document, XML schema), which governs the format collectors must use when sending data to DISCO in response to a gRPC call (Java Collectors) or XML-RPC call (Perl Collectors). This section also acts as a method reference for the communication protocols such as gRPC/XML-RPC method reference (the methods DISCO calls to retrieve data).

Chapter 3: Network Manager Collector Support provides an insight into what Network Manager does with collector data. This information is useful both when deciding which features to add to a collector and during issue investigation.

Information regarding developing Perl and Java collectors can be found in the separate Perl and Java collector support library documentation. Note: The API documentation is generated from the Perl and Java library source code and as such follows the documentation style of commonly used for APIs written in that programming language.

Below is a data flow oriented chapter index to aid quick reference navigation of this document for those already familiar with the basics. Readers new to collectors are, however, encouraged to read through the document in order.



Chapter 1: Collector Overview

Collectors provide the solution to the problem of how to import data from an external data source into Network Manager at a level equivalent to the standard SNMP based agents. The collector system presents a clearly defined XML interface into Network Manager which allows integrations without requiring changes to the core Network Manager product.

Collectors retrieve data from a data source (e.g. an EMS) and make it available in a standard form (XML adhering to the XML schema specified in this document) via a defined interface (gRPC /XML-RPC) that DISCO can use to import the data at agent level. There are a number of standard collector discovery agents that will import this data and pass it on to the discovery stitchers for processing (e.g. topology creation).

A collector is relatively independent of the rest of Network Manager; it is configured and run independently, perhaps even on a remote box. From a Network Manager point of view it is similar to any other discoverable network device the difference being that a single collector may provide data on many network devices.

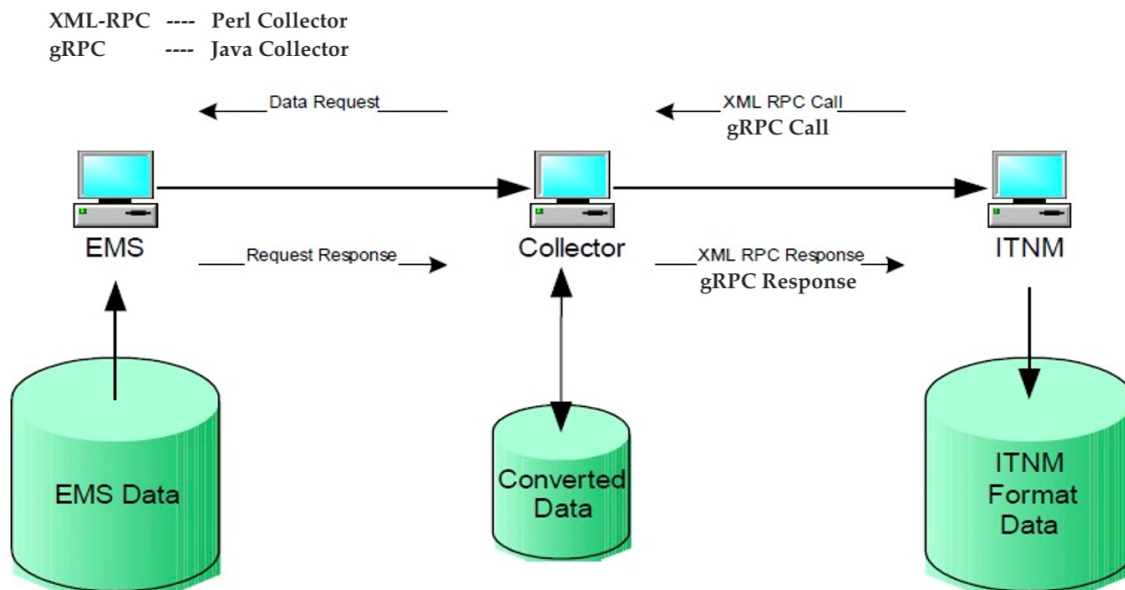
Collectors are responsible for:

- Importing data from a data source
- Implementing an gRPC/XML-RPC server to which DISCO can connect
- Implementing at a minimum those RPC methods marked as essential, as defined in Chapter 2: XML Schema & gRPC/XML-RPC Method Reference
- Ensuring the data returned by these methods is of the correct format, as defined in Chapter 2: XML Schema & gRPC/XML-RPC Method Reference

Network Manager does not impose limits on the choice of development language. However, Perl and Java modules have been developed that will aid development of Perl and Java based collectors.

The following figure shows how the collector interacts with the rest of Network Manager and the target EMS. Note that, although the collector-to-DISCO communications must be via gRPC/XML-RPC, there are no such limitations on the collector-to-EMS communications method.

DISCO knows the collector exists because you configure DISCO with a seed host and port before running a discovery (where the host is the box running the collector, and the port is the port on which the collector is listening for DISCO gRPC/XML-RPC requests).



Collector Data

From the Network Manager perspective collector data (the data in the gRPC/XML-RPC message sent to Network Manager) falls roughly into three categories:

- Network Manager discovery process (DISCO) data
- NCIM data
- Custom data

These categories are simply a reflection of the name and position of the data in the gRPC/XML-RPC response, and this name/position impacts whether the data is used by the DISCO processing stitchers, and how it travels to NCIM (if at all).

DISCO data (i.e. XML Schema defined fields)

These are data fields that may be used by DISCO to deduce the entities and relationships in the network and are the fields that are explicitly defined in the XML schema. DISCO fields can be (and often are) stored directly or indirectly in an associated NCIM field.

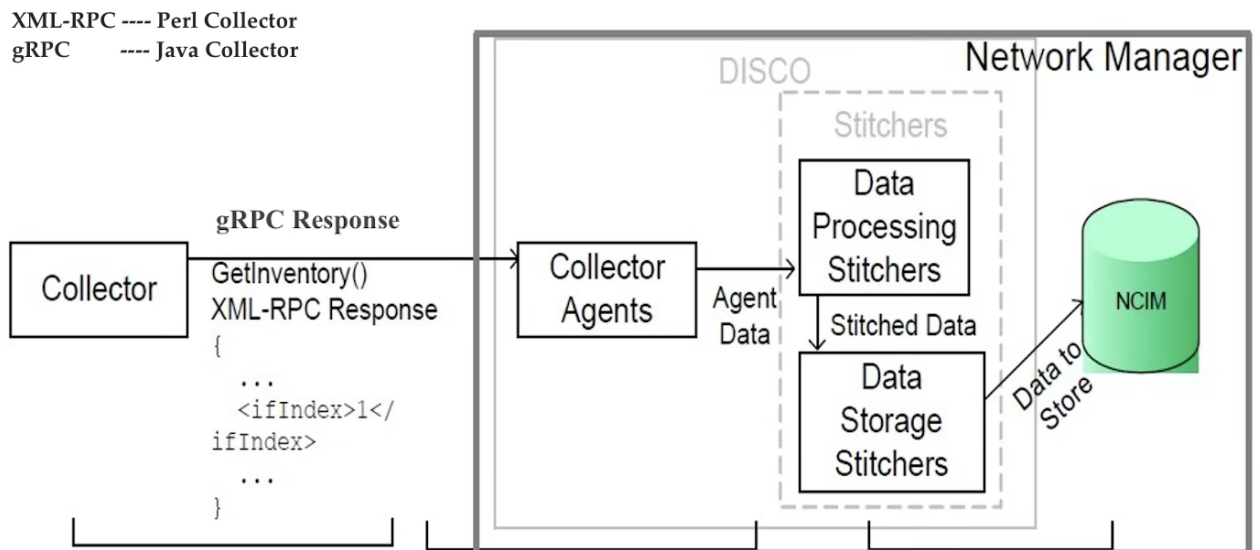
Put DISCO data in an gRPC/XML-RPC response (i.e. populate non-freeform XML Schema tags) to take advantage of DISCO's data processing stitchers or to meet any mandatory data requirements of the gRPC/XML RPC schema (the mandatory fields exist because they are required in mandatory DISCO data processing).

For historical reasons the name used in the XML tag differs from DISCO and NCIM field names; this makes it difficult to follow the data flow during issue investigation. For example, the 'card' tag in the XML Schema becomes 'm_LocalNbrCard' in DISCO and changes again to 'cardNumber' in NCIM. Refer to chapter 3 for details as to how XML Schema tags map to DISCO field names and refer to the DNCIM stitchers (\$PRECISION_HOME/disco/stitchers/DNCIM/) and

\$NCHOME/etc/precision/ModelNcimDb.cfg to see how DISCO fields relate to NCIM fields.

Any desired DISCO fields that are NOT represented in the published XML schema, for example, DISCO's m_LowerNeighbors field, which can be used in defining interface hierarchy, must to be passed as freeform data (see Extending The XML Schema for details on how to do this). This is an advanced usage of the collectors and requires advanced knowledge of how and why DISCO uses data fields, which is out of the scope of this document.

The Figure below shows an example of DISCO data being processed by collectors and Network Manager.



Category: DISCO data The ifIndex XML Tag → DISCO Field
above is considered DISCO data because it is one of the tags explicitly defined in the XML Schema, which implies that the field produced by the Agents from the XML tag will be used in DISCOs data processing stiches
Section 3.1 provides information on the mapping of tags to Agent (DISCO) fields.

DISCO Field → NCIM Field
The stiches in \$PRECISION_HOME/disco/stiches / define the mapping between DISCO field name and NCIM field name.
In this case m_IfIndex maps to networkInterface->ifIndex

NCIM data (i.e. freeform data that mirrors the NCIM schema)

Although DISCO data fields can end up in NCIM there is a clearer way to specify fields intended for NCIM only and this is where the NCIM data category comes in.

Fields considered 'NCIM data' are data fields that are not normally examined by the DISCO processing stiches (i.e. not used by the existing stitching to deduce relationships): These fields are simply copied from the collector XML response to NCIM (while taking advantage of non-field specific features of the DISCO system).

NCIM style data fields can either be piggy-backed on to responses from standard gRPC/XML-RPC calls via the freeform (extrainfo) sections of the collector responses, or they can be sent as the responses from custom gRPC based calls(gRPC calls added by users that are not supported by

Network Manager out of the box and are intended to be called by custom Java agents) and XML-RPC based calls (i.e. XML-RPC added by users that are not supported by Network Manager out of the box and are intended to be called by custom Perl agents)

Either way the data for a table would be of a the following form;

```
<NCIMTableName>
  <NCIMFieldName>Value</NCIMFieldName>    ...
</NCIMTableName>
```

It is your responsibility to ensure that the table names and field names match a real NCIM table. For information on the the NCIM schema, see the IBM Tivoli Network Manager Topology Database Reference.

NCIM data fields are stored in NCIM after any required translations (for example, of enumeration types from integer to text string) by DISCO's Data Storage stitchers (also known as DNCIM stitchers).

You must ensure that NCIM data is returned in response to an appropriate gRPC/XML-RPC call (see Limitations below).

Limitations:

- Not all NCIM tables are currently supported.

NCIM Table	GRPC / XML RPC Call (in which NCIM data should be sent by collector)
physicalChassis	GetDeviceInfo() or GetEntities() for Chassis entities
snmpSystem	GetDeviceInfo() or GetEntities() for Chassis entities
computerSystem	GetDeviceInfo() or GetEntities() for Chassis entities
operatingSystem	GetDeviceInfo() or GetEntities() for Chassis entities
networkInterface	GetInventory() or GetEntities() for port entities.
physicalConnector	GetInventory() or GetEntities() for port entities.
transmissionTp	GetInventory() or GetEntities() for port entities.
physicalSlot	GetEntities() for slot entities
physicalBackplane	GetEntities() for backplane entities
physicalPowerSupply	GetEntities() for PSU entities
physicalFan	GetEntities() for fan entities
physicalSensor	GetEntities() for sensor entities
physicalOther	GetEntities() for other/unknown entities
physicalCard	GetEntities() for card (module) entities

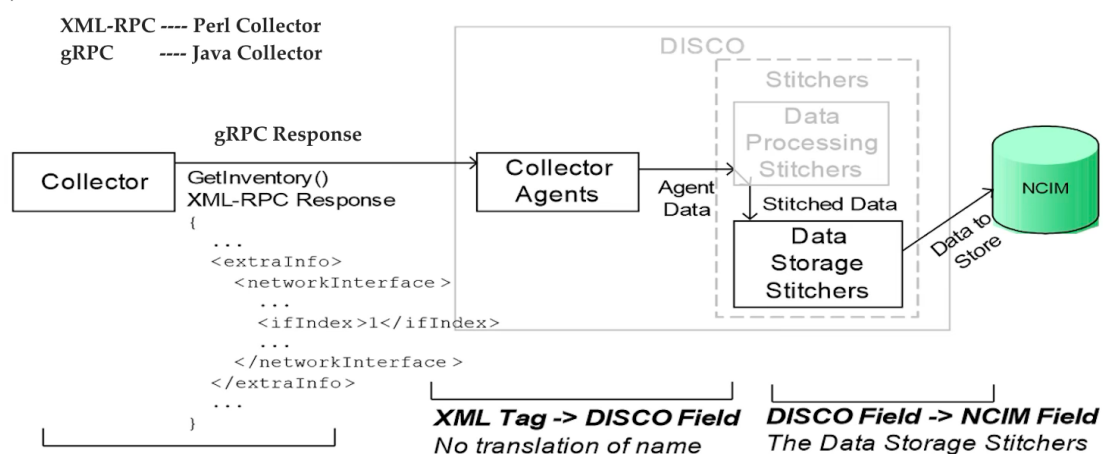
The NCIM tables that can currently be populated via piggy-backing freeform data to existing gRPC/XML-RPC calls are as follows;

- Only a single entry per NCIM table

You can only specify a single instance of a table in the XML response. This is not usually an issue for the currently supported NCIM tables as a separate freeform data section can be returned within each entity due to the way in which stitchers work.

- If, for some reason, a collector responds with a DISCO data field and NCIM data field both destined for the same NCIM table field then the NCIM style field will be used in NCIM population and the DISCO field used during discovery stitching.

Example of NCIM type data retrieved using freeform 'piggybacking'



Category: NCIM data
The *ifIndex* above is considered NCIM data because it is in the freeform section, and has tags matching an NCIM table & field.

XML Tag -> DISCO Field
No translation of name and no data processing stitching is performed. The data will appear in DISCO as

```

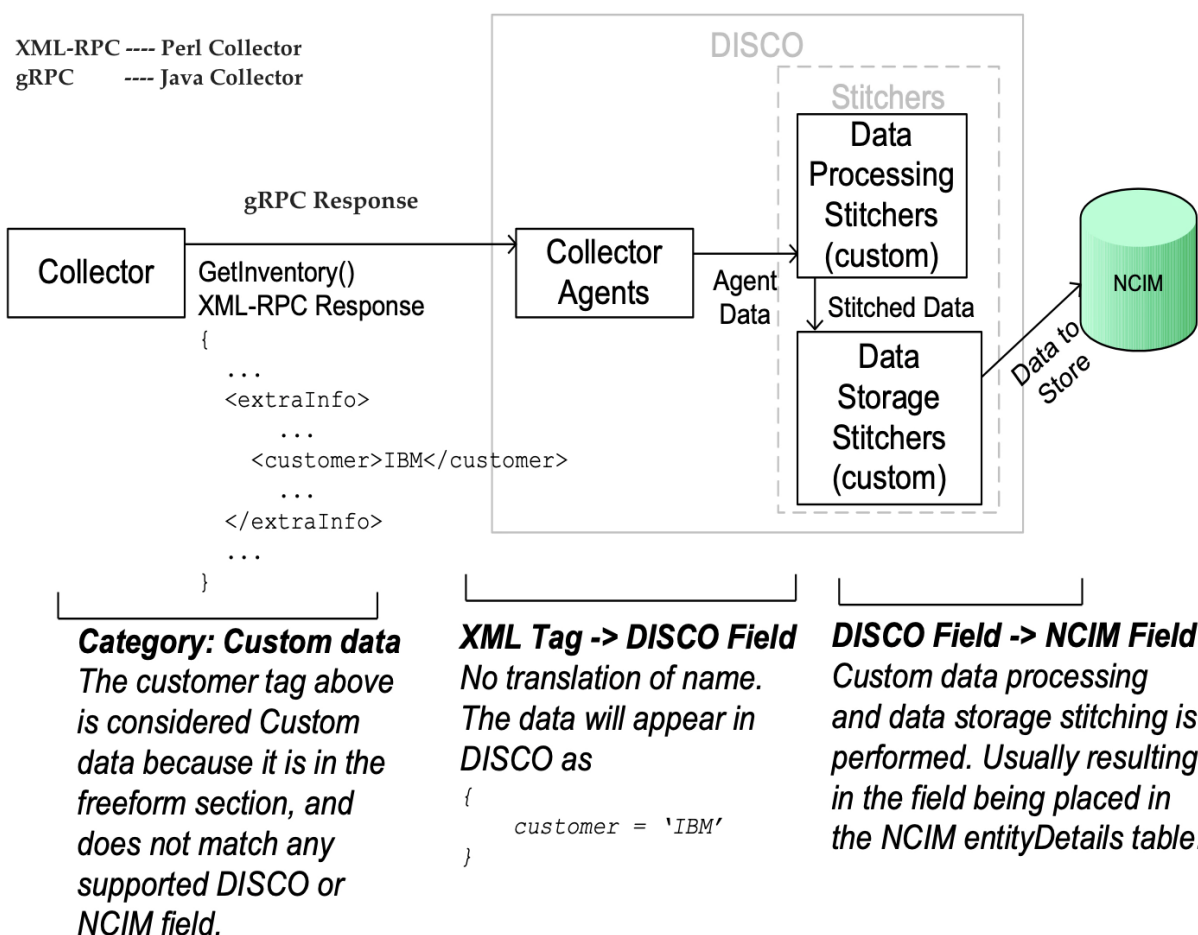
networkInterface = {
  ...
  ifIndex = 1
  ...
}
  
```

DISCO Field -> NCIM Field
The Data Storage Stitches will copy the NCIM data into NCIM. In this case *networkInterface->ifIndex* is populated.

Custom data (data lacking DISCO or NCIM support)

Custom data is that which is not natively supported in the XML Schema, DISCO or NCIM. Such data may take the form of extra attributes that you want to store in an extended NCIM database (see NCIM extension via entityDetails in the **Network Manager** documentation entityDetails) or attributes to be used with custom data processing stitchers (supplied by the collector developer) to resolve any relationship or entity discovery not possible with the standard data.

As with the NCIM data fields, you would typically place custom data in the freeform (extrainfo) sections or in custom gRPC/XML-RPC call responses. You must also provide custom stitching to process the data.



Writing a Collector

This section explains how to develop a collector. Consult one of the following language-specific collector library reference documents for more information and working examples:

Java Collector support libraries

Perl Collector support libraries

It is assumed that you already have an gRPC/XML-RPC server library, that you know what data you need from the EMS in order to satisfy the XML schema (chapter 2), and you know how this data can be retrieved.

It is *not* possible to provide much guidance on EMS-to-Collector data extraction and interpretation or conversion as this is entirely dependent on the EMS in question. You must understand the data present on the EMS and how it can be related to the data required by **Network Manager** (i.e. how it can be converted into the published XML schema).

There are numerous places on the Internet that can help you create an gRPC/XML-RPC server from scratch or find a third party library to do the work. **Network Manager** ships with a Perl XML-RPC server and Java gRPC server.

Again, remember that there are Java and Perl Collector support libraries to aid Collector development. These libraries are supported by the separate API useroriented documentation sets listed at the beginning of this section.

Sample XML-RPC collector code

The code presented in this section addresses the following collector responsibilities:

- Implementing, at a minimum, those RPC methods marked as essential, as defined in section 2.1
- Ensuring the data returned by these methods is of the correct format, as defined in section 2.1

The mandatory XML-RPC methods are `UpdateData()`, `GetInfo()`, `GetDeviceList()`, and `GetDeviceInfo()`. Combined, these methods provide the minimum amount of data that **Network Manager** requires to represent a device.

Getting the XML data format correct for these methods is a matter of following the XML requirements specified in section 2.

The pseudo code for a collector that supports all the mandatory XML-RPC calls and returns valid data is as follows (*Italics* indicate functionality that is assumed to have

```
// Define our Collector Name, Description
// and supported data sources.
// This Collector only supports a single data source
//
collectorName = "ExampleCollector"
collectorDescr = "An example collector
                  just supporting device list and device info"
dataSource = 1
dataSourceDescr = "the EMS"

// Setup the XML-RPC Server to support the chosen RPC methods
// and set it into listening mode
//
xmlRpcServerPort = 8080
server = CreateXmlRpcServer(XxmRpcServerPort)
server->RegisterRpcMethod( GetInfo(), &GetInfo() );
```

```

server->RegisterRpcMethod( UpdateData(), &UpdateData() );
server->RegisterRpcMethod( GetDeviceList(), &GetDeviceList() );
server->RegisterRpcMethod( GetDeviceInfo(), &GetDeviceInfo() );

server->Listen()    // Never returns

```

The remaining work goes into implementing the RPC methods, as shown below.

```

//
// Implementation of Network Manager supported XML-RPC Methods
//

// UpdateData() Implementation
//
Sub UpdateData( address, subnet )

    // Refresh the data
    RefreshEMSDData( address, subnet );

    Xml = "<updateResponse></updateResponse>"
    return xml
End Sub

// GetInfo() Implementation
//
Sub GetInfo()
    Xml = "<collectorInfo>
        <name>" + collectorName + "</name>
        <descr>" + collectorDescr + "</descr>
        <datasources>
            <datasource>
                <id>" + dataSourceId + "</id>
                <descr>" + dataSourceDescr + "</descr>
            </datasource>
        </datasources>
    </collectorInfo>"
    return xml
End Sub

// GetDeviceList()
//
Sub GetDeviceList( dataSourceId )

    listOfDevices = GetListOfDevicesManagedByEMS( dataSourceId )

    Xml = "<deviceList>"

    For each entry in listOfDevices
        Xml = xml +
            "<device>
                <id>" + entry->id + "</id>
                <ip>" + entry->ip + "</ip>
                <addressSpace>" + entry->space + "</addressSpace>
            </device>"
    Next entry

    Xml = xml + "</deviceList>"

    return xml

```

```

End Sub

// GetDeviceInfo
//
Sub GetDeviceInfo( dataSourceId, deviceId )

    device = GetDeviceInfoFromEMS( dataSourceId, deviceId )

    Xml = "<deviceInfo>
        <sysObjectId>device.sysOid</sysObjectId>
        <descr>device.descr</descr>
        <name>device.name</name>
    </deviceInfo>"

    return xml
End Sub

```

The XML-RPC Schema reference in sections 2.1 and 2.2 provide further detail on the XML-RPC calls. For example, in GetDeviceList() we return an <id> and <ip>; to find out what a device id is you can look up the GetDeviceList() method in section 2.1 and read the description.

Tip: *The ncp_query_collector tool*

ncp_query_investigator is a Perl based tool that allows you to issue XMLRPC calls to the collector in development and print the response. This allows a collector to be quickly interrogated without the need to run an Network Manager discovery, thus speeding up collector development.

The tool works against both Perl and Java based collectors and has online help accessible by typing 'help' at the prompt.

The ncp_query_collector tool can be found in the following directory;

\$NCHOME/precision/scripts/perl/scripts/

and can be run against the port on which the collector in development is running as follows;

ncp_perl ncp_query_collector.pl -port <collectorPort>

gRPC Method Reference(Java Collector)

Starting with ITNM v4.2 FP24, Java collectors use gRPC (Google Remote Procedure Call) instead of XML-RPC for communication with Network Manager. gRPC provides improved performance, type safety, and modern RPC capabilities through Protocol Buffers.

Key Benefits of gRPC:

- **Performance** : Binary protocol is faster than XML text parsing
- **Type Safety** : Strong typing through Protocol Buffers prevents runtime errors
- **Code Generation** : Automatic generation of client and server code from .proto files
- **Modern Standards** : Built on HTTP/2 with better connection management

Note : Perl collectors continue to use XML-RPC. The ITNM system supports both protocols simultaneously.

Sample gRPC collector code (Java)

The code presented in this section addresses the following collector responsibilities:

- Implementing, at a minimum, those RPC methods marked as essential, as defined in section 2.1
- Ensuring the data returned by these methods is of the correct format, as defined in section 2.1

The mandatory gRPC methods are `UpdateData()`, `GetInfo()`, `GetDeviceList()`, and `GetDeviceInfo()`. Combined, these methods provide the minimum amount of data that **Network Manager** requires to represent a device.

Getting the XML data format correct for these methods is a matter of following the XML requirements specified in section 2.

The pseudo code for a Java collector that supports all the mandatory gRPC calls and returns valid data is as follows (*Italics indicate functionality that is assumed to have been implemented elsewhere*):

```
// Define our Collector Name, Description
// and supported data sources.
// This Collector only supports a single data source
//
collectorName = "ExampleGrpcCollector"
collectorDescr = "An example gRPC collector
                  just supporting device list and device info"
dataSourceId = 1
dataSourceDescr = "the EMS"

// Setup the gRPC Server to support the chosen RPC methods
// and set it into listening mode
//
grpcServerPort = 8082
collector = new MyCollector()
grpcCollector = new GrpcCollector(collector)
server = new CollectorGrpcEmbeddedServer(grpcCollector, grpcServerPort)

server.start()
server.blockUntilShutdown()    // Never returns
...

```

The remaining work goes into implementing the RPC methods, as shown below.

Implementation of Network Manager Supported gRPC Methods

UpdateData() Implementation

```
```java
// UpdateData() Implementation

```

```
//
public String UpdateData(int dataSourceId, int requestType,
 String address, String subnetMask) {

 // Refresh the data
 RefreshEMSData(dataSourceId, requestType, address, subnetMask);

 xml = "<updateResponse></updateResponse>"
 return xml
}
...
```

---

### ### GetInfo() Implementation

```
```java
// GetInfo() Implementation
//
public String GetInfo() {
    xml = "<collectorInfo>" +
        " <name>" + collectorName + "</name>" +
        " <descr>" + collectorDescr + "</descr>" +
        " <datasources>" +
        "   <datasource>" +
        "     <id>" + dataSourceId + "</id>" +
        "     <descr>" + dataSourceDescr + "</descr>" +
        "   </datasource>" +
        " </datasources>" +
        "</collectorInfo>"

    return xml
}
...
```

GetDeviceList() Implementation

```
// GetDeviceList()
//
public String GetDeviceList(int dataSourceId, int requestType,
                            String address, String subnetMask) {

    listOfDevices = GetListOfDevicesManagedByEMS(dataSourceId,
                                                    requestType,
                                                    address,
                                                    subnetMask)

    xml = "<deviceList>"

    for (Device entry : listOfDevices) {
```

```

        xml = xml +
            "<device>" +
            "  <id>" + entry.id + "</id>" +
            "  <ip>" + entry.ip + "</ip>" +
            "  <addressSpace>" + entry.space + "</addressSpace>" +
            "</device>"
    }

    xml = xml + "</deviceList>"

    return xml
}

```

GetDeviceInfo() Implementation

```

```java
// GetDeviceInfo
//
public String GetDeviceInfo(int dataSourceId, String deviceId) {

 device = GetDeviceInfoFromEMS(dataSourceId, deviceId)

 xml = "<deviceInfo>" +
 " <sysObjectId>" + device.sysOid + "</sysObjectId>" +
 " <descr>" + device.descr + "</descr>" +
 " <name>" + device.name + "</name>" +
 "</deviceInfo>"

 return xml
}

```

The gRPC Schema reference in sections 2.1 and 2.2 provide further detail on the gRPC calls. For example, in `GetDeviceList()` we return an `<id>` and `<ip>`; to find out what a device id is you can look up the `GetDeviceList()` method in section 2.1 and read the description.

### Important Notes:

1. Your Collector class methods still use PascalCase (`GetInfo`, `GetAmfData`).
2. The `GrpcCollector` wrapper handles the mapping to gRPC's camelCase.
3. The XML data format remains the same for both protocols.
4. Perl collectors continue to use XML-RPC.



**Tip: The GrpcQueryCollector tool**

*GrpcQueryCollector is a Java based tool that allows you to issue gRPC calls to the collector in development and print the response. This allows a collector to be quickly interrogated without the need to run a Network Manager discovery, thus speeding up collector development.*

*The tool works against Java gRPC collectors and has online help accessible by typing 'help' at the prompt.*

*The GrpcQueryCollector tool can be found in the following directory:*

***\$NCHOME/precision/jars/collectors/***

*and can be run against the port on which the collector in development is running as follows:*

***java -jar GrpcQueryCollector.jar -port <collectorPort>***

*From FP24 onwards, can use the following command as well*

***java -jar GrpcQueryCollector.jar -propsFile < GrpcQueryCollector.properties >***

**Example:**

***java -jar GrpcQueryCollector.jar -port 8082***

*Once started, the tool provides an interactive prompt where you can issue commands:*

```
> help
> GetInfo
> GetDeviceList
> GetDeviceInfo
> GetAmfData
```

**Example :**

```
package com.example.collector;

import com.ibm.tivoli.nm.collectors.framework.collector.Collector;
import com.ibm.tivoli.nm.collectors.framework.collector.GrpcCollector;
import com.ibm.tivoli.nm.collectors.framework.server.CollectorGrpcEmbeddedServer;
public class ExampleGrpcCollector extends Collector {

 private static final int GRPC_PORT = 8082;

 public static void main(String[] args) {
 try {
 ExampleGrpcCollector collector = new ExampleGrpcCollector();
 GrpcCollector grpcCollector = new GrpcCollector(collector);
 CollectorGrpcEmbeddedServer server =
```

```

 new CollectorGrpcEmbeddedServer(grpcCollector, GRPC_PORT);

 server.start();
 server.blockUntilShutdown();
 } catch (Exception e) {
 e.printStackTrace();
 System.exit(1);
 }
}

@Override
public String GetInfo() {
 return "<collectorInfo>" +
 " <name>ExampleGrpcCollector</name>" +
 " <descr>Example gRPC collector</descr>" +
 " <datasources>" +
 " <datasource><id>1</id><descr>EMS</descr></datasource>" +
 " </datasources>" +
 "</collectorInfo>";
}

@Override
public String UpdateData(int dataSourceId, int requestType,
 String address, String subnetMask) {
 // Refresh data from EMS
 return "<updateResponse></updateResponse>";
}

@Override
public String GetDeviceList(int dataSourceId, int requestType,
 String address, String subnetMask) {
 return "<deviceList>" +
 " <device>" +
 " <id>AMF-001</id>" +
 " <ip>10.0.1.10</ip>" +
 " <addressSpace>default</addressSpace>" +
 " </device>" +
 "</deviceList>";
}

@Override
public String GetDeviceInfo(int dataSourceId, String deviceId) {
 return "<deviceInfo>" +
 " <sysObjectId>1.3.6.1.4.1.9.1.1</sysObjectId>" +
 " <descr>5G Core Network Function</descr>" +
 " <name>" + deviceId + "</name>" +
 " <extraInfo><n5gFunction>AMF</n5gFunction></extraInfo>" +
 "</deviceInfo>";
}
}

```

---

```

@Override
public String GetAmfData(int dataSourceId, String deviceId) {
 N5gDataStore dataStore = (N5gDataStore) getDataStore();
 return dataStore.getAMFData(dataSourceId, deviceId);
}

// Implement other 5G methods similarly...
}

```

## Migration Advice & Change Summary

The Collector framework is backwards compatible: If your Collector works with, say, 3.9 GA then it should work with, say, 4.1.1 FP1 too. As such migration should largely be a matter of copying over your Collector directory to the target system.

You may want to consider updating your custom Collector to take advantage of new features available in the later releases in which case please review the following change summary sections.

Starting with ITNM v4.2, the Collector framework has transitioned from XML-RPC to gRPC as the communication protocol. This guide helps you migrate existing Java Collectors from older Fix Packs (using XML-RPC) to the new version (using gRPC).

### Key Changes

#### 1. Protocol Change: XML-RPC → gRPC

Old (XML-RPC): Used Apache XML-RPC library for remote procedure calls

New (gRPC): Uses Google's gRPC framework with Protocol Buffers

#### 2. Backwards Compatibility

The Collector framework maintains backwards compatibility:

Collectors from ITNM 3.9 GA work with ITNM 4.2

Collectors from ITNM 4.1.1 FP1 work with ITNM 4.2

Migration is primarily a matter of copying your Collector directory to the target system

However, to take advantage of new features (5G Core, enhanced LTE, improved performance), you should migrate to gRPC.

## DISCO Agent Change Summary

The agents are the main source of DISCO gRPC/XML-RPC calls to Collectors. Any new gRPC/XML-RPC calls made by agents will not require mandatory Collector support and so existing Collectors should not be impacted beyond the cost of a call to an unsupported method. Any modified calls will be backwards compatible and so need no change in the Collector.

The main changes (e.g. additional calls) to the Collector Agent since 3.9 GA are listed below to aid users wishing to take advantage of the additional functionality. See the gRPC/XML-RPC for details of any calls that may have changed

Agent	Version Introduced	Summary
CollectorLayer1	4.1 GA	New agent: see chapter 3
CollectorRAN	4.1 GA	New agent: see chapter 3
CollectorLTE	4.1.1 GA	New agent: see chapter 3
Collector5G	4.2 GA	New agent: see chapter 3

## gRPC/XML-RPC XML Interface Change Summary

The following changes have been made to the XML-RPC based XML interface (see chapter 2) since the 3.9 GA release.

Note that all changes were backwards compatible, i.e. a Collector that worked in 3.9 GA can be copied over to a more recent release and still function as it did.

The Collector framework maintains backwards compatibility:

Collectors from ITNM 3.9 GA work with ITNM 4.2

Collectors from ITNM 4.1.1 FP1 work with ITNM 4.2

Migration is primarily a matter of copying your Collector directory to the target system

However, to take advantage of new features (5G Core, enhanced LTE, improved performance), you should migrate to gRPC.

The Version Introduced column in the table below shows when the change was introduced: If this is a GA version then the change will also be in later GA releases, and subsequent fix pack releases. For example, a value of '4.2 GA' means the change will be in 4.2 GA, 4.1 FP1 and later fix packs, 4.1.1 GA and later fix packs etc.. If the version is a fix pack (FP) version then the change will be in subsequent fix packs for that major release but NOT other major releases unless otherwise stated.

Method	Version Introduced	Summary
GetInfo	4.1 GA	<b>New fields:</b> emsHost, emsName, emsVersion, emsIdentifier, emsRole, emsStatus, extraInfo
GetDeviceInfo	4.1 GA	<b>New field:</b> protocol
GetDeviceList	4.1 GA	<b>New fields:</b> meId, protocol
GetEntities	3.9 IF1/FP4	<b>New fields:</b> ifIndex, interfaceId, cdmType, parent, hwRev, swRev, fwRev

	4.1 GA	as above + serialNumber
GetLayer2VPNs	4.1 GA	<b>New field:</b> peerInterfaceId
GetLayer2Connections	4.1 GA	<b>New fields:</b> unidirectional, topology
GetLayer1Connections	4.1 GA	<b>New call</b>
GetConnections	4.1 GA	<b>New call</b>
GetRanData	4.1 GA	<b>New call</b>
GetENodeBData	4.1 GA	<b>New call</b>
GetMmeData	4.1 GA	<b>New call</b>
GetSgwData	4.1 GA	<b>New call</b>
GetPgwData	4.1 GA	<b>New call</b>
GetHssData	4.1 GA	<b>New call</b>
GetPcrfData	4.1 GA	<b>New call</b>
GetEirData	4.1 GA	<b>New call</b>
GetAmfData	4.2 GA	<b>New call</b>
GetSmfData	4.2 GA	<b>New call</b>
GetUpfData	4.2 GA	<b>New call</b>
GetPcfData	4.2 GA	<b>New call</b>
GetUdmData	4.2 GA	<b>New call</b>
GetAusfData	4.2 GA	<b>New call</b>
GetNrfData	4.2 GA	<b>New call</b>
GetNssfData	4.2 GA	<b>New call</b>
GetNefData	4.2 GA	<b>New call</b>
GetAfData	4.2 GA	<b>New call</b>
GetGnodebData	4.2 GA	<b>New call</b>
GetSaeGatewayData	4.2 GA	<b>New call</b>

---

## Chapter 2: XML Schema & GRPC/ XML-RPC Method Reference

This section details the XML Schema that collectors must adhere to when sending data to Network Manager in response to an gRPC/XML-RPC call. It describes each of the supported mandatory and optional RPC methods that Network Manager's collector finder and collector agents may issue to the collector.

---

### Mandatory RPC Method Reference

A Collector **MUST** support the following methods at a minimum if it is to work correctly with Network Manager.

- UpdateData()
- GetInfo()
- GetDeviceList()
- GetDeviceInfo()
- GetAssociatedAddresses()

#### UpdateData()

The collector implementation of UpdateData() is responsible for ensuring that data is updated as appropriate, i.e. the collector should check the EMS for new data and update any internal stores as appropriate.

If the collector does not need to update its data then it does not need to perform any work other than returning the response message "<updateResponse></updateResponse>".

Note: It is the collector's responsibility to determine which devices the supplied address relates to; the address is NOT guaranteed to be device id of the EMS.

<b>Method Name:</b>	UpdateData
<b>Signature:</b>	(iiss)
<b>Parameters:</b>	(i) Data source id – holds the id of the data source which should be updated. (i) Request Type - determines how the remaining parameters are interpreted. Valid values are; 0 - Update all data (used during an Network Manager Full Discovery) 1 - Update data for single device (specified by Address) 2 - Update data for all devices falling within subnet Address/Mask (s) Address – if mask is not defined then it holds the address of the device to refresh, or else it holds the subnet to refresh. (s) Mask – holds the subnet mask or is not defined. Only applicable to IPv4 addresses. Example: '255.255.255.0'.

<b>Status:</b>	Mandatory
<b>Usage:</b>	Called by Network Manager's collector Finder prior to requesting data.
<b>Data Definition:</b>  <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="updateResponse"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;/xs:sequence&gt;     &lt;/xs:complexType&gt;   &lt;/xs:element&gt; &lt;/xs:schema&gt;</pre>	
<b>Example:</b>  <pre>&lt;updateResponse&gt; &lt;/updateResponse&gt;</pre>	

## GetInfo()

The collector implementation of GetInfo() is responsible for responding with information on the collector and its supported data sources.

This method is called by the Network Manager's collector finder to determine which collectors are valid and which data sources they support. Network Manager subsequently issues RPC calls for data from the listed data sources.

The collector is responsible for ensuring that each data source has a unique identifier.

*Tip: A note on data sources.*

*The collector framework allows a collector to support multiple data sources, essentially making the collector act as multiple collectors each identified by an identifier unique within that collector. However, a collector is only configured to support a single data source (usually with data source id '1'). This is because in most cases where multiple data sources need to be supported it is more natural to simply run multiple collectors against them.*

<b>Method Name:</b>	GetInfo
<b>Signature:</b>	()
<b>Parameters:</b>	N/A
<b>Status:</b>	Mandatory
<b>Usage:</b>	Called by the Network Manager collector finder, once per collector.
<b>Data Definition:</b>  <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="collectorInfo"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;!--         - name:          Name of the Collector       --&gt;     &lt;/xs:sequence&gt;   &lt;/xs:complexType&gt; &lt;/xs:element&gt; &lt;/xs:schema&gt;</pre>	

```

- descr: Description of the Collector
- datasources: List of data sources known to the Collector.
- Typically there will be only one.
-->
<xs:element name="name" type="xs:string" minOccurs="1"/>
<xs:element name="descr" type="xs:string" minOccurs="0"/>
<xs:element name="datasources">
 <xs:complexType>
 <xs:sequence>

 <xs:element name="datasource" minOccurs="1" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>

 <!--
 - id: Collectors identifier representing the data source.
 - Unique within the Collector.
 - Usually just one per Collectors with id '1'.
 - descr: Description of the data source represented by <id>
 -
 - emsHost: Host of source EMS (IPv4 or DNS name)
 - emsName: Name of source EMS
 - emsVersion: Version of source EMS
 - emsIdentifier: Custom identifier to represent the EMS
 - emsRole: Ems role. Valid values are;
 - unknown, primary, backup, other
 - emsStatus: Ems status. Valid values are;
 - unknown, up, down, other
 -->
 <xs:element name="id" type="xs:string" minOccurs="1"/>
 <xs:element name="descr" type="xs:string" minOccurs="0"/>
 <xs:element name="emsHost" type="xs:string" minOccurs="0"/>
 <xs:element name="emsName" type="xs:string" minOccurs="0"/>
 <xs:element name="emsVersion" type="xs:string" minOccurs="0"/>
 <xs:element name="emsIdentifier" type="xs:string" minOccurs="0"/>
 <xs:element name="emsRole" type="xs:string" minOccurs="0"/>
 <xs:element name="emsStatus" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

 </xs:sequence>
 </xs:complexType>
</xs:element>

</xs:sequence>
</xs:complexType>
</xs:element>

</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

**Example:**

```
<collectorInfo>
 <name>CollectorsName</name>
 <descr>Collectors Description</descr>
 <datasources>
 <datasource>
 <id>1</id>
 <descr>Example data source</descr>
 <emsHost>mybox.ibm.com</emsHost>
 <emsName>AnEMS</emsName>
 <emsVersion>1.0</emsVersion>
 <emsIdentifier>myEmsId</emsIdentifier>
 <emsRole>primary</emsRole>
 <emsStatus>up</emsStatus>
 </datasource> .. other data
 sources ..
</datasources>
</collectorInfo>
```



## GetDeviceList()

The Collector implementation of GetDeviceList() is responsible for determining and returning the addresses and identifiers of all devices that are managed by the Collector within the specified data source.

The device identifier <id> should uniquely identify the device within the collector/data source.

Note that non-IP devices can be supported by putting the non-IP address in the ip field and setting the protocol field to an appropriate value (i.e. 4 to indicate an address supplied by an EMS).

Network Manager supplies the device identifiers returned by GetDeviceList() in further calls to the Collector.

### *Tip: Device Identifiers*

*The Device Id field is intended to store the data source's native identifier for the device - i.e. the tag by which the EMS refers to the device in its data. It is possible that where multiple EMSs manage the same device this native identifier differs between collectors.*

<b>Method Name:</b>	GetDeviceList
<b>Signature:</b>	(i)
<b>Parameters:</b>	(i) integer - Data source id
<b>Status:</b>	Mandatory
<b>Usage:</b>	Called by the Network Manager' collector finder, once per data source per Collector
<b>Data Definition:</b>	
<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="deviceList"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;xs:element name="device" minOccurs="0" maxOccurs="unbounded"&gt;         &lt;xs:complexType&gt;           &lt;xs:all&gt;              &lt;!-- -      id:      Identifier that uniquely identifies the device -      within the Collector. This is considered the 'native id', -      i.e. the identifier used to represent the device in the          -      Collector -      (and ideally in the originating EMS). -      meId:    Optional custom identifier similar to 'id' but doesn't          -      need to be the native id used by the Collector/EMS. -      This field can be of use when integrating managed devices -      (managed elemetns) with external systems          -      ip:      Address of the device. -      Note: This doesn't have to be an IP address. -      protocol: The protocol to which the address in 'ip' belongs. -      Valid values are; -      0 - Unknown -      1 - IPv4 -      2 - NAT -      3 - IPv6 -      4 - EMS Supplied Address (i.e. the value in          -      &lt;ip&gt; is a general string based identifier. -      addressSpace: Address space to which the address belongs --&gt;       &lt;xs:element name="id" type="xs:string" minOccurs="1"/&gt; </pre>	

```

 <xs:element name="meId" type="xs:string" minOccurs="0"/> <xs:element name="ip"
type="xs:string" minOccurs="1"/>
 <xs:element name="protocol" type="xs:integer" minOccurs="0"/>
 <xs:element name="addressSpace" type="xs:string" minOccurs="0"/>

 </xs:all>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

### Example:

```

<deviceList>
 <device>
 <id>10.1.230.3</id>
 <meId>customIdForManagedDeviceA</meId>
 <ip>10.1.230.3</ip>
 <addressSpace></addressSpace>
 </device> .. other devices
 ..
</deviceList>

```

## GetDeviceInfo()

The collector implementation of GetDeviceInfo() is responsible for gathering and returning basic device level information for a specified device and data source.

<b>Name:</b>	GetDeviceInfo
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Identifier
<b>Status:</b>	Mandatory
<b>Usage:</b>	Called by the Network Manager CollectorDetails agent.
<b>Data Definition:</b>	<pre> &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="deviceInfo"&gt;     &lt;xs:complexType&gt;       &lt;xs:all&gt;          &lt;!-- -       name:          Name uniquely identifying the device -       sysObjectId:   Device type identifier used by Network Manager to determine how to handle the device. -       See RFC1213-MIB sysObjectId. -       ipForwarding:  The IP forwarding capability of the device. -       See RFC1213-MIB ipForwarding. -       sysName:       Administratively assigned name. -       See RFC1213-MIB sysName. -       descr:         Description of the device. -       See RFC1213-MIB sysDescr. -       extraInfo:     (optional) Any freeform data including geographic location --&gt;         &lt;xs:element name="name" type="xs:string" minOccurs="1"/&gt;         &lt;xs:element name="sysObjectId" type="xs:string" minOccurs="1"/&gt;         &lt;xs:element name="ipForwarding" type="xs:integer" minOccurs="1"/&gt; </pre>

```

<xs:element name="sysName" type="xs:string" minOccurs="0"/>
<xs:element name="descr" type="xs:string" minOccurs="0"/>

<xs:element name="extraInfo" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded">
 </xs:sequence>
 </xs:complexType>
</xs:element>

</xs:all>
</xs:complexType>
</xs:element>
</xs:schema>

```

### Example:

```

<deviceInfo>
 <sysObjectId>1.3.6.1.4.1.0.1.94</sysObjectId>
 <descr>Vendor Device Description (sysDescr)</descr>
 <name>10.1.254.1</name>
</deviceInfo>

```

## GetAssociatedAddresses()

The collector implementation of GetAssociatedAddresses() is responsible for gathering and returning all IP addresses configured on a given device id and data source.

This method is used by the CollectorInventory agents to produce a list of associated IP addresses to allow Network Manager to perform address translation.

<b>Name:</b>	GetAssociatedAddresses
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by the Network Manager CollectorInventory agent.
<b>Data Definition:</b> <pre> &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="associatedAddressList"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;xs:element name="addressEntry" minOccurs="0" maxOccurs="unbounded"&gt;         &lt;xs:complexType&gt;           &lt;xs:all&gt;              &lt;!-- -       ifIndex:      Index uniquely identifying the interface within a device. Usually an RFC1213-MIB ifIndex. -       MUST be specified if interfaceId is not specified. -       interfaceId: A string based unique interface identifier. -       MUST be specified if ifIndex is not specified. -       ifOperStatus: Operational status of the interface. -       See RFC1213-MIB ifOperStatus for acceptable values. -       ipAddress:   IP (V4) address associated with the interface - --&gt;           &lt;xs:element name="ifIndex" type="xs:integer" minOccurs="0"/&gt; </pre>	

```

 <xs:element name="interfaceId" type="xs:string" minOccurs="0"/>
 <xs:element name="ifOperStatus" type="xs:integer" minOccurs="1"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="1"/>

 </xs:all>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

### Example:

```

<associatedAddressList>
 <addressEntry>
 <ifOperStatus>1</ifOperStatus>
 <ifIndex>10</ifIndex>
 <ipAddress>10.1.4.1</ipAddress>
 </addressEntry>
 <addressEntry>
 <ifOperStatus>1</ifOperStatus>
 <interfaceId> MyUniqueInterfaceIdFor19</interfaceId>
 <ipAddress>10.1.4.1</ipAddress>
 </addressEntry> .. other
entries ..
</associatedAddressList>

```

## Optional RPC Method Reference

A Collector may optionally support any of the following methods:

- GetInventory()
- GetEntities()
- GetLayer3Vpns()
- GetMplsInterfaces()
- GetLayer3Connections()
- GetLayer2Connections()
- GetLayer1Connections()
- GetConnections()
- GetRanData()
- GetENodeBData()
- GetMmeData()
- GetSgwData()
- GetPgwData()
- GetHssData()
- GetEirData()
- GetPcrfData()
- GetAmfData()
- GetSmfData()
- GetUpfData()
- GetPcfData()
- GetUdmData()

- GetAusfData()
- GetNrfData()
- GetNssfData()
- GetNefData()
- GetAfData()
- GetGnodebData()
- GetSaeGatewayData()

***Note: GetDeviceInfo() & GetInventory() vs GetEntities(): Why am I defining interfaces/chassis data in two places?***

The XML Schema details two gRPC/XML-RPC methods that both support chassis data; GetDeviceInfo() and GetEntities(). There are also two methods that support interface data; GetInventory() and GetEntities(). This text attempts to explain the reason behind this apparent redundancy.

Historically an Network Manager discovery discovers devices via SNMP using data from the 'system' and 'ifTable' sections of RFC1213-MIB, the former providing chassis data and the latter providing physical and logical interface data. It also discovers physical entity data using the 'entPhysicalTable' of the ENTITY-MIB (including (but not limited to) chassis and ports(interfaces)).

GetDeviceInfo() and GetInventory() reflect the RFC1213-MIB discovery for chassis and interfaces respectively. The data from GetDeviceInfo(), which is a mandatory method, provides Network Manager with the early information it needs to coordinate the discovery. The data from GetInventory() represents both physical and logical interfaces and specialises in interface specific attributes such as those used in connectivity processing.

GetEntities() reflects the ENTITY-MIB discovery; it represents a range of physical entities including chassis and ports (interfaces) and is of most importance in entity containment processing. One useful ability that the collector has is to also return logical interface data along with physical interface data in the GetEntities() response, thus allowing logical interfaces to be included in the containment model.

In order to take advantage of Network Manager containment stitching you should ensure the chassis/interface is represented by GetEntities() and to take full advantage of topology stitching you should ensure that interfaces are represented by GetInventory().

## GetInventory()

The Collector implementation of GetInventory() is responsible for gathering and returning device interface information for a specified device id and data source.

<b>Name:</b>	GetInventory
<b>Signature:</b>	(is)

<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorInventory agent.

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="deviceInventory">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="deviceId" type="xs:string"/>
 <xs:element name="interfaceList">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:all>

 <!--
- ifIndex: See RFC1213 ifIndex. MUST be specified if -
interfaceId is not specified.
- interfaceId: A string based unique interface identifier.
- MUST be specified if ifIndex is not specified.
- card: Card number (with port this should uniquely
- identify the interface)
- port: Port number (with card this should uniquely
identify the interface)
- ifOperStatus: See RFC1213 ifOperStatus
- ifAdminStatus: See RFC1213 ifAdminStatus
- ifPhysAddress: See RFC1213 ifPhysAddress
- ifDescr: See RFC1213 ifDescr
- ifName: See RFC1213 ifName
- ifType: See RFC1213 ifType
- isConnected: See RFC1213 isConnected
- ipAddress: See RFC1213 ipAdEntAddr
- netmask: Number of Host bits in the subnet
- subnet: Subnet address
- subnetMask: Subnet mask
- extraInfo: (optional) Any freeform data
-->
 <xs:element name="ifIndex" type="xs:integer" minOccurs="0"/>
 <xs:element name="interfaceId" type="xs:string" minOccurs="0"/>
 <xs:element name="card" type="xs:integer" minOccurs="0"/>
 <xs:element name="port" type="xs:integer" minOccurs="0"/>
 <xs:element name="ifOperStatus" type="xs:integer" minOccurs="0"/>
 <xs:element name="ifAdminStatus" type="xs:integer" minOccurs="0"/>
 <xs:element name="ifPhysAddress" type="xs:integer" minOccurs="0"/>
 <xs:element name="ifDescr" type="xs:string" minOccurs="0"/>
 <xs:element name="ifName" type="xs:string" minOccurs="0"/>
 <xs:element name="ifType" type="xs:integer" minOccurs="0"/>
 <xs:element name="isConnected" type="xs:integer" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 <xs:element name="netmask" type="xs:integer" minOccurs="0"/>
 <xs:element name="subnet" type="xs:string" minOccurs="0"/>
 <xs:element name="subnetMask" type="xs:string" minOccurs="0"/>

 <xs:element name="extraInfo" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded">
 </xs:sequence>
 </xs:complexType>

```

```

 </xs:element>

 </xs:all>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

### Example:

```

<deviceInventory>
 <deviceId>10.1.254.1</deviceId>
 <interfaceList>
 <interface>
 <ifPhysAddress>00:99:00:E5:C4:06</ifPhysAddress>
 <ifDescr>FastEthernet0/1.10</ifDescr>
 <ifOperStatus>1</ifOperStatus>
 <ifIndex>19</ifIndex>
 <interfaceId>MyUniqueInterfaceIdFor19</interfaceId>
 <ifType>135</ifType>
 <ipAddress></ipAddress>
 <ifName>Fa0/1.10</ifName>
 </interface> .. other
 </interfaceList>
</deviceInventory>

```

## GetEntities()

The Collector implementation of GetEntities() is responsible for gathering and returning entity information for a given device id and data source. The data supports both an ENTITY-MIB data form and a more generic non-ENTITY-MIB form for 27odelling27e.

This method is used by the CollectorInventory agent to produce a list of entity information for later use in containment 27odelling.

<b>Name:</b>	GetEntities
<b>Signature:</b>	(is)
<b>Parameters:</b>	integer - Data source id string – Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorInventory agent.

## Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="entityData">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="entityList">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="entity" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:all>

 <!--
- Fields applicable to both ENTITY-T-MIB and Generic Styles
- name: The name of the entity. If ENTITY-MIB style is - used then
it is the equivalent of entPhysicalName.
- descr: Entity description. If ENTITY-MIB style is - used then it is
the equivalent of entPhysicalDescr.
- alias: Entity alias value. If ENTITY-MIB style is - used then it is
the equivalent of entPhysicalAlias.
- parentRelPos: The relative position of the entity within - it is the equivalent
of entPhysicalParentRelPos.
- fwRev: Entity firmware version. If ENTITY-MIB style used then - it
is the equivalent of entPhysicalFirmwareRev.
- hwRev: Entity hardware version. If ENTITY-MIB style used then - it
is the equivalent of entPhysicalHardwareRev.
- swRev: Entity software version. If ENTITY-MIB style used then - it
is the equivalent of entPhysicalSoftwareRev.
- serialNumber: Entity serial number. If ENTITY-MIB style used - then
it is the equivalent of entPhysicalSerialNum.
- extraInfo: (optional) freeform data
-->
 <xs:element name="name" type="xs:string" minOccurs="1"/>
 <xs:element name="descr" type="xs:string" minOccurs="0"/>
 <xs:element name="alias" type="xs:string" minOccurs="0"/>
 <xs:element name="parentRelPos" type="xs:integer" minOccurs="1"/>
 <xs:element name="fwRev" type="xs:string" minOccurs="0"/>
 <xs:element name="hwRev" type="xs:string" minOccurs="0"/>
 <xs:element name="swRev" type="xs:string" minOccurs="0"/>
 <xs:element name="serialNumber" type="xs:string" minOccurs="0"/>

 <xs:element name="extraInfo" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded">
 </xs:sequence>
 </xs:complexType>
 </xs:element>

 <!--
- ENTITY-MIB Style Specific Fields
- index: See ENTITY-MIB entPhysicalIndex
- class: See ENTITY-MIB entPhysicalClass
- containedIn: See ENTITY-MIB entPhysicalContainedIn
- vendorType: See ENTITY-MIB entPhysicalVendorType
-->
 <xs:element name="index" type="xs:integer" minOccurs="1"/>
 <xs:element name="class" type="xs:string" minOccurs="1"/>
 <xs:element name="containedIn" type="xs:integer" minOccurs="1"/>
</xs:element name="entityData" type="xs:string" minOccurs="0"/>

<!--
- Generic Style
- parent: The name of the parent entity
- cdmType: The entity type (based on the CDM 'type'
- Supported values are;
```



```

- 0 : Other
- 1 : Unknown
- 2 : Chassis
- 3 : Backplane
- 4 : Slot
- 5 : Power Supply
- 6 : Fan
- 7 : Sensor
- 8 : Module
- 9 : Port
- 10 : Rack
-->
<xs:element name="parent" type="xs:string" minOccurs="1"/>
<xs:element name="cdmType" type="xs:integer" minOccurs="1"/>

 </xs:all>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

### Example:

ENTITY-MIB Style Example:

```

<entityData>
 <entityList>
 <entity>
 <name>ACME 2000 9-slot Chassis System</name>
 <class>3</class>
 <index>1</index>
 <vendorType>1.3.6.1.4.1.1234.12.175</vendorType>
 <descr>AME-2000</descr>
 <parentRelPos>-1</parentRelPos>
 </entity> .. other entities
 ..
</entityList>
</entityData> Generic Example:

```

```

<entityData>
 <entityList>
 <entity>
 <name>ACME 2000 9-slot Chassis System</name>
 <cdmType>3</cdmType>
 <parent>0</parent>
 <descr>AME-2000</descr>
 <parentRelPos>0</parentRelPos>
 </entity> .. other entities
 ..
</entityList>
</entityData>

```

## GetLayer3Vpns()

The Collector implementation of GetLayer3Vpns() is responsible for gathering and returning all layer 3 VPNs configured on a given device identifier and data source.

Network Manager processes this data using standard MPLS stitchers to generate VPN membership information for display in the GUI.

<b>Name:</b>	GetLayer3Vpns
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorVpn agent.
<b>Data Definition:</b>	
<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="layer3Vpns"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;xs:element name="vpn" minOccurs="0" maxOccurs="unbounded"&gt;         &lt;xs:complexType&gt;           &lt;xs:all&gt;              &lt;!-- - vpnName: VPN name - vrfName: VRF supporting the VPN - rd: Route distinguisher - descr: VPN description - status: VPN status - importRTs: Imported route targets - exportRTs: Exported route targets - interfaces: Associated interfaces (CE facing) - extraInfo: (optional) freeform data --&gt;           &lt;xs:element name="vpnName" type="xs:string" minOccurs="0"/&gt;           &lt;xs:element name="vrfName" type="xs:string" minOccurs="1"/&gt;           &lt;xs:element name="rd" type="xs:string" minOccurs="1"/&gt;           &lt;xs:element name="descr" type="xs:string" minOccurs="0"/&gt;           &lt;xs:element name="status" type="xs:integer" minOccurs="0"/&gt;            &lt;xs:element name="importRTs" minOccurs="1"&gt;             &lt;xs:complexType&gt;               &lt;xs:sequence&gt;                 &lt;xs:element name="rt" type="xs:string" minOccurs="0" maxOccurs="unbounded" /&gt;               &lt;/xs:sequence&gt;             &lt;/xs:complexType&gt;           &lt;/xs:element&gt;            &lt;xs:element name="exportRTs" minOccurs="1"&gt;             &lt;xs:complexType&gt;               &lt;xs:sequence&gt;                 &lt;xs:element name="rt" type="xs:string" minOccurs="0" maxOccurs="unbounded" /&gt;               &lt;/xs:sequence&gt;             &lt;/xs:complexType&gt;           &lt;/xs:element&gt;         &lt;/xs:complexType&gt;       &lt;/xs:element&gt;     &lt;/xs:sequence&gt;   &lt;/xs:complexType&gt; &lt;/xs:element&gt;</pre>	

```

</xs:element>

<xs:element name="interfaces">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interface"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
<!--
- ifIndex: ifIndex MUST be specified if
interfaceId is not specified.
- interfaceId: String based interface identifier.
- MUST be specified if no ifIndex
- ceIp: Address of CE connected to ifIndex
- protocol: Textual description of PE-CE protocol
- customerName: Customer name
- customerDescr: Customer description
-->
 <xs:element name="ifIndex"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="interfaceId"
 type="xs:string" minOccurs="0"/>
 <xs:element name="ceIp"
 type="xs:string" minOccurs="0"/>
 <xs:element name="protocol"
 type="xs:string" minOccurs="0"/>
 <xs:element name="customerName"
 type="xs:string" minOccurs="0"/>
 <xs:element name="customerDescr"
 type="xs:string" minOccurs="0"/>
 <xs:element name="extraInfo"
 minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded">
 </xs:sequence>
 </xs:complexType>
 </xs:element>

 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<xs:element name="extraInfo" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded">
 </xs:sequence>
 </xs:complexType>
</xs:element>

</xs:all>
</xs:complexType>
</xs:element>

</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## Example:

```
layer3Vpns>
 <vpn>
 <descr>my blue VPN</descr>
 <vrfName>blue</vrfName>
 <vpnName>blue</vpnName>
 <rd>10:401</rd>
 <<status>1</status>
 <importRTs>
 <rt>10:401</rt>
 </importRTs>
 <exportRTs>
 <rt>10:601</rt>
 </exportRTs>
 <interfaces>
 <interface>
 <customerName>A Company</customerName>
 <ceIp>10.0.0.1</ceIp>
 <ifIndex>10</ifIndex>
 <customerDescr> A Company</customerDescr>
 <protocol>2</protocol>
 </interface>
 <interface>
 <customerName>A Company</customerName>
 <ceIp>10.0.0.1</ceIp>
 <interfaceId>MyeIdFor19</interfaceId>
 <customerDescr> A Company</customerDescr>
 <protocol>2</protocol>
 </interface>
 .. other interfaces ..
 </interfaces>
 </vpn>
 .. other vpns ..
</layer3Vpns>.0.1</ceIp>
```

## GetLayer2Vpns()

The Collector implementation of GetLayer2Vpns() is responsible for gathering and returning all layer 2 VPNs configured on a given device identifier and data source.

Network Manager processes this data using standard MPLS stitchers to generate VPN membership information for display in the GUI.

<b>Name:</b>	GetLayer2Vpns
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorVpn agent.
<b>Data Definition:</b>	
<pre>&lt;!-- -      GetLayer2VpnsResponse.xsd - -      This schema represents the XML response to the - GetLayer2Vpns() method. - --&gt; &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="layer2Vpns"&gt;   &lt;xs:complexType&gt;</pre>	

```

<xs:sequence>
 <xs:element name="vpn" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:all>

 <!--
 - vpnName: Name of the VPN
 - vcId: Circuit Id.
 - vcType: 0=invalid, 1= framerelay, 2=atm aal5 vcc,
 3=atm trans, 4=vlan, 5=Ethernet, 6=hdlc, 7=ppp,
 8=cep, 9=atm vcc, 10=atm vpl, 11 vpls
 Common values are 5 (for VPWS) and 11 (for VPLS)
 - peerIp: IP address of remote device.
 - peerIfIndex: Remote interface connected to the service
 MUST be specified if peerIp is specified
 but peerInterfaceId is not specified.
 - peerInterfaceId: String based interface identifier. An alternative
 to peerIfIndex for non-IfIndex supporting devices.
 MUST be specified if peerIp is specified
 but peerInterfaceId is not specified.
 - localIfIndex: Local interface connected to the service
 MUST be specified if localInterfaceId is not specified.
 - localInterfaceId: String based interface identifier. An alternative
 to localIfIndex for non-IfIndex supporting devices.
 MUST be specified if localIfIndex is not specified.
 - status: 0=unknown, 1=down, 2=up
 - topologyType: 0=invalid, 1=other, 2=bgp ip, 3=bgp layer 2,
 4=bgp vpls. 5=l2 circuit, 6=ldp vpls, 7=optical,
 8=vp ocx, 9=ccc, 10=atm.
 Common values are 3 or 5 when vcType is 5 (for VPWS)
 and 4 or 6 when vcType is 11 (VPLS).
 - localLabel: Label imposed for local->remote LSP
 - peerLabel: Label imposed for remote->local LSP
 - extraInfo: (optional) Any freeform data
 -->
 <xs:element name="vpnName" type="xs:string" minOccurs="1"/>
 <xs:element name="vcId" type="xs:string" minOccurs="1"/>
 <xs:element name="vcType" type="xs:integer" minOccurs="1"/>
 <xs:element name="peerIp" type="xs:string" minOccurs="0"/>
 <xs:element name="peerIfIndex" type="xs:integer" minOccurs="0"/>
 <xs:element name="peerInterfaceId" type="xs:string" minOccurs="0"/>
 <xs:element name="localIfIndex" type="xs:integer" minOccurs="0"/>
 <xs:element name="localInterfaceId" type="xs:string" minOccurs="0"/>
 <xs:element name="status" type="xs:integer" minOccurs="0"/>
 <xs:element name="topologyType" type="xs:integer" minOccurs="0"/>
 <xs:element name="localLabel" type="xs:integer" minOccurs="1"/>
 <xs:element name="peerLabel" type="xs:integer" minOccurs="1"/>

 <xs:element name="extraInfo" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded">
 </xs:sequence>
 </xs:complexType>
 </xs:element>

 </xs:all>
 </xs:complexType>
 </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

**Example:**

```
<layer2Vpns>
 <vpn>
 <vpnName>VPWS50</vpnName>
 <localLabel>26</localLabel>
 <vcId>50</vcId>
 <localIfIndex>32</localIfIndex>
 <topologyType>5</topologyType>
 <vcType>5</vcType>
 <peerLabel>28</peerLabel>
 <status>1</status>
 <peerIp>10.1.254.2</peerIp>
 <peerIfIndex>5</peerIfIndex>
 </vpn>
 <vpn>
 <vpnName>VPWS50</vpnName>
 <localLabel>26</localLabel>
 <vcId>50</vcId>
 <localInterfaceId>MyInterfaceId32</localInterfaceId>
 <topologyType>5</topologyType>
 <vcType>5</vcType>
 <peerLabel>28</peerLabel>
 <status>1</status>
 <peerIp>10.1.254.2</peerIp>
 <peerInterfaceId>MyInterfaceId5</peerInterfaceId>
 </vpn> .. other vpns ..
</layer2Vpns>
```

**GetMplsInterfaces()**

The Collector implementation of GetMplsInterfaces() is responsible for gathering and returning the identifiers of all interfaces on a given device id and data source that support MPLS label forwarding.

Network Manager processes this data using standard MPLS stitchers to generate MPLS Core membership information for display in the GUI.

<b>Name:</b>	GetMplsInterfaces
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorVpn agent.

## Data Definition:

```
<!--
- GetMplsInterfaces.xsd
-
- This schema represents the XML response to the - GetMplsInterfaces() method.
-
-->
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="mplsInterfaceData">
 <xs:complexType>
 <xs:sequence>
 <!--
- deviceId: The EMS identifier for the device to which the
- MPLS interfaces belong
-->
 <xs:element name="deviceId" type="xs:string" minOccurs="1"/>
 <xs:element name="interfaceList">
 <xs:complexType>
 <xs:sequence>

 <xs:element name="interface" minOccurs="1" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>

 <!--
- ifIndex: The RFC1213::IfIndex for the interface - MUST
be present if interfaceId not present.
- interfaceId: A string that uniquely identifies the interface -
on the device. - MUST be present if ifIndex not present.
-->
 <xs:element name="ifIndex" type="xs:string" minOccurs="0"/>

 <xs:element name="interfaceid" type="xs:string" minOccurs="0"/>

 </xs:sequence>
 </xs:complexType>
 </xs:element>

 </xs:sequence>
 </xs:complexType>
 </xs:element>

 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:schema>
```

## Example:

```
<mplsInterfaceData>
 <deviceId>10.1.1.3</deviceId>
 <interfaceList>
 <interface>
 <ifIndex>15</ifIndex>
 </interface>
 <interface>
 <interfaceId>Gi10/1</interfaceId>
 </interface>
 </interfaceList>
</mplsInterfaceData>
```

## GetLayer3Connections()

The Collector implementation of GetLayer3Connections() is responsible for gathering and returning all resolved layer 3 link information for the supplied device id and data source.

Network Manager processes this data resulting in layer 3 connectivity information in the GUI.

<b>Name:</b>	GetLayer3Connections
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorLayer3 agent.
<b>Data Definition:</b>  <pre> &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="layer3Connections"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;xs:element name="connection" minOccurs="0" maxOccurs="unbounded"&gt;         &lt;xs:complexType&gt;           &lt;xs:all&gt;              &lt;!-- -      dest:          Destination name/IP -      destIfIndex:   Destination ifIndex          - destInterfaceId: String based interface identifier. -      MUST be specified if destIfIndex is not specified. -      src:           Source name/IP -      srcIfIndex:    Source ifIndex              - srcInterfaceId: String based interface identifier. -      MUST be specified if srcIfIndex is not specified. -      extraInfo:     (optional) Any freeform data --&gt;           &lt;xs:element name="dest" type="xs:string" minOccurs="1"/&gt;           &lt;xs:element name="destIfIndex" type="xs:integer" minOccurs="0"/&gt;           &lt;xs:element name="destInterfaceId" type="xs:string" minOccurs="0"/&gt;           &lt;xs:element name="src" type="xs:string" minOccurs="0"/&gt;           &lt;xs:element name="srcIfIndex" type="xs:integer" minOccurs="0"/&gt;           &lt;xs:element name="srcInterfaceId" type="xs:string" minOccurs="0"/&gt;            &lt;xs:element name="extraInfo" minOccurs="0" maxOccurs="1"&gt;             &lt;xs:complexType&gt;               &lt;xs:sequence&gt;                 &lt;xs:any maxOccurs="unbounded"&gt;               &lt;/xs:sequence&gt;             &lt;/xs:complexType&gt;           &lt;/xs:element&gt;         &lt;/xs:all&gt;       &lt;/xs:complexType&gt;     &lt;/xs:sequence&gt;   &lt;/xs:complexType&gt; &lt;/xs:element&gt; &lt;/xs:schema&gt; </pre>	



### Returned XML:

```
<layer3Connections>
 <connection>
 <dest>10.1.230.1</dest>
 <destIfIndex>22</destIfIndex>
 <srcIfIndex>9</srcIfIndex>
 <src>10.1.254.1</src>
 </connection>
 <connection>
 <dest>10.1.230.1</dest>
 <destInterfaceId>MyUniqueId22</destInterfaceId>
 <srcInterfaceId>MyUniqueId9</srcInterfaceId>
 <src>10.1.254.1</src>
 </connection>
</layer3Connections>
```

## GetLayer2Connections()

The Collector implementation of GetLayer2Connections() is responsible for gathering and returning all resolved layer 2 connection information for the supplied device data source.

Network Manager processes this data resulting in layer 2 connectivity information in the GUI.

<b>Name:</b>	GetLayer2Connections
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorLayer2 agent.
<b>Data Definition:</b>	
<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="layer2Connections"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;xs:element name="connection" minOccurs="0" maxOccurs="unbounded"&gt;         &lt;xs:complexType&gt;           &lt;xs:all&gt;              &lt;!-- -      dest:      Destination name/IP -      destIfIndex: Destination ifIndex          - destInterfaceId: String based interface identifier. -      MUST be specified if destIfIndex is not specified. -      src:      Source name/IP -      srcIfIndex: Source ifIndex          - srcInterfaceId: String based interface identifier. -      MUST be specified if srcIfIndex is not specified. -      extraInfo: (optional) Any freeform data --&gt;           &lt;xs:element name="dest" type="xs:string" minOccurs="1"/&gt;           &lt;xs:element name="destIfIndex" type="xs:integer" minOccurs="0"/&gt;</pre>	

```
<layer2Connections>
 <connection>
 <dest>10.1.230.1</dest>
 <destIfIndex>22</destIfIndex>
 <srcIfIndex>9</srcIfIndex>
 <src>10.1.254.1</src>
 </connection>
 <connection>
 <dest>10.1.230.1</dest>
 <destInterfaceId>MyUniqueId22</destInterfaceId>
 <srcInterfaceId>MyUniqueId9</srcInterfaceId>
 <src>10.1.254.1</src>
 </connection>
</layer2Connections>
```

<b>Name:</b>	GetLayer1Connections
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer      - Data source id (s) string        - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorLayer1 agent.
<b>Data Definition:</b>  <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt; &lt;xs:element name="layer2Connections"&gt;   &lt;xs:complexType&gt;     &lt;xs:sequence&gt;       &lt;xs:element name="connection" minOccurs="0" maxOccurs="unbounded"&gt;         &lt;xs:complexType&gt;           &lt;xs:all&gt;</pre>	

```

- <!--
- dest: Destination name or IP.
- destIfIndex: Destination ifIndex - destInterfaceId: String based interface
identifier.
-
- src: Source name or IP
- srcIfIndex: Source ifIndex - srcInterfaceId: String based interface
identifier.
-
- unidirectional: 1 (unidirectional) or 0 (bidirectional)
-
- extraInfo: (optional) Any freeform data
-->
<xs:element name="dest" type="xs:string" minOccurs="1"/>
<xs:element name="destIfIndex" type="xs:integer" minOccurs="0"/>
<xs:element name="destInterfaceId" type="xs:string" minOccurs="0"/>
<xs:element name="src" type="xs:string" minOccurs="0"/>
<xs:element name="srcIfIndex" type="xs:integer" minOccurs="0"/>
<xs:element name="srcInterfaceId" type="xs:string" minOccurs="0"/>
<xs:element name="unidirectional" type="xs:integer" minOccurs="0"/>
<xs:element name="extraInfo" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded">
 </xs:sequence>
 </xs:complexType>
</xs:element>

</xs:all>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

### Example:

```

<layer1Connections>
 <connection>
 <dest>10.1.230.1</dest>
 <destInterfaceId>MyInterface22</destInterfaceId>
 <src>10.1.254.1</src>
 <srcInterfaceId>myInterface9</srcInterfaceId>
 <unidirectional>1</unidirectional>
 </connection>
 <connection> ..
etc...
 </connection>
</layer1Connections>

```

## GetConnections()

The Collector implementation of GetConnections() can be used to retrieve connection information in a standard format for any topology layer.

Note that the root element name is defined as the concatenation of the lower-case topology name and 'Connections'. For example, when called with Topology name 'Microwave', the root element name will be 'microwaveConnections'. Available topology names are dependent upon the collector implementation.

<b>Name:</b>	GetConnections
<b>Signature:</b>	(iss)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id (s) string - Topology name (eg 'Layer3', 'Microwave')
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorLayer1 agent to retrieve Microwave connections, and by the CollectorRAN agent to retrieve logical RAN connections

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
<xs:element name="<modelName>Connections">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:all>
 <!-- - dest: Destination name or
IP.
- destIfIndex: Destination ifIndex - destInterfaceId: String based interface
identifier.
-
- src: Source name or IP
- srcIfIndex: Source ifIndex - srcInterfaceId: String based interface
identifier.
-
- unidirectional: 1 (unidirectional) or 0 (bidirectional)
-
- extraInfo: (optional) Any freeform data
-->
 <xs:element name="dest" type="xs:string" minOccurs="1"/>
 <xs:element name="destIfIndex" type="xs:integer" minOccurs="0"/>
 <xs:element name="destInterfaceId" type="xs:string" minOccurs="0"/>
 <xs:element name="src" type="xs:string" minOccurs="0"/>
 <xs:element name="srcIfIndex" type="xs:integer" minOccurs="0"/>
 <xs:element name="srcInterfaceId" type="xs:string" minOccurs="0"/>
 <xs:element name="unidirectional" type="xs:integer" minOccurs="0"/>
 <xs:element name="extraInfo" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:any maxOccurs="unbounded"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:all>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
```

### Example:

```
<microwaveConnections>
 <connection>
 <dest>10.1.230.1</dest>
 <destInterfaceId>MyInterface22</destInterfaceId>
 <src>10.1.254.1</src>
 <srcInterfaceId>myInterface9</srcInterfaceId>
 <unidirectional>1</unidirectional>
 </connection>
```

```

 <connection>
 <dest>10.1.230.2</dest>
 </connection>
 <connection> ..
etc...
 </connection>
</microwaveConnections>

```

## GetRanData()

The GetRanData() gRPC/XML-RPC call returns RAN data that is representative of the radio area network (RAN) NCIM model.

<b>Name:</b>	GetRanData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's CollectorRAN agent to gather RAN data for NCIM

### Data Definition:

In the case of GetRanData() the returned freeform XML data should be representative of the RAN NCIM model.

For example, for the ranBaseStation NCIM table which is defined as;

```

CREATE TABLE ranBaseStation
(
 entityId INTEGER NOT NULL,
 ranTechnologyType VARCHAR(10) CONSTRAINT ck_BSRANType
 CHECK(ranTechnologyType IN ('Unknown',
 'Other', 'GSM', 'GPRS' , 'UMTS')),
 baseStationId VARCHAR(64) NOT NULL,)

```

the XML within the 'calledMethod' tags would be;

```

<ranBaseStation>
 <ranTechnologyType>GPRS</ ranTechnologyType>
 <baseStationId>base1234</baseStationId>
</ranBaseStation>

```

Note that a value for entityId is not specified as this is automatically generated when NCIM is populated.

### Example:

```

<GetRanData>
 <ranBaseStation>
 <ranTechnologyType>GPRS</ ranTechnologyType>
 <baseStationId>base1234</baseStationId>
 </ranBaseStation>
</GetRanData>

```

## GetENodeBData()

The Collector implementation of GetENodeBData() is responsible for returning information relating to the Evolved NodeB (eNodeB) network element of a Long Term Evolution (LTE) mobile communications network. A device implementing eNodeB should be identified by returning the lteFunction value "ENODEB" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

Network Manager processes the returned data to populate configuration parameters and connectivity information for the eNodeB and its associated cells, sectors and antenna.

<b>Name:</b>	GetENodeBData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's LTE Collector agent.
<b>Data Definition:</b>	<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="eNodeBData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt;         &lt;!-- -      parentChassisId = Identifier of the physicalChassis supporting the eNodeB (as         by GetDeviceList() -      parentChassisDn = The distinguished name of the eNodeB physicalChassis as         known by the EMS -      locationName = Identifier for the geographic location at which the eNodeB is         located -      latitude = Angular distance in decimal degrees east (+) and west (-) from the prime         meridian on the earth's surface. e.g. 35.832636. (WGS84 standard) -      longitude = Angular distance in decimal degrees north (+) and south (-) from         the equator on the earth's surface. e.g. -78.838753 (WGS84 standard) -      altitude = This is the vertical height in metres above WGS84 datum surface         (EGM96) of the geographical location -      timezoneOffset = Offset of geographic location local time from UTC in format         UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30 --&gt;         &lt;xs:element name="parentChassisId" type="xs:string" minOccurs="1"/&gt;         &lt;xs:element name="parentChassisDn" type="xs:string" minOccurs="1"/&gt;         &lt;xs:element name="locationName" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="latitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="longitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="altitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/&gt;       &lt;!--         The list of eNodeB functions supported by the physical chassis -      eNodeBId = Unique identifier of the eNodeB -      eNodeBName = User friendly name of the eNodeB -      maximumOutputPower = The maximum output power of the eNodeB in Watts -      userCapacity = Maximum number of active users supported by the eNodeB -      eNodeBId = Unique identifier of the eNodeB         A single eNodeB function can support multiple PLMNs. Each supported PLMN is listed         here:         - mcc = The Mobile Country Code (MCC) of the PLMN consisting of three         digits.         - mnc = The Mobile Network Code (MNC) of the PLMN consisting of two         or three digits. -      supportedPLMNs = The number of PLMNs supported by the eNodeB -      vendorName = The name of the eNodeB vendor --&gt;       &lt;!-- --&gt;     &lt;/xs:sequence&gt;   &lt;/xs:element&gt; &lt;/xs:schema&gt;</pre>

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- operationalState = The operational state of the eNodeB
- administrativeState = The administrative state of the eNodeB
- vendorModuleType = Vendor specific eNodeB type
- softwareVersion = Vendor specific eNodeB software version
- distinguishedName = The EMS distinguished name of the eNodeB
- emsIpAddress = The IP address of the element management system
- backHaulConnection = The IP address of the first hop backhaul device to which the
enbFunction is connected, for example the IP address of a cell-site router.
-->
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 <xs:element name="mnc"
type="xs:string" minOccurs="0"/>
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 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
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type="xs:string" minOccurs="0"/>
 <xs:element name="softwareVersion"

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 type="xs:string" minOccurs="0"/>
 <xs:element name="distinguishedName"
 type="xs:string" minOccurs="0"/>
 <xs:element name="emsIpAddress" type="xs:string" minOccurs="0"/>
 <xs:element name="backHaulConnection"
 type="xs:string" minOccurs="0"/>
<!--
This section lists each logical LTE interface supported by the eNodeB function
- interfaceType = The type of LTE logical interface
- lteInterfaceDescription = Description of the LTE logical interface. Should contain
the interface type and be unique within the physical chassis.
- ipAddress = The IP address of the logical interface
- subNet = The subnetwork of the logical interface
- vLan = The VLAN to which the logical interface belongs
-->
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 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains the adjacent eNodeB functions which are connected via an
X2 interface
- adjENodeBId = Adjacent eNodeB identifier
- adjENodeBName = Adjacent eNodeB name
- adjENodeBIpAddr = Adjacent eNodeB IP address
-->
 <xs:element name="x2NeighbourList" minOccurs="0" maxOccurs="1">
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 type="xs:string" minOccurs="0"/>
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 type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

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<!--
This section contains data on eUtranCells supported by this eNodeB function
- eUtranCellId = Identifier of the eUtranCell. Often constructed from eNodeB
 eNodeB ID + Physical Cell ID
- eUtranCellName = The user firendly name of the eUtranCell
- physicalCellId = The physical cell id of the eUtranCell (integer 0 to 503)
- localCellId = Locall cell id, an integer value unique within the eNodeB
- channelBandwidthDl = Downlink channel bandwidth in MHz
- channelBandwidthUl = Uplink channel bandwidth in MHz
- maximumOutputPower = The maximum output power of the eUtranCell in Watts
- userCapacity = Maximum number of active users supported by the eUtranCell
- earfcnDl = E-UTRA Absolute Radio Frequency Channel Number (downlink). An
 integer value which identifies the downlink carrier frequency of the cell.
- earfcnUl = E-UTRA Absolute Radio Frequency Channel Number (uplink). An
 integer value which identifies the uplink carrier frequency of the cell.
- tac = Tracking area code of tracking area which contains the eUtranCell
- operationalState = The operational state of the eUtranCell
- administrativeState = The administrative state of the eUtranCell
- sectorId = The identifier of the sector which supports the eUtranCell
- sectorName = The name of the sector which supports the eUtranCell
- distinguishedName = The distinguished name by which the eUtranCell is known
 to its element management system (EMS)
-->

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 type="xs:string" minOccurs="0"/>
 <xs:element name="localCellId"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="channelBandwidthDl"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="channelBandwidthUl"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="maximumOutputPower"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="userCapacity"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="earfcnDl"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="earfcnUl"
 type="xs:integer" minOccurs="0"/>
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 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
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 </xs:restriction>
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 </xs:element>
 <xs:element name="sectorId"

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 type="xs:string" minOccurs="1"/>
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 type="xs:string" minOccurs="0"/>
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 type="xs:string" minOccurs="0"/>
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</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains data on sectors supported by this eNodeB function
- eUtranCellId = Identifier of the eUtranCell. Often constructed from
 eNodeB ID + Physical Cell ID
- sectorId = Sector identifier
- sectorName = Sector Name
- sectorNumber = Numeric id of the sector
- frequencyBand = An integer value which identifies the frequency band supported
 by the sector. All cells serviced by the sector must have
 carrier frequencies falling within this band.
- maximumOutputPower = The maximum available sector power in watts
- distinguishedName = The distinguished name by which the sector is known to
 its element management system (EMS)
- operationalState = The operational state of the sector
- administrativeState = The administrative state of the sector
-->
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 type="xs:integer" minOccurs="0"/>
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 type="xs:string" minOccurs="0"/>
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 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
<!--
Each sector is supported by one or more physical antenna, this section lists the
identifiers (serial numbers) of the antenna supporting this sector.
- antennaSerialNumber = Serial number of an antenna supporting this sector
-->
 <xs:element name="antennaList"
 minOccurs="0" maxOccurs="1">

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 <xs:complexType>
 <xs:sequence>
 <xs:element name="antennaSerialNumber"
 minOccurs="0"
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 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

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<!--  
This section contains information on the antenna functions which support the  
enbFunction  
- antennaSerialNumber = Unique antenna identifier  
- antennaHeight = This is the vertical height of the antenna in metres above  
WGS84 datum surface  
- antennaDownTilt = The antenna vertical tilt in degrees.  
- antennaBearing = The bearing in degrees that the antenna is pointing in.  
- antennaMaxAzimuth = The maximum amount of change of azimuth the system  
system can support. This is the change in degrees clockwise from bearing.  
- antennaMinAzimuth = The minimum amount of change of azimuth the system  
can support. This is the change in degrees clockwise from bearing.  
- antennaHorizontalBeamwidth = The power beamwidth of the antenna pattern in  
the horizontal plane. A value of 360 indicates an omni-directional antenna.  
A single integral value corresponding to an angle in degrees between 0 and 360.  
- antennaVerticalBeamwidth = The power beamwidth of the antenna pattern in  
the vertical plane. A value of 360 indicates an omni-directional antenna.  
A single integral value corresponding to an angle in degrees between 0 and 360.  
- antennaLatitude = Latitude of Antenna equipment. This is the angular distance  
(east and west) from the prime meridian on the earth's surface. e.g. 35.832636  
Based on WGS84 standard.  
- antennaLongitude = Longitude of Antenna equipment. This is the angular  
distance (north and south) from the equator on the earth's surface  
e.g. -78.838753. Based on WGS84 standard.  
- antennaLocationName = The antenna location name  
- antennaManufacturer = The vendor/manufacturer of the antenna  
- antennaModel = Vendor specific antenna model type  
- distinguishedName = The distinguished name by which the antenna is known to  
its element management system (EMS)  
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<!--
Each antennFunction supports one or more sectors, this section lists the
sectorIds of those supported sectors
- sectorId = Supported sector identifier
-->

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<!--
This section contains information on the S1-MME interfaces which connect this
enbFunction to EPC mmeFunctions.
- mmeName = The name of the mmeFunction connected over this S1-MME
 interface
- mmeCode= The code which niquely identifies the MME within its MME group
- mmeGroupId = Uniquely identifies the MME Group within the PLMN
- mmeMcc = Mobile country code of the connected MME
- mmeMnc = Mobile network code of the connected MME
- mmeIpAddress = The IP address on the connected MME which supports
 this S1-MME interface
- mmeLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the enbFunction. The weight is expressed
 as a percentage.
- mmeLinkUsage = Indicates the usage of the S1-MME link, where available
 and applicable
-->

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 </xs:simpleType>
 </xs:element>
 </xs:sequence>
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</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the S1-U interfaces which connect this
enbFunction to EPC sgwFunctions.
- sgwName = The name of the sgwFunction connected over this S1-U
 interface
- sgwIpAddress = The IP address on the connected SGW which supports
 this S1-U interface
- sgwLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the enbFunction. The weight is expressed
 as a percentage.
- sgwLinkUsage = Indicates the usage of the S1-U link, where available
 and applicable
-->
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 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains information on the OAM interfaces which connect this
enbFunction to an EMS
- oamName = The name of the EMS connected over this OAM interface
- oamIpAddress = The IP address on the connected EMS which supports
 this OAM interface
- oamLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the enbFunction. The weight is expressed
 as a percentage.
- oamLinkUsage = Indicates the usage of the OAM link, where available
 and applicable
-->
 <xs:element name="oamConnectionList" minOccurs="0" maxOccurs="1">
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 <xs:element name="oamName"
 type="xs:string" minOccurs="1"/>
 <xs:element name="oamIpAddr"
 type="xs:string" minOccurs="1"/>
 <xs:element name="oamLinkWeight"

```



```

 <subNet>255.255.255.252</subNet>
 <vLan>601</vLan>
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 <lteInterfaceDescription>X2</lteInterfaceDescription>
 <parentInterface>ETH-1-2</parentInterface>
 <ipAddress>12.34.56.78</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>111</vLan>
 </lteInterface>
</lteInterfaceList>
<x2NeighbourList>
 <x2Neighbour>
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 <x2Neighbour>
 <adjENodeBID>10003</adjENodeBID>
 <adjENodeBName>ENodeB-3</adjENodeBName>
 <adjENodeBIPAddr>12.34.56.92</adjENodeBIPAddr>
 </x2Neighbour>
</x2NeighbourList>
<eUtranCellList>
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 <earfcnUL>2222</earfcnUL>
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 <administrativeState>Unlocked</administrativeState>
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 </eUtranCell>
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 <tac>3333</tac>
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 <administrativeState>Unlocked</administrativeState>
 <sectorId>100012</sectorId>
 <sectorName>Sector-10001-2</sectorName>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/CELL-2</distinguishedName>
 </eUtranCell>
 <eUtranCell>
 <eUtranCellId>1000133</eUtranCellId>
 <eUtranCellName>Cell-10001-3-3</eUtranCellName>
 <physicalCellId>3</physicalCellId>
 <localCellId>3</localCellId>
 <channelBandwidthDL>20</channelBandwidthDL>
 <channelBandwidthUL>20</channelBandwidthUL>
 <maximumOutputPower>20</maximumOutputPower>
 <userCapacity>50</userCapacity>
 <earfcnDL>1111</earfcnDL>
 <earfcnUL>2222</earfcnUL>
 <tac>3333</tac>
 <operationalState>Enabled</operationalState>

```

```

 <administrativeState>Unlocked</administrativeState>
 <sectorId>100013</sectorId>
 <sectorName>Sector-10001-3</sectorName>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/CELL-3</distinguishedName>
 </eUtranCell>
</eUtranCellList>
<eUtranSectorList>
 <eUtranSector>
 <sectorId>100011</sectorId>
 <sectorName>Sector-10001-1</sectorName>
 <sectorNumber>1</sectorNumber>
 <frequencyBand>5</frequencyBand>
 <maximumOutputPower>100</maximumOutputPower>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/SECTOR-1</distinguishedName>
 <operationalState>Enabled</operationalState>
 <administrativeState>Unlocked</administrativeState>
 <antennaList>
 <antennaSerialNumber>10101</antennaSerialNumber>
 </antennaList>
 </eUtranSector>
 <eUtranSector>
 <sectorId>100012</sectorId>
 <sectorName>Sector-10001-2</sectorName>
 <sectorNumber>2</sectorNumber>
 <frequencyBand>5</frequencyBand>
 <maximumOutputPower>100</maximumOutputPower>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/SECTOR-2</distinguishedName>
 <operationalState>Enabled</operationalState>
 <administrativeState>Unlocked</administrativeState>
 <antennaList>
 <antennaSerialNumber>10102</antennaSerialNumber>
 </antennaList>
 </eUtranSector>
 <eUtranSector>
 <sectorId>100013</sectorId>
 <sectorName>Sector-10001-3</sectorName>
 <sectorNumber>3</sectorNumber>
 <frequencyBand>5</frequencyBand>
 <maximumOutputPower>100</maximumOutputPower>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/SECTOR-3</distinguishedName>
 <operationalState>Enabled</operationalState>
 <administrativeState>Unlocked</administrativeState>
 <antennaList>
 <antennaSerialNumber>10103</antennaSerialNumber>
 </antennaList>
 </eUtranSector>
</eUtranSectorList>
<antennaFunctionList>
 <antennaFunction>
 <antennaSerialNumber>10101</antennaSerialNumber>
 <antennaHeight>10</antennaHeight>
 <antennaDownTilt>10</antennaDownTilt>
 <antennaBearing>270</antennaBearing>
 <antennaMaxAzimuth>30</antennaMaxAzimuth>
 <antennaMinAzimuth>5</antennaMinAzimuth>
 <antennaHorizontalBeamwidth>30</antennaHorizontalBeamwidth>
 <antennaVerticalBeamwidth>30</antennaVerticalBeamwidth>
 <antennaLatitude>10.000</antennaLatitude>
 <antennaLongitude>-20.000</antennaLongitude>
 <antennaLocationName>Southbank Tower</antennaLocationName>
 <antennaManufacturer>AERIAL</antennaManufacturer>
 <antennaModel>1234</antennaModel>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/ANT-1</distinguishedName>
 <sectorIdList>
 <sectorId>100011</sectorId>
 </sectorIdList>
 </antennaFunction>
 <antennaFunction>
 <antennaSerialNumber>10102</antennaSerialNumber>
 <antennaHeight>10</antennaHeight>
 <antennaDownTilt>10</antennaDownTilt>
 <antennaBearing>150</antennaBearing>
 <antennaMaxAzimuth>30</antennaMaxAzimuth>
 <antennaMinAzimuth>5</antennaMinAzimuth>

```



```

 <antennaHorizontalBeamwidth>30</antennaHorizontalBeamwidth>
 <antennaVerticalBeamwidth>30</antennaVerticalBeamwidth>
 <antennaLatitude>10.000</antennaLatitude>
 <antennaLongitude>-20.000</antennaLongitude>
 <antennaLocationName>Southbank Tower</antennaLocationName>
 <antennaManufacturer>AERIAL</antennaManufacturer>
 <antennaModel>1234</antennaModel>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/ANT-2</distinguishedName>
 <sectorIdList>
 <sectorId>100012</sectorId>
 </sectorIdList>
 </antennaFunction>
 <antennaFunction>
 <antennaSerialNumber>10103</antennaSerialNumber>
 <antennaHeight>10</antennaHeight>
 <antennaDownTilt>10</antennaDownTilt>
 <antennaBearing>30</antennaBearing>
 <antennaMaxAzimuth>30</antennaMaxAzimuth>
 <antennaMinAzimuth>5</antennaMinAzimuth>
 <antennaHorizontalBeamwidth>30</antennaHorizontalBeamwidth>
 <antennaVerticalBeamwidth>30</antennaVerticalBeamwidth>
 <antennaLatitude>10.000</antennaLatitude>
 <antennaLongitude>-20.000</antennaLongitude>
 <antennaLocationName>Southbank Tower</antennaLocationName>
 <antennaManufacturer>AERIAL</antennaManufacturer>
 <antennaModel>1234</antennaModel>
 <distinguishedName>PLMN/CHASSIS-1/ENB-10001/ANT-3</distinguishedName>
 <sectorIdList>
 <sectorId>100013</sectorId>
 </sectorIdList>
 </antennaFunction>
</antennaFunctionList>
<connectedMMEList>
 <connectedMME>
 <mmeName>MME-1</mmeName>
 <mmeCode>1</mmeCode>
 <mmeGroupId>6000</mmeGroupId>
 <mmeMcc>123</mmeMcc>
 <mmeMnc>456</mmeMnc>
 <mmeIpAddress>12.34.56.78</mmeIpAddress>
 <mmeLinkWeight>100</mmeLinkWeight>
 <mmeLinkUsage>Primary</mmeLinkUsage>
 </connectedMME>
 <connectedMME>
 <mmeName>MME-2</mmeName>
 <mmeCode>2</mmeCode>
 <mmeGroupId>6000</mmeGroupId>
 <mmeMcc>123</mmeMcc>
 <mmeMnc>456</mmeMnc>
 <mmeIpAddress>12.34.56.89</mmeIpAddress>
 <mmeLinkWeight>0</mmeLinkWeight>
 <mmeLinkUsage>Secondary</mmeLinkUsage>
 </connectedMME>
</connectedMMEList>
<oamConnectionList>
 <oamConnection>
 <oamName>EMS-1</oamName>
 <oamIpAddr>23.45.66.77</oamIpAddr>
 <oamLinkWeight>100</oamLinkWeight>
 <oamLinkUsage>Primary</oamLinkUsage>
 </oamConnection>
</oamConnectionList>
</enbFunction>
</enbFunctionList>
</eNodeBData>

```

## GetMmeData()

The Collector implementation of GetMmeData() is responsible for returning information relating to the Mobility Management Entity (MME) network element of a Long Term Evolution (LTE) mobile communications network. A device implementing MME functionality should be identified by returning the lteFunction value “MME” as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

Network Manager processes the returned data to populate configuration parameters and connectivity information for the MME.

<b>Name:</b>	GetMmeData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager’s LTE Collector agent.
<b>Data Definition:</b> <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="mmeData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt; &lt;!-- - parentChassisId = Identifier of the physicalChassis supporting the mmeFunction (as   by GetDeviceList()) - parentChassisDn = The distinguished name of the MME physicalChassis as   known by the EMS - locationName = Identifier for the geographic location at which the MME is   located - latitude = Angular distance in decimal degrees east (+) and west (-) from the   prime meridian on the earth's surface. e.g. 35.832636.(WGS84 standard) - longitude = Angular distance in decimal degrees north (+) and south (-) from the   equator on the earth's surface. e.g. -78.838753 (WGS84 standard) - altitude = This is the vertical height in metres above WGS84 datum surface   (EGM96) of the geographical location - timezoneOffset = Offset of geographic location local time from UTC in format   UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30 --&gt;     &lt;xs:element name="parentChassisId" type="xs:string" minOccurs="0" maxOccurs="1"/&gt;     &lt;xs:element name="parentChassisDn" type="xs:string" minOccurs="0" maxOccurs="1"/&gt;     &lt;xs:element name="locationName" type="xs:string" minOccurs="0"/&gt;     &lt;xs:element name="latitude" type="xs:string" minOccurs="0"/&gt;     &lt;xs:element name="longitude" type="xs:string" minOccurs="0"/&gt;     &lt;xs:element name="altitude" type="xs:string" minOccurs="0"/&gt;     &lt;xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/&gt; &lt;!-- The list of MME functions supported by the physical chassis - mmeName = Unique identifier of the mmeFunction within this physical chassis - mmcCode = MME Code: Uniquely identifies an MME within an MME Group - mmeGroupId = MME Group Identifier: Uniquely identifies an MME Group - mmePoolName = The name of the MME Pool to which this mmeFunction belongs A single MME function can support multiple PLMNs. Each supported PLMN is listed here: - mcc = The Mobile Country Code (MCC) of the PLMN consisting of   three digits. - mnc = The Mobile Network Code (MNC) of the PLMN consisting of two</pre>	

```

 or three digits.
- supportedPLMNs = The number of PLMNs supported by the MME
- vendorName = The name of the MME vendor
- operationalState = The operational state of the MME
- administrativeState = The administrative state of the MME
- vendorModuleType = Vendor specific MME type
- softwareVersion = Vendor specific MME software version
- distinguishedName = The EMS distinguished name of the MME
- emsIpAddress = The IP address of the element management system
-->
<xs:element name="mmeFunctionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mmeFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mmeName" type="xs:string" minOccurs="1" maxOccurs="1"/>
 <xs:element name="mmeCode" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="mmeGroupId" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="mmePoolName" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="plmnList" minOccurs="0" maxOccurs="1">
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 <xs:sequence>
 <xs:element name="plmn" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mcc" type="xs:string" minOccurs="0"/>
 <xs:element name="mnc" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 <xs:element name="supportedPLMNs" minOccurs="0"/>
 <xs:element name="vendorName" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Nokia-Siemens"/>
 <xs:enumeration value="Alcatel-Lucent"/>
 <xs:enumeration value="Ericsson"/>
 <xs:enumeration value="Huawei"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="operationalState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Enabled"/>
 <xs:enumeration value="Disabled"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="administrativeState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Locked"/>
 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="vendorModuleType" type="xs:string" minOccurs="0"/>
 <xs:element name="softwareVersion" type="xs:string" minOccurs="0"/>
 <xs:element name="distinguishedName" type="xs:string" minOccurs="0"/>
 <xs:element name="emsIpAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
</xs:element>
<!--
This section lists each logical LTE interface supported by the MME function
- interfaceType = The type of LTE logical interface
- lteInterfaceDescription = Description of the LTE logical interface. Should contain

```

the interface type and be unique within the physical chassis.

- ipAddress = The IP address of the logical interface
  - subNet = The subnetwork of the logical interface
  - vLan = The VLAN to which the logical interface belongs
- >

```
<xs:element name="lteInterfaceList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="lteInterface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceType" minOccurs="1" maxOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="S1-MME"/>
 <xs:enumeration value="S3"/>
 <xs:enumeration value="S6a"/>
 <xs:enumeration value="S10"/>
 <xs:enumeration value="S11"/>
 <xs:enumeration value="S13"/>
 <xs:enumeration value="OAM"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="lteInterfaceDescription" type="xs:string" minOccurs="0"
maxOccurs="1"/>
 <xs:element name="parentInterface" type="xs:string" minOccurs="0"
maxOccurs="1"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="subNet" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="vLan" type="xs:string" minOccurs="0" maxOccurs="1"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!--
This section contains information on the S1-MME interfaces which connect this
mmeFunction to EUTRAN enbFunctions.
- eNodeBName = The name of the enbFunction connected over this interface
- eNodeBIPAddr = The IP address on the connected enbFunction which supports this interface
- slmmeLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- slmmeLinkUsage = Indicates the usage of the link, where available and applicable
-->

 <xs:element name="slmmeConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="slmmeConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="eNodeBName" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="eNodeBIPAddr" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="slmmeLinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="slmmeLinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

<!--
This section contains information on the S3 interfaces which connect this
```

```

mmeFunction to an SGSN
- sgsnName = The name of the SGSN connected over this interface
- sgsnIpAddr = The IP address on the connected SGSN which supports this interface
- s3LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s3LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s3ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s3Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sgsnName" type="xs:string" minOccurs="1" maxOccurs="1"/>
 <xs:element name="sgsnIpAddr" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="s3LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s3LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains information on the S6a interfaces which connect this
mmeFunction to an HSS
- hssName = The name of the HSS connected over this interface
- hssIpAddr = The IP address on the connected HSS which supports this interface
- s6aLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s6aLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s6aConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s6aConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="hssName" type="xs:string" minOccurs="1" maxOccurs="1"/>
 <xs:element name="hssIpAddr" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="s6aLinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s6aLinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains information on the S10 interfaces which connect this
mmeFunction to a peer mmeFunction
- mmeName = The name of the peer mmeFunction connected over this interface
- mmeCode = The MME Code of the peer mmeFunction connected over this interface
- mmeGroupId = The MME Group Id of the peer mmeFunction connected over this interface

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- mmeMcc = The MCC of the peer mmeFunction connected over this interface
- mmeMnc = The MNC of the peer mmeFunction connected over this interface
- mmeIpAddr = The IP address on the connected mmeFunction which supports this interface
- s10LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s10LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s10ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s10Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mmeName" type="xs:string" minOccurs="1" maxOccurs="1"/>
 <xs:element name="mmeCode" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="mmeGroupId" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="mmeMcc" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="mmeMnc" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="mmeIpAddr" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="s10LinkWeight" type="xs:integer" minOccurs="0" maxOccurs="0"/>
 <xs:element name="s10LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:element>
 </xs:element>
<!--
This section contains information on the S11 interfaces which connect this
mmeFunction to an sgwFunction
- sgwName = The name of the sgwFunction connected over this interface
- sgwIpAddr = The IP address on the connected sgwFunction which supports this interface
- s11LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s11LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s11ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s11Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sgwName" type="xs:string" minOccurs="1" maxOccurs="1"/>
 <xs:element name="sgwIpAddr" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="s11LinkWeight" type="xs:integer" minOccurs="0" maxOccurs="0"/>
 <xs:element name="s11LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:element>
 </xs:element>
<!--
This section contains information on the S13 interfaces which connect this

```

```

mmeFunction to an EIR
- eirName = The name of the EIR connected over this interface
- eirIpAddr = The IP address on the connected EIR which supports this interface
- s13LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s13LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s13ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s13Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="eirName" type="xs:string" minOccurs="1" maxOccurs="1"/>
 <xs:element name="eirIpAddr" type="xs:string" minOccurs="0" maxOccurs="1"/>
 <xs:element name="s13LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s13LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains information on the OAM interfaces which connect this
mmeFunction to an EMS
- oamName = The name of the EMS connected over this interface
- oamIpAddr = The IP address on the connected EMS which supports this interface
- oamLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- oamLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="oamConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamName" type="xs:string" minOccurs="1"/>
 <xs:element name="oamIpAddr" type="xs:string" minOccurs="1"/>
 <xs:element name="oamLinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="oamLinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
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 </xs:restriction>
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 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
</xs:complexType>
</xs:element>

```

```

 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:schema>

```

## Example:

```

<mmeData>
 <parentChassisId>MME-CHASSIS-01</parentChassisId>
 <parentChassisDn>PLMN/MME-CHASSIS-01</parentChassisDn>
 <locationName>Southbank Switch Site</locationName>
 <latitude>10.00000</latitude>
 <longitude>-20.0000</longitude>
 <altitude>2</altitude>
 <timezoneOffset>102</timezoneOffset>
 <mmeFunctionList>
 <mmeFunction>
 <mmeName>MME01</mmeName>
 <mmeCode>1</mmeCode>
 <mmeGroupId>22222</mmeGroupId>
 <mmePoolName>MMEPOOL-01</mmePoolName>
 <plmnList>
 <plmn>
 <mcc>123</mcc>
 <mnc>456</mnc>
 </plmn>
 </plmnList>
 <supportedPLMNs>1</supportedPLMNs>
 <vendorName>Nokia-Siemens</vendorName>
 <operationalState>Enabled</operationalState>
 <administrativeState>Unlocked</administrativeState>
 <vendorModuleType>MMEMODEL1</vendorModuleType>
 <softwareVersion>MMESW1</softwareVersion>
 <distinguishedName>PLMN/MME-01</distinguishedName>
 <emsIpAddress>12.34.56.78</emsIpAddress>
 <lteInterfaceList>
 <lteInterface>
 <interfaceType>S1-MME</interfaceType>
 <lteInterfaceDescription>S1-MME</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.67.89</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S3</interfaceType>
 <lteInterfaceDescription>S3</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.67.88</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S6a</interfaceType>
 <lteInterfaceDescription>S6a</lteInterfaceDescription>
 <parentInterface>ETHERNET-2</parentInterface>
 <ipAddress>23.45.67.87</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S10</interfaceType>
 <lteInterfaceDescription>S10</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.67.86</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S11</interfaceType>
 <lteInterfaceDescription>S11</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>

```



```

 <ipAddress>23.45.67.85</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S13</interfaceType>
 <lteInterfaceDescription>S13</lteInterfaceDescription>
 <parentInterface>ETHERNET-2</parentInterface>
 <ipAddress>23.45.67.84</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>OAM</interfaceType>
 <lteInterfaceDescription>OAM</lteInterfaceDescription>
 <parentInterface>ETHERNET-3</parentInterface>
 <ipAddress>23.45.67.83</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
</lteInterfaceList>
<slmmeConnectionList>
 <slmmeConnection>
 <eNodeBName>ENodeB-01</eNodeBName>
 <eNodeBIPAddr>99.88.77.66</eNodeBIPAddr>
 </slmmeConnection>
 <slmmeConnection>
 <eNodeBName>ENodeB-02</eNodeBName>
 <eNodeBIPAddr>99.88.77.55</eNodeBIPAddr>
 </slmmeConnection>
</slmmeConnectionList>
<s3ConnectionList>
 <s3Connection>
 <sgsnName>SGSN-01</sgsnName>
 <sgsnIPAddr>44.33.22.11</sgsnIPAddr>
 </s3Connection>
</s3ConnectionList>
<s6aConnectionList>
 <s6aConnection>
 <hssName>HSS-01</hssName>
 <hssIPAddr>55.33.22.11</hssIPAddr>
 </s6aConnection>
</s6aConnectionList>
<s10ConnectionList>
 <s10Connection>
 <mmeName>MME-02</mmeName>
 <mmeCode>6</mmeCode>
 <mmeGroupId>33333</mmeGroupId>
 <mmeMcc>123</mmeMcc>
 <mmeMnc>456</mmeMnc>
 <mmeIPAddr>66.33.22.11</mmeIPAddr>
 </s10Connection>
</s10ConnectionList>
<s11ConnectionList>
 <s11Connection>
 <sgwName>SGW-01</sgwName>
 <sgwIPAddr>77.33.22.11</sgwIPAddr>
 </s11Connection>
</s11ConnectionList>
<s13ConnectionList>
 <s13Connection>
 <eirName>EIR-01</eirName>
 <eirIPAddr>88.33.22.11</eirIPAddr>
 </s13Connection>
</s13ConnectionList>
<oamConnectionList>
 <oamConnection>
 <oamName>OAM-01</oamName>
 <oamIPAddr>99.33.22.11</oamIPAddr>
 </oamConnection>
</oamConnectionList>
</mmeFunction>
</mmeFunctionList>
</mmeData>

```

## GetSgwData()

The Collector implementation of GetSgwData() is responsible for returning information relating to the Serving Gateway (SGW) network element of a Long Term Evolution (LTE) mobile communications network. A device implementing SGW functionality should be identified by returning the lteFunction value "SGW" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

Network Manager processes the returned data to populate configuration parameters and connectivity information for the SGW.

<b>Name:</b>	GetSgwData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's LTE Collector agent.

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="sgwData">
 <xs:complexType>
 <xs:sequence>
 <!--
 - parentChassisId = Identifier of the physicalChassis supporting the
 sgwFunction (as returned by GetDeviceList())
 - parentChassisDn = The distinguished name of the SGW physicalChassis
 as known by the EMS
 - locationName = Identifier for the geographic location at which the SGW is
 located
 - latitude = Angular distance in decimal degrees east (+) and west (-) from the
 prime meridian on the earth's surface. e.g. 35.832636.(WGS84 standard)
 - longitude = Angular distance in decimal degrees north (+) and south (-) from the
 equator on the earth's surface. e.g. -78.838753 (WGS84 standard)
 - altitude = This is the vertical height in metres above WGS84 datum surface
 (EGM96) of the geographical location
 - timezoneOffset = Offset of geographic location local time from UTC in
 format UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30
 -->
 <xs:element name="parentChassisId" type="xs:string" minOccurs="0"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>
 <!--
 The list of SGW functions supported by the physical chassis
 - sgwName = Unique identifier of the sgwFunction within this physical chassis
 A single SGW function can support multiple PLMNs. Each supported PLMN
 is listed here:
 - mcc = The Mobile Country Code (MCC) of the PLMN consisting of
 three digits.
 - mnc = The Mobile Network Code (MNC) of the PLMN consisting of two
 or three digits.
 - supportedPLMNs = The number of PLMNs supported by the SGW
 - vendorName = The name of the SGW vendor
 - operationalState = The operational state of the SGW
 - administrativeState = The administrative state of the SGW
 - vendorModuleType = Vendor specific SGW type
 - softwareVersion = Vendor specific SGW software version
 - distinguishedName = The EMS distinguished name of the SGW
 - emsIpAddress = The IP address of the element management system
 -->
 <xs:element name="sgwFunctionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
```

```

<xs:element name="sgwFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sgwName" type="xs:string" minOccurs="1"/>
 <xs:element name="plmnList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="plmn" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mcc" type="xs:string" minOccurs="0"/>
 <xs:element name="mnc" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 <xs:element name="supportedPLMNs" minOccurs="0"/>
 <xs:element name="vendorName" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Nokia-Siemens"/>
 <xs:enumeration value="Alcatel-Lucent"/>
 <xs:enumeration value="Ericsson"/>
 <xs:enumeration value="Huawei"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="operationalState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Enabled"/>
 <xs:enumeration value="Disabled"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="administrativeState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Locked"/>
 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="vendorModuleType" type="xs:string" minOccurs="0"/>
 <xs:element name="softwareVersion" type="xs:string" minOccurs="0"/>
 <xs:element name="distinguishedName" type="xs:string" minOccurs="0"/>
 <xs:element name="emsIpAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!--
This section lists each logical LTE interface supported by the SGW function
- interfaceType = The type of LTE logical interface
- lteInterfaceDescription = Description of the LTE logical interface. Should contain
the interface type and be unique within the physical chassis.
- ipAddress = The IP address of the logical interface
- subNet = The subnetwork of the logical interface
- vLan = The VLAN to which the logical interface belongs
-->

 <xs:element name="lteInterfaceList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="lteInterface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceType" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="S1-U"/>
 <xs:enumeration value="S11"/>

```

```

 <xs:enumeration value="S4"/>
 <xs:enumeration value="S5"/>
 <xs:enumeration value="S8"/>
 <xs:enumeration value="OAM"/>
 </xs:restriction>
</xs:simpleType>
</xs:element>
<xs:element name="lteInterfaceDescription" type="xs:string"
minOccurs="1"/>

 <xs:element name="parentInterface" type="xs:string" minOccurs="1"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 <xs:element name="subNet" type="xs:string" minOccurs="0"/>
 <xs:element name="vLan" type="xs:string" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the S1-U interfaces which connect this
sgwFunction to EUTRAN enbFunctions.
- eNodeBName = The name of the enbFunction connected over this interface
- eNodeBIPAddr = The IP address on the connected enbFunction which supports this interface
- slULinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- slULinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="slUConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="slUConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="eNodeBName" type="xs:string" minOccurs="1"/>
 <xs:element name="eNodeBIPAddr" type="xs:string" minOccurs="0"/>
 <xs:element name="slULinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="slULinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains information on the S11 interfaces which connect this
sgwFunction to a peer mmeFunction
- mmeName = The name of the peer mmeFunction connected over this interface
- mmeCode = The MME Code of the peer mmeFunction connected over this interface
- mmeGroupId = The MME Group Id of the peer mmeFunction connected over this interface
- mmeMcc = The MCC of the peer mmeFunction connected over this interface
- mmeMnc = The MNC of the peer mmeFunction connected over this interface
- mmeIpAddr = The IP address on the connected mmeFunction which supports this interface
- s11LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s11LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s11ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s11Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>

```

```

 <xs:element name="mmeName" type="xs:string" minOccurs="1"/>
 <xs:element name="mmeCode" type="xs:string" minOccurs="0"/>
 <xs:element name="mmeGroupId" type="xs:string" minOccurs="0"/>
 <xs:element name="mcc" type="xs:string" minOccurs="0"/>
 <xs:element name="mnc" type="xs:string" minOccurs="0"/>
 <xs:element name="mmeIpAddr" type="xs:string" minOccurs="0"/>
 <xs:element name="s11LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s11LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<!--
This section contains information on the S4 interfaces which connect this
sgwFunction to an SGSN
- sgsnName = The name of the SGSN connected over this interface
- sgsnIpAddr = The IP address on the connected SGSN which supports this interface
- s4LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s4LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s4ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s4Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sgsnName" type="xs:string" minOccurs="1"/>
 <xs:element name="sgsnIpAddr" type="xs:string" minOccurs="0"/>
 <xs:element name="s4LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s4LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

<!--
This section contains information on the S5 interfaces which connect this
sgwFunction to a PGW
- pgwName = The name of the PGW connected over this interface
- pgwIpAddr = The IP address on the connected PGW which supports this interface
- s5LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s5LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s5ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s5Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>

```

```

 <xs:element name="pgwName" type="xs:string" minOccurs="1"/>
 <xs:element name="pgwIpAddr" type="xs:string" minOccurs="0"/>
 <xs:element name="s5LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s5LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<!--
This section contains information on the S8 interfaces which connect this
sgwFunction to a PGW
- pgwName = The name of the PGW connected over this interface
- pgwIpAddr = The IP address on the connected PGW which supports this interface
- s8LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s8LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s8ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s8Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="pgwName" type="xs:string" minOccurs="1"/>
 <xs:element name="pgwIpAddr" type="xs:string" minOccurs="0"/>
 <xs:element name="s8LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s8LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

<!--
This section contains information on the OAM interfaces which connect this
sgwFunction to an EMS
- oamName = The name of the EMS connected over this interface
- oamIpAddr = The IP address on the connected EMS which supports this interface
- oamLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the sgwFunction. The weight is expressed
 as a percentage.
- oamLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="oamConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamName" type="xs:string" minOccurs="1"/>
 <xs:element name="oamIpAddr" type="xs:string" minOccurs="1"/>
 <xs:element name="oamLinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="oamLinkUsage" minOccurs="0">

```

[illegible]

```
<sgwData>
 <parentChassisId>SGW-CHASSIS-01</parentChassisId>
 <parentChassisDn>PLMN/SGW-CHASSIS-01</parentChassisDn>
 <locationName>Southbank Switch Site</locationName>
 <latitude>10.00000</latitude>
 <longitude>-20.0000</longitude>
 <altitude>2</altitude>
 <timezoneOffset>102</timezoneOffset>
 <sgwFunctionList>
 <sgwFunction>
 <sgwName>SGW01</sgwName>
 <plmnList>
 <plmn>
 <mcc>123</mcc>
 <mnc>456</mnc>
 </plmn>
 </plmnList>
 <supportedPLMNs>1</supportedPLMNs>
 <vendorName>Nokia-Siemens</vendorName>
 <operationalState>Enabled</operationalState>
 <administrativeState>Unlocked</administrativeState>
 <vendorModuleType>SGWMODEL1</vendorModuleType>
 <softwareVersion>SGWSW1</softwareVersion>
 <distinguishedName>PLMN/SGW-01</distinguishedName>
 <emsIpAddress>12.34.56.78</emsIpAddress>
 <lteInterfaceList>
 <lteInterface>
 <interfaceType>S1-U</interfaceType>
 <lteInterfaceDescription>S1-MME</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.66.89</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S11</interfaceType>
 <lteInterfaceDescription>S11</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.66.88</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S5</interfaceType>

```

```

 <lteInterfaceDescription>S5</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.66.87</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>S8</interfaceType>
 <lteInterfaceDescription>S8</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.66.86</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>OAM</interfaceType>
 <lteInterfaceDescription>OAM</lteInterfaceDescription>
 <parentInterface>ETHERNET-2</parentInterface>
 <ipAddress>23.45.66.85</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
</lteInterfaceList>
<sluConnectionList>
 <sluConnection>
 <eNodeBName>ENodeB-01</eNodeBName>
 <eNodeBIPAddr>99.88.77.66</eNodeBIPAddr>
 </sluConnection>
 <sluConnection>
 <eNodeBName>ENodeB-02</eNodeBName>
 <eNodeBIPAddr>99.88.77.55</eNodeBIPAddr>
 </sluConnection>
</sluConnectionList>
<s11ConnectionList>
 <s11Connection>
 <mmeName>MME-01</mmeName>
 <mmeIPAddr>77.33.22.11</mmeIPAddr>
 </s11Connection>
</s11ConnectionList>
<s4ConnectionList>
 <s4Connection>
 <sgsnName>SGSN-01</sgsnName>
 <sgsnIPAddr>44.33.22.11</sgsnIPAddr>
 </s4Connection>
</s4ConnectionList>
<s5ConnectionList>
 <s5Connection>
 <pgwName>PGW-01</pgwName>
 <pgwIPAddr>55.33.22.11</pgwIPAddr>
 </s5Connection>
</s5ConnectionList>
<s8ConnectionList>
 <s8Connection>
 <pgwName>PGW-66</pgwName>
 <pgwIPAddr>77.33.22.11</pgwIPAddr>
 </s8Connection>
</s8ConnectionList>
<oamConnectionList>
 <oamConnection>
 <oamName>OAM-01</oamName>
 <oamIPAddr>99.33.22.11</oamIPAddr>
 </oamConnection>
</oamConnectionList>
</sgwFunction>
</sgwFunctionList>
</sgwData>

```



## GetPgwData()

The Collector implementation of GetPgwData() is responsible for returning information relating to the Packet Gateway (aka Packet Data Network Gateway) (PGW) network element of a Long Term Evolution (LTE) mobile communications network. A device implementing PGW functionality should be identified by returning the lteFunction value "PGW" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

Network Manager processes the returned data to populate configuration parameters and connectivity information for the PGW.

<b>Name:</b>	GetPgwData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's LTE Collector agent.
<b>Data Definition:</b>	
<pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="pgwData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt;         &lt;!--           - parentChassisId = Identifier of the physicalChassis supporting the pgwFunction (as             by GetDeviceList())           - parentChassisDn = The distinguished name of the PGW physicalChassis as             known by the EMS           - locationName = Identifier for the geographic location at which the PGW is             located           - latitude = Angular distance in decimal degrees east (+) and west (-) from the             prime meridian on the earth's surface. e.g. 35.832636.(WGS84 standard)           - longitude = Angular distance in decimal degrees north (+) and south (-) from the             equator on the earth's surface. e.g. -78.838753 (WGS84 standard)           - altitude = This is the vertical height in metres above WGS84 datum surface             (EGM96) of the geographical location           - timezoneOffset = Offset of geographic location local time from UTC in format             UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30         --&gt;         &lt;xs:element name="parentChassisId" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="locationName" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="latitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="longitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="altitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/&gt;         &lt;!--           The list of PGW functions supported by the physical chassis           - pgwName = Unique identifier of the pgwFunction within this physical chassis           A single PGW function can support multiple PLMNs. Each supported PLMN           is listed here:             - mcc = The Mobile Country Code (MCC) of the PLMN consisting of               three digits.             - mnc = The Mobile Network Code (MNC) of the PLMN consisting of two               or three digits.           - supportedPLMNs = The number of PLMNs supported by the PGW           - vendorName = The name of the PGW vendor           - operationalState = The operational state of the PGW           - administrativeState = The administrative state of the PGW           - vendorModuleType = Vendor specific PGW type           - softwareVersion = Vendor specific PGW software version           - distinguishedName = The EMS distinguished name of the PGW           - emsIpAddress = The IP address of the element management system         --&gt;         &lt;xs:element name="pgwFunctionList" minOccurs="0" maxOccurs="1"&gt;           &lt;xs:complexType&gt;             &lt;xs:sequence&gt;</pre>	

```

<xs:element name="pgwFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="pgwName" type="xs:string" minOccurs="1"/>
 <xs:element name="plmnList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="plmn" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mcc" type="xs:string" minOccurs="0"/>
 <xs:element name="mnc" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 <xs:element name="supportedPLMNs" minOccurs="0"/>
 <xs:element name="vendorName" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Nokia-Siemens"/>
 <xs:enumeration value="Alcatel-Lucent"/>
 <xs:enumeration value="Ericsson"/>
 <xs:enumeration value="Huawei"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="operationalState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Enabled"/>
 <xs:enumeration value="Disabled"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="administrativeState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Locked"/>
 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="vendorModuleType" type="xs:string" minOccurs="0"/>
 <xs:element name="softwareVersion" type="xs:string" minOccurs="0"/>
 <xs:element name="distinguishedName" type="xs:string" minOccurs="0"/>
 <xs:element name="emsIpAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
</xs:element>
<!--
This section lists each logical LTE interface supported by the PGW function
- interfaceType = The type of LTE logical interface
- lteInterfaceDescription = Description of the LTE logical interface. Should contain
 the interface type and be unique within the physical chassis.
- ipAddress = The IP address of the logical interface
- subNet = The subnetwork of the logical interface
- vLan = The VLAN to which the logical interface belongs
-->
 <xs:element name="lteInterfaceList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="lteInterface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceType" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="S5"/>
 <xs:enumeration value="S8"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

```

```

 <xs:enumeration value="Gx"/>
 <xs:enumeration value="OAM"/>
 </xs:restriction>
</xs:simpleType>
</xs:element>
<xs:element name="lteInterfaceDescription" type="xs:string" minOccurs="1"/>
<xs:element name="parentInterface" type="xs:string" minOccurs="1"/>
<xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
<xs:element name="subNet" type="xs:string" minOccurs="0"/>
<xs:element name="vLan" type="xs:string" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the S5 interfaces which connect this
pgwFunction to an SGW
- sgwName = The name of the SGW connected over this interface
- sgwIpAddr = The IP address on the connected SGW which supports this interface
- s5LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s5LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s5ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s5Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sgwName" type="xs:string" minOccurs="1"/>
 <xs:element name="sgwIpAddr" type="xs:string" minOccurs="1"/>
 <xs:element name="s5LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s5LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains information on the S8 interfaces which connect this
pgwFunction to an SGW
- sgwName = The name of the SGW connected over this interface
- sgwIpAddr = The IP address on the connected SGW which supports this interface
- s8LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s8LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s8ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s8Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sgwName" type="xs:string" minOccurs="1"/>
 <xs:element name="sgwIpAddr" type="xs:string" minOccurs="1"/>
 <xs:element name="s8LinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="s8LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>

```

```

 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
</xs:simpleType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<!--
This section contains information on the Gx interfaces which connect this
pgwFunction to a PCRF
- pcrfName = The name of the SGW connected over this interface
- pcrfIpAddr = The IP address on the connected SGW which supports this interface
- GxLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- GxLinkUsage = Indicates the usage of the link, where available and applicable
-->

 <xs:element name="GxConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="GxConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="pcrfName" type="xs:string" minOccurs="1"/>
 <xs:element name="pcrfIpAddr" type="xs:string" minOccurs="1"/>
 <xs:element name="GxLinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="GxLinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

<!--
This section contains information on the OAM interfaces which connect this
pgwFunction to an EMS
- oamName = The name of the EMS connected over this interface
- oamIpAddr = The IP address on the connected EMS which supports this interface
- oamLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the pgwFunction. The weight is expressed
 as a percentage.
- oamLinkUsage = Indicates the usage of the link, where available and applicable
-->

 <xs:element name="oamConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamName" type="xs:string" minOccurs="1"/>
 <xs:element name="oamIpAddr" type="xs:string" minOccurs="1"/>
 <xs:element name="oamLinkWeight" type="xs:integer" minOccurs="0"/>
 <xs:element name="oamLinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

```

**Example:**

Chapter 2: XML Schema &amp; GRPC/XML-RPC Method Reference

```

 <interfaceType>OAM</interfaceType>
 <lteInterfaceDescription>OAM</lteInterfaceDescription>
 <parentInterface>ETHERNET-2</parentInterface>
 <ipAddress>23.45.66.85</ipAddress>
 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
</lteInterfaceList>
<s5ConnectionList>
 <s5Connection>
 <sgwName>SGW-01</sgwName>
 <sgwIpAddr>77.33.22.11</sgwIpAddr>
 </s5Connection>
</s5ConnectionList>
<s8ConnectionList>
 <s8Connection>
 <sgwName>SGW-66</sgwName>
 <sgwIpAddr>77.33.21.11</sgwIpAddr>
 </s8Connection>
</s8ConnectionList>
<GxConnectionList>
 <GxConnection>
 <pcrfName>PCRF-01</pcrfName>
 <pcrfIpAddr>88.33.20.11</pcrfIpAddr>
 </GxConnection>
</GxConnectionList>
<oamConnectionList>
 <oamConnection>
 <oamName>OAM-01</oamName>
 <oamIpAddr>99.33.22.11</oamIpAddr>
 </oamConnection>
</oamConnectionList>
</pgwFunction>
</pgwFunctionList>
</pgwData>

```

## GetHssData()

The Collector implementation of GetHssData() is responsible for returning information relating to the Home Subscriber Server (HSS) network element of a mobile communications network. A device implementing HSS functionality should be identified by returning the lteFunction value "HSS" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

Network Manager processes the returned data to populate configuration parameters and connectivity information for the HSS.

<b>Name:</b>	GetHssData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's LTE Collector agent.

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="hssData">
 <xs:complexType>
 <xs:sequence>
 <!--
 - parentChassisId = Identifier of the physicalChassis supporting the hssFunction (as
 by GetDeviceList())
 - parentChassisDn = The distinguished name of the HSS physicalChassis as
 known by the EMS
 - locationName = Identifier for the geographic location at which the HSS is
 located
 - latitude = Angular distance in decimal degrees east (+) and west (-) from the
 prime meridian on the earth's surface. e.g. 35.832636.(WGS84 standard)
 - longitude = Angular distance in decimal degrees north (+) and south (-) from the
 equator on the earth's surface. e.g. -78.838753 (WGS84 standard)
 - altitude = This is the vertical height in metres above WGS84 datum surface
 (EGM96) of the geographical location
 - timezoneOffset = Offset of geographic location local time from UTC in format
 UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30
 -->
 <xs:element name="parentChassisId" type="xs:string" minOccurs="0"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>
 <!--
 The list of HSS functions supported by the physical chassis
 - hssName = Unique identifier of the hssFunction within this physical chassis
 A single HSS function can support multiple PLMNs. Each supported PLMN
 is listed here:
 - mcc = The Mobile Country Code (MCC) of the PLMN consisting of
 three digits.
 - mnc = The Mobile Network Code (MNC) of the PLMN consisting of two
 or three digits.
 - supportedPLMNs = The number of PLMNs supported by the HSS
 - vendorName = The name of the HSS vendor
 - operationalState = The operational state of the HSS
 - administrativeState = The administrative state of the HSS
 - vendorModuleType = Vendor specific HSS type
 - softwareVersion = Vendor specific HSS software version
 - distinguishedName = The EMS distinguished name of the HSS
 - emsIpAddress = The IP address of the element management system
 -->
 <xs:element name="hssFunctionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
```

```

<xs:element name="hssFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="hssName" type="xs:string" minOccurs="1"/>
 <xs:element name="plmnList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="plmn" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mcc" type="xs:string" minOccurs="0"/>
 <xs:element name="mnc" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 <xs:element name="supportedPLMNs" minOccurs="0"/>
 <xs:element name="vendorName" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Nokia-Siemens"/>
 <xs:enumeration value="Alcatel-Lucent"/>
 <xs:enumeration value="Ericsson"/>
 <xs:enumeration value="Huawei"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="operationalState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Enabled"/>
 <xs:enumeration value="Disabled"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="administrativeState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Locked"/>
 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="vendorModuleType" type="xs:string" minOccurs="0"/>
 <xs:element name="softwareVersion" type="xs:string" minOccurs="0"/>
 <xs:element name="distinguishedName" type="xs:string" minOccurs="0"/>
 <xs:element name="emsIpAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
</xs:element>
<!--
This section lists each logical LTE interface supported by the HSS function
- interfaceType = The type of LTE logical interface
- lteInterfaceDescription = Description of the LTE logical interface. Should contain
 the interface type and be unique within the physical chassis.
- ipAddress = The IP address of the logical interface
- subNet = The subnetwork of the logical interface
- vLan = The VLAN to which the logical interface belongs
-->
 <xs:element name="lteInterfaceList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="lteInterface"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceType" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="S6a"/>

```



```

 <xs:enumeration value="OAM"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="lteInterfaceDescription"
 type="xs:string" minOccurs="1"/>
 <xs:element name="parentInterface"
 type="xs:string" minOccurs="1"/>
 <xs:element name="ipAddress"
 type="xs:string" minOccurs="0"/>
 <xs:element name="subNet" type="xs:string" minOccurs="0"/>
 <xs:element name="vLan" type="xs:string" minOccurs="0"/>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the S6a interfaces which connect this
hssFunction to an MME
- mmeName = The name of the MME connected over this interface
- mmeIpAddr = The IP address on the connected MME which supports this interface
- s6aLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the mmeFunction. The weight is expressed
 as a percentage.
- s6aLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s6aConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s6aConnection"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mmeName" type="xs:string"
 minOccurs="1"/>
 <xs:element name="mmeIpAddr"
 type="xs:string" minOccurs="1"/>
 <xs:element name="s6aLinkWeight"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="s6aLinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
<!--
This section contains information on the OAM interfaces which connect this
hssFunction to an EMS
- oamName = The name of the EMS connected over this interface
- oamIpAddr = The IP address on the connected EMS which supports this interface
- oamLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the hssFunction. The weight is expressed
 as a percentage.
- oamLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="oamConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamConnection"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>

```

[illegible]

```
<hssData>
 <parentChassisId>HSS-CHASSIS-01</parentChassisId>
 <parentChassisDn>PLMN/HSS-CHASSIS-01</parentChassisDn>
 <locationName>Southbank Switch Site</locationName>
 <latitude>10.00000</latitude>
 <longitude>-20.0000</longitude>
 <altitude>2</altitude>
 <timezoneOffset>102</timezoneOffset>
 <hssFunctionList>
 <hssFunction>
 <hssName>SGW01</hssName>
 <plmnList>
 <plmn>
 <mcc>123</mcc>
 <mnc>456</mnc>
 </plmn>
 </plmnList>
 <supportedPLMNs>1</supportedPLMNs>
 <vendorName>Nokia-Siemens</vendorName>
 <operationalState>Enabled</operationalState>
 <administrativeState>Unlocked</administrativeState>
 <vendorModuleType>HSSMODEL1</vendorModuleType>
 <softwareVersion>HSSSW1</softwareVersion>
 <distinguishedName>PLMN/HSS-01</distinguishedName>
 <emsIpAddress>12.34.56.78</emsIpAddress>
 <lteInterfaceList>
 <lteInterface>
 <interfaceType>S6a</interfaceType>
 <lteInterfaceDescription>S6a</lteInterfaceDescription>
 <parentInterface>ETHERNET-1</parentInterface>
 <ipAddress>23.45.64.89</ipAddress>
 <subNet>255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
 <lteInterface>
 <interfaceType>OAM</interfaceType>
 <lteInterfaceDescription>OAM</lteInterfaceDescription>

```

```
<parentInterface>ETHERNET-2</parentInterface>
<ipAddress>23.45.64.85</ipAddress>
<subNet>255.255.255.252</subNet>
<vLan>2</vLan>
</lteInterface>
</lteInterfaceList>
<s6aConnectionList>
 <s6aConnection>
 <mmeName>MME-01</mmeName>
 <mmeIpAddr>77.33.26.11</mmeIpAddr>
 </s6aConnection>
</s6aConnectionList>
<oamConnectionList>
 <oamConnection>
 <oamName>OAM-01</oamName>
 <oamIpAddr>99.33.21.11</oamIpAddr>
 </oamConnection>
</oamConnectionList>
</hssFunction>
</hssFunctionList>
</hssData>
```

## GetPcrfData()

The Collector implementation of GetPcrfData() is responsible for returning information relating to the Policy and Charging Rules Function (PCRF) network element of a mobile communications network. A device implementing PCRF functionality should be identified by returning the lteFunction value "PCRF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

Network Manager processes the returned data to populate configuration parameters and connectivity information for the PCRF.

<b>Name:</b>	GetPcrfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer - Data source id (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's LTE Collector agent.

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="pcrfData">
 <xs:complexType>
 <xs:sequence>
 <!--
 - parentChassisId = Identifier of the physicalChassis supporting the pcrfFunction (as
 by GetDeviceList())
 - parentChassisDn = The distinguished name of the PCRF physicalChassis as
 known by the EMS
 - locationName = Identifier for the geographic location at which the PCRF is
 located
 - latitude = Angular distance in decimal degrees east (+) and west (-) from the
 prime meridian on the earth's surface. e.g. 35.832636.(WGS84 standard)
 - longitude = Angular distance in decimal degrees north (+) and south (-) from the
 equator on the earth's surface. e.g. -78.838753 (WGS84 standard)
 - altitude = This is the vertical height in metres above WGS84 datum surface
 (EGM96) of the geographical location
 - timezoneOffset = Offset of geographic location local time from UTC in format
 UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30
 -->
 <xs:element name="parentChassisId" type="xs:string" minOccurs="0"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>
 <!--
 The list of PCRF functions supported by the physical chassis
 - pcrfName = Unique identifier of the pcrfFunction within this physical chassis
 A single PCRF function can support multiple PLMNs. Each supported PLMN
 is listed here:
 - mcc = The Mobile Country Code (MCC) of the PLMN consisting of
 three digits.
 - mnc = The Mobile Network Code (MNC) of the PLMN consisting of two
 or three digits.
 - supportedPLMNs = The number of PLMNs supported by the PCRF
 - vendorName = The name of the PCRF vendor
 - operationalState = The operational state of the PCRF
 - administrativeState = The administrative state of the PCRF
 - vendorModuleType = Vendor specific PCRF type
 - softwareVersion = Vendor specific PCRF software version
 - distinguishedName = The EMS distinguished name of the PCRF
 - emsIpAddress = The IP address of the element management system
 -->
 <xs:element name="pcrfFunctionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="pcrfFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
```

```

<xs:sequence>
 <xs:element name="pcrfName" type="xs:string" minOccurs="1"/>
 <xs:element name="plmnList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="plmn" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mcc" type="xs:string" minOccurs="0"/>
 <xs:element name="mnc" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 <xs:element name="supportedPLMNs" minOccurs="0"/>
 <xs:element name="vendorName" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Nokia-Siemens"/>
 <xs:enumeration value="Alcatel-Lucent"/>
 <xs:enumeration value="Ericsson"/>
 <xs:enumeration value="Huawei"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="operationalState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Enabled"/>
 <xs:enumeration value="Disabled"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="administrativeState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Locked"/>
 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="vendorModuleType" type="xs:string" minOccurs="0"/>
 <xs:element name="softwareVersion" type="xs:string" minOccurs="0"/>
 <xs:element name="distinguishedName" type="xs:string" minOccurs="0"/>
 <xs:element name="emsIpAddress" type="xs:string" minOccurs="0"/>
<!--
This section lists each logical LTE interface supported by the PCRF function
- interfaceType = The type of LTE logical interface
- lteInterfaceDescription = Description of the LTE logical interface. Should contain
the interface type and be unique within the physical chassis.
- ipAddress = The IP address of the logical interface
- subNet = The subnetwork of the logical interface
- vLan = The VLAN to which the logical interface belongs
-->
 <xs:element name="lteInterfaceList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="lteInterface"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceType" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Gx"/>
 <xs:enumeration value="OAM"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

```

```

 </xs:simpleType>
 </xs:element>
 <xs:element name="lteInterfaceDescription"
 type="xs:string" minOccurs="1"/>
 <xs:element name="parentInterface"
 type="xs:string" minOccurs="1"/>
 <xs:element name="ipAddress"
 type="xs:string" minOccurs="0"/>
 <xs:element name="subNet" type="xs:string" minOccurs="0"/>
 <xs:element name="vLan" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the Gx interfaces which connect this
pcrfFunction to a PGW
- pgwName = The name of the PGW connected over this interface
- pgwIpAddr = The IP address on the connected PGW which supports this interface
- GxLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the pcrfFunction. The weight is expressed
 as a percentage.
- GxLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="GxConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="GxConnection"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="pgwName" type="xs:string" minOccurs="1"/>
 <xs:element name="pgwIpAddr"
 type="xs:string" minOccurs="1"/>
 <xs:element name="GxLinkWeight"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="GxLinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the OAM interfaces which connect this
pcrfFunction to an EMS
- oamName = The name of the EMS connected over this interface
- oamIpAddr = The IP address on the connected EMS which supports this interface
- oamLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the pcrfFunction. The weight is expressed
 as a percentage.
- oamLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="oamConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamConnection"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamName" type="xs:string" minOccurs="1"/>
 <xs:element name="oamIpAddr"
 type="xs:string" minOccurs="1"/>

```



```
<vLan>2</vLan>
</lteInterface>
</lteInterfaceList>
<GxConnectionList>
 <GxConnection>
 <pgwName>PGW-01</pgwName>
 <pgwIpAddr>77.33.26.11</pgwIpAddr>
 </GxConnection>
</GxConnectionList>
<oamConnectionList>
 <oamConnection>
 <oamName>OAM-01</oamName>
 <oamIpAddr>99.33.20.11</oamIpAddr>
 </oamConnection>
</oamConnectionList>
</pcrfFunction>
</pcrfFunctionList>
</pcrfData>
```



## GetEirData()

The Collector implementation of GetEirData() is responsible for returning information relating to the Equipment Identity Register (EIR) network element of a mobile communications network. A device implementing EIR functionality should be identified by returning the lteFunction value "EIR" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

Network Manager processes the returned data to populate configuration parameters and connectivity information for the EIR.

<b>Name:</b>	GetEirData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	(i) integer     - Data source id (s) string       - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's LTE Collector agent.

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="eirData">
 <xs:complexType>
 <xs:sequence>
<!--
 - parentChassisId = Identifier of the physicalChassis supporting the eirFunction (as
 by GetDeviceList())
 - parentChassisDn = The distinguished name of the EIR physicalChassis as
 known by the EMS
 - locationName = Identifier for the geographic location at which the EIR is
 located
 - latitude = Angular distance in decimal degrees east (+) and west (-) from the
 prime meridian on the earth's surface. e.g. 35.832636.(WGS84 standard)
 - longitude = Angular distance in decimal degrees north (+) and south (-) from the
 equator on the earth's surface. e.g. -78.838753 (WGS84 standard)
 - altitude = This is the vertical height in metres above WGS84 datum surface
 (EGM96) of the geographical location
 - timezoneOffset = Offset of geographic location local time from UTC in format
 UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30
-->
 <xs:element name="parentChassisId" type="xs:string" minOccurs="0"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>
<!--
 The list of EIR functions supported by the physical chassis
 - eirName = Unique identifier of the eirFunction within this physical chassis
 A single EIR function can support multiple PLMNs. Each supported PLMN
 is listed here:
 - mcc = The Mobile Country Code (MCC) of the PLMN consisting of
 three digits.
 - mnc = The Mobile Network Code (MNC) of the PLMN consisting of two
 or three digits.
 - supportedPLMNs = The number of PLMNs supported by the EIR
 - vendorName = The name of the EIR vendor
 - operationalState = The operational state of the EIR
 - administrativeState = The administrative state of the EIR
 - vendorModuleType = Vendor specific EIR type
 - softwareVersion = Vendor specific EIR software version
 - distinguishedName = The EMS distinguished name of the EIR
 - emsIpAddress = The IP address of the element management system
-->
 <xs:element name="eirFunctionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="eirFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
```

```

<xs:sequence>
 <xs:element name="eirName" type="xs:string" minOccurs="1"/>
 <xs:element name="plmnList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="plmn" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mcc" type="xs:string" minOccurs="0"/>
 <xs:element name="mnc" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 <xs:element name="supportedPLMNs" minOccurs="0"/>
 <xs:element name="vendorName" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Nokia-Siemens"/>
 <xs:enumeration value="Alcatel-Lucent"/>
 <xs:enumeration value="Ericsson"/>
 <xs:enumeration value="Huawei"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="operationalState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Enabled"/>
 <xs:enumeration value="Disabled"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="administrativeState" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Unknown"/>
 <xs:enumeration value="Locked"/>
 <xs:enumeration value="Unlocked"/>
 <xs:enumeration value="Shutting Down"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 <xs:element name="vendorModuleType" type="xs:string" minOccurs="0"/>
 <xs:element name="softwareVersion" type="xs:string" minOccurs="0"/>
 <xs:element name="distinguishedName" type="xs:string" minOccurs="0"/>
 <xs:element name="emsIpAddress" type="xs:string" minOccurs="0"/>
<!--
This section lists each logical LTE interface supported by the EIR function
- interfaceType = The type of LTE logical interface
- lteInterfaceDescription = Description of the LTE logical interface. Should contain
the interface type and be unique within the physical chassis.
- ipAddress = The IP address of the logical interface
- subNet = The subnetwork of the logical interface
- vLan = The VLAN to which the logical interface belongs
-->
 <xs:element name="lteInterfaceList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="lteInterface"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceType" minOccurs="1">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="S13"/>
 <xs:enumeration value="OAM"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

```

```

 </xs:simpleType>
 </xs:element>
 <xs:element name="lteInterfaceDescription"
 type="xs:string" minOccurs="1"/>
 <xs:element name="parentInterface" type="xs:string"
 minOccurs="1"/>
 <xs:element name="ipAddress"
 type="xs:string" minOccurs="0"/>
 <xs:element name="subNet" type="xs:string" minOccurs="0"/>
 <xs:element name="vLan" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the S13 interfaces which connect this
eirFunction to an MME
- mmeName = The name of the MME connected over this interface
- mmeIpAddr = The IP address on the connected MME which supports this interface
- s13LinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the eirFunction. The weight is expressed
 as a percentage.
- s13LinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="s13ConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s13Connection"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="mmeName"
 type="xs:string" minOccurs="1"/>
 <xs:element name="mmeIpAddr"
 type="xs:string" minOccurs="1"/>
 <xs:element name="s13LinkWeight"
 type="xs:integer" minOccurs="0"/>
 <xs:element name="s13LinkUsage" minOccurs="0">
 <xs:simpleType>
 <xs:restriction base="xs:string">
 <xs:enumeration value="Primary"/>
 <xs:enumeration value="Secondary"/>
 <xs:enumeration value="Backup"/>
 <xs:enumeration value="Other"/>
 </xs:restriction>
 </xs:simpleType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!--
This section contains information on the OAM interfaces which connect this
eirFunction to an EMS
- oamName = The name of the EMS connected over this interface
- oamIpAddr = The IP address on the connected EMS which supports this interface
- oamLinkWeight= An indication of the relative probability that the link will be
 used from the perspective of the eirFunction. The weight is expressed
 as a percentage.
- oamLinkUsage = Indicates the usage of the link, where available and applicable
-->
 <xs:element name="oamConnectionList" minOccurs="0" maxOccurs="1">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamConnection"
 minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="oamName"
 type="xs:string" minOccurs="1"/>

```



```

 <subNet>255.255.255.252</subNet>
 <vLan>2</vLan>
 </lteInterface>
</lteInterfaceList>
<s13ConnectionList>
 <s13Connection>
 <mmeName>MME-01</mmeName>
 <mmeIpAddr>77.33.26.11</mmeIpAddr>
 </s13Connection>
</s13ConnectionList>
<oamConnectionList>
 <oamConnection>
 <oamName>OAM-01</oamName>
 <oamIpAddr>99.33.20.11</oamIpAddr>
 </oamConnection>
</oamConnectionList>
</eirFunction>
</eirFunctionList>
</eirData>

```

## New gRPC/XML-RPC Methods for 5G Core and Enhanced LTE

### GetAmfData()

The Collector implementation of GetAmfData() is responsible for returning information relating to the Access and Mobility Management Function (AMF) network element of a 5G Core mobile communications network. A device implementing AMF functionality should be identified by returning the n5gFunction value "AMF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetAmfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	<ul style="list-style-type: none"> <li>- (i) integer - Data source id</li> <li>- (s) string - Device Id</li> </ul>
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the AMF
<b>Data Definition:</b> <pre> &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="n5gAMFData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt;         &lt;!--           - parentChassisId = Identifier of the physicalChassis supporting the AMF function             (as returned by GetDeviceList())           - parentChassisDn = The distinguished name of the AMF physicalChassis as known by the EMS           - locationName = Identifier for the geographic location at which the AMF is located           - latitude = Angular distance in decimal degrees east (+) and west (-) from the         --&gt; </pre>	

```

 prime meridian on the earth's surface. e.g. 35.832636 (WGS84 standard)
- longitude = Angular distance in decimal degrees north (+) and south (-) from the
 equator on the earth's surface. e.g. -78.838753 (WGS84 standard)
- altitude = Vertical height in metres above WGS84 datum surface (EGM96)
- timezoneOffset = Offset of geographic location local time from UTC in format
 UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30
-->
<xs:element name="parentChassisId" type="xs:string"/>
<xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
<xs:element name="locationName" type="xs:string" minOccurs="0"/>
<xs:element name="latitude" type="xs:string" minOccurs="0"/>
<xs:element name="longitude" type="xs:string" minOccurs="0"/>
<xs:element name="altitude" type="xs:string" minOccurs="0"/>
<xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

<!--
- guami = Globally Unique AMF Identifier
- servedPLMN = List of PLMNs served by this AMF
- supportedSlice = List of S-NSSAIs (Single Network Slice Selection Assistance Information)
- amfRegionId = AMF Region ID
- amfSetId = AMF Set ID
- amfPointer = AMF Pointer
-->
<xs:element name="guami" type="xs:string" minOccurs="0"/>
<xs:element name="servedPLMN" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="supportedSlice" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="amfRegionId" type="xs:string" minOccurs="0"/>
<xs:element name="amfSetId" type="xs:string" minOccurs="0"/>
<xs:element name="amfPointer" type="xs:string" minOccurs="0"/>

<!-- Interface connections -->
<xs:element name="n1Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n1Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedUE" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<xs:element name="n2Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>

```

```

 <xs:element name="n2Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedGNodeB" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

 <xs:element name="n8Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n8Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedUDM" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

 <xs:element name="n11Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n11Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedSMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>

 <xs:element name="n12Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n12Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>

```

```

 <xs:element name="connectedAUSF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<xs:element name="n14Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n14Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<xs:element name="n15Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n15Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedPCF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<xs:element name="n22Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n22Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedNSSF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

```



```

 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## GetSmfData()

The Collector implementation of GetSmfData() is responsible for returning information relating to the Session Management Function (SMF) network element of a 5G Core mobile communications network. A device implementing SMF functionality should be identified by returning the n5gFunction value "SMF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetSmfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	<ul style="list-style-type: none"> <li>- (i) integer - Data source id</li> <li>- (s) string - Device Id</li> </ul>
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the SMF

### Data Definition:

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="n5gSMFData">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="parentChassisId" type="xs:string"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

 <!--
 - smfInstanceId = Unique identifier for this SMF instance
 - servedPLMN = List of PLMNs served by this SMF
 - supportedSlice = List of S-NSSAIs supported
 - supportedDNN = List of Data Network Names supported
 -->
 <xs:element name="smfInstanceId" type="xs:string" minOccurs="0"/>
 <xs:element name="servedPLMN" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>

```

```

<xs:element name="supportedSlice" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="supportedDNN" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>

<!-- N4 Interface to UPF -->
<xs:element name="n4Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n4Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedUPF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N7 Interface to PCF -->
<xs:element name="n7Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n7Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedPCF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N10 Interface to UDM -->
<xs:element name="n10Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n10Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedUDM" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

```

```

</xs:element>

<!-- N11 Interface to AMF -->
<xs:element name="n11Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n11Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:schema>

```

## GetUpfData()

The Collector implementation of GetUpfData() is responsible for returning information relating to the User Plane Function (UPF) network element of a 5G Core mobile communications network. A device implementing UPF functionality should be identified by returning the n5gFunction value "UPF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetUpfData ()
<b>Signature:</b>	(is)
<b>Parameters:</b>	<ul style="list-style-type: none"> <li>- (i) integer - Data source id</li> <li>- (s) string - Device Id</li> </ul>
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the UPF
<b>Data Definition:</b> <pre> &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="n5gUPFData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt; </pre>	

```

<xs:element name="parentChassisId" type="xs:string"/>
<xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
<xs:element name="locationName" type="xs:string" minOccurs="0"/>
<xs:element name="latitude" type="xs:string" minOccurs="0"/>
<xs:element name="longitude" type="xs:string" minOccurs="0"/>
<xs:element name="altitude" type="xs:string" minOccurs="0"/>
<xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

<!--
- upfInstanceId = Unique identifier for this UPF instance
- supportedDNN = List of Data Network Names supported
- upfType = Type of UPF (PSA-UPF, I-UPF, A-UPF)
-->
<xs:element name="upfInstanceId" type="xs:string" minOccurs="0"/>
<xs:element name="supportedDNN" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
<xs:element name="upfType" type="xs:string" minOccurs="0"/>

<!-- N3 Interface to gNodeB -->
<xs:element name="n3Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n3Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedGNodeB" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N4 Interface to SMF -->
<xs:element name="n4Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n4Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedSMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

```

```

<!-- N6 Interface to Data Network -->
<xs:element name="n6Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n6Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedDN" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N9 Interface to other UPF -->
<xs:element name="n9Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n9Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedUPF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:schema>

```

## GetPcfData()

The Collector implementation of GetPcfData() is responsible for returning information relating to the Policy Control Function (PCF) network element of a 5G Core mobile communications network. A device implementing PCF functionality should be identified by returning the n5gFunction value "PCF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetPcfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	- (i) integer - Data source id - (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the PCF

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="n5gPCFData">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="parentChassisId" type="xs:string"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

 <!--
 - pcfInstanceId = Unique identifier for this PCF instance
 - supportedPolicyTypes = List of policy types supported
 -->
 <xs:element name="pcfInstanceId" type="xs:string" minOccurs="0"/>
 <xs:element name="supportedPolicyTypes" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>

 <!-- N5 Interface to AF -->
 <xs:element name="n5Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
```

```

 <xs:element name="n5Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
</xs:complexType>
</xs:element>

<!-- N7 Interface to SMF -->
<xs:element name="n7Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n7Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedSMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N15 Interface to AMF -->
<xs:element name="n15Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n15Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## GetUdmData()

The Collector implementation of GetUdmData() is responsible for returning information relating to the Unified Data Management (UDM) network element of a 5G Core mobile communications network. A device implementing UDM functionality should be identified by returning the n5gFunction value "UDM" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device

<b>Method Name:</b>	GetUdmData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	- (i) integer - Data source id - (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the UDM
<b>Data Definition:</b>  <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="n5gUDMData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt;         &lt;xs:element name="parentChassisId" type="xs:string"/&gt;         &lt;xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="locationName" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="latitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="longitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="altitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/&gt;          &lt;!--         - udmInstanceId = Unique identifier for this UDM instance         - supportedDataSets = List of data sets managed         --&gt;         &lt;xs:element name="udmInstanceId" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="supportedDataSets" type="xs:string" minOccurs="0" maxOccurs="unbounded"/&gt;          &lt;!-- N8 Interface to AMF --&gt;         &lt;xs:element name="n8Interfaces" minOccurs="0"&gt;           &lt;xs:complexType&gt;             &lt;xs:sequence&gt;               &lt;xs:element name="n8Interface" minOccurs="0" maxOccurs="unbounded"&gt;                 &lt;xs:complexType&gt;                   &lt;xs:sequence&gt;</pre>	



```

 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<!-- N10 Interface to SMF -->
<xs:element name="n10Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n10Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedSMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N13 Interface to AUSF -->
<xs:element name="n13Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n13Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAUSF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## GetAusfData()

The Collector implementation of GetAusfData() is responsible for returning information relating to the Authentication Server Function (AUSF) network element of a 5G Core mobile communications network. A device implementing AUSF functionality should be identified by returning the n5gFunction value "AUSF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetAusfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	- (i) integer - Data source id - (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the AUSF

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="n5gAUSFData">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="parentChassisId" type="xs:string"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

 <!--
 - ausfInstanceId = Unique identifier for this AUSF instance
 - supportedAuthMethods = List of authentication methods supported
 -->
 <xs:element name="ausfInstanceId" type="xs:string" minOccurs="0"/>
 <xs:element name="supportedAuthMethods" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>

 <!-- N12 Interface to AMF -->
 <xs:element name="n12Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n12Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:sequence>
 </xs:complexType>
 </xs:sequence>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:schema>
```

```

 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N13 Interface to UDM -->
<xs:element name="n13Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n13Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedUDM" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## GetNrfData()

The Collector implementation of GetNrfData() is responsible for returning information relating to the Network Repository Function (NRF) network element of a 5G Core mobile communications network. A device implementing NRF functionality should be identified by returning the n5gFunction value "NRF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetNrfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	<ul style="list-style-type: none"> <li>- (i) integer - Data source id</li> <li>- (s) string - Device Id</li> </ul>
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the NRF

## Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="n5gNRFDData">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="parentChassisId" type="xs:string"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

 <!--
 - nrfInstanceId = Unique identifier for this NRF instance
 - registeredNFProfiles = List of registered NF profiles
 -->
 <xs:element name="nrfInstanceId" type="xs:string" minOccurs="0"/>
 <xs:element name="registeredNFProfiles" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="nfProfile" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="nfInstanceId" type="xs:string"/>
 <xs:element name="nfType" type="xs:string"/>
 <xs:element name="nfStatus" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:schema>
```

## GetNssfData()

The Collector implementation of GetNssfData() is responsible for returning information relating to the Network Slice Selection Function (NSSF) network element of a 5G Core mobile communications network. A device implementing NSSF functionality should be identified by returning the n5gFunction value "NSSF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetNssfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	<ul style="list-style-type: none"> <li>- (i) integer - Data source id</li> <li>- (s) string - Device Id</li> </ul>
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the NSSF
<b>Data Definition:</b> <pre> &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="n5gNSSFData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt;         &lt;xs:element name="parentChassisId" type="xs:string"/&gt;         &lt;xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="locationName" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="latitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="longitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="altitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/&gt;          &lt;!--         - nssfInstanceId = Unique identifier for this NSSF instance         - supportedSlices = List of network slices supported         --&gt;         &lt;xs:element name="nssfInstanceId" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="supportedSlices" minOccurs="0"&gt;           &lt;xs:complexType&gt;             &lt;xs:sequence&gt;               &lt;xs:element name="slice" minOccurs="0" maxOccurs="unbounded"&gt;                 &lt;xs:complexType&gt;                   &lt;xs:sequence&gt;                     &lt;xs:element name="sNSSAI" type="xs:string"/&gt;                     &lt;xs:element name="sliceType" type="xs:string" minOccurs="0"/&gt;                   &lt;/xs:sequence&gt;                 &lt;/xs:complexType&gt;               &lt;/xs:element&gt;             &lt;/xs:sequence&gt;           &lt;/xs:complexType&gt;         &lt;/xs:element&gt;          &lt;!-- N22 Interface to AMF --&gt;         &lt;xs:element name="n22Interfaces" minOccurs="0"&gt;           &lt;xs:complexType&gt;             &lt;xs:sequence&gt; </pre>	

```

 <xs:element name="n22Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAMF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## GetNefData()

The Collector implementation of GetNefData() is responsible for returning information relating to the Network Exposure Function (NEF) network element of a 5G Core mobile communications network. A device implementing NEF functionality should be identified by returning the n5gFunction value "NEF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetNefData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	<ul style="list-style-type: none"> <li>- (i) integer - Data source id</li> <li>- (s) string - Device Id</li> </ul>
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the NEF

### Data Definition:

```

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="n5gNEFData">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="parentChassisId" type="xs:string"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:schema>

```

- nefInstanceId = Unique identifier for this NEF instance  
 - exposedAPIs = List of exposed APIs

```

-->
<xs:element name="nefInstanceId" type="xs:string" minOccurs="0"/>
<xs:element name="exposedAPIs" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>
<!-- N33 Interface to AF -->
<xs:element name="n33Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n33Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:schema>

```

## GetAfData()

The Collector implementation of GetAfData() is responsible for returning information relating to the Application Function (AF) network element of a 5G Core mobile communications network. A device implementing AF functionality should be identified by returning the n5gFunction value "AF" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetAfData()
<b>Signature:</b>	(is)
<b>Parameters:</b>	<ul style="list-style-type: none"> <li>- (i) integer - Data source id</li> <li>- (s) string - Device Id</li> </ul>
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G Core Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the AF
<b>Data Definition:</b> <pre> &lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="n5gAFData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt;         &lt;xs:element name="parentChassisId" type="xs:string"/&gt;         &lt;xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/&gt;       &lt;/xs:sequence&gt;     &lt;/xs:complexType&gt;   &lt;/xs:element&gt; &lt;/xs:schema&gt; </pre>	

```

<xs:element name="locationName" type="xs:string" minOccurs="0"/>
<xs:element name="latitude" type="xs:string" minOccurs="0"/>
<xs:element name="longitude" type="xs:string" minOccurs="0"/>
<xs:element name="altitude" type="xs:string" minOccurs="0"/>
<xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

<!--
- afInstanceId = Unique identifier for this AF instance
- applicationServices = List of application services provided
-->
<xs:element name="afInstanceId" type="xs:string" minOccurs="0"/>
<xs:element name="applicationServices" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>

<!-- N5 Interface to PCF -->
<xs:element name="n5Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n5Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedPCF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N33 Interface to NEF -->
<xs:element name="n33Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n33Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedNEF" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:schema>

```



## GetGnodebData()

The Collector implementation of GetGnodebData() is responsible for returning information relating to the gNodeB (5G Base Station) network element of a 5G RAN mobile communications network. A device implementing gNodeB functionality should be identified by returning the n5gFunction value "GNODEB" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device

<b>Method Name:</b>	GetGnodebData ()
<b>Signature:</b>	(is)
<b>Parameters:</b>	- (i) integer - Data source id - (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's 5G RAN Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the gNodeB
<b>Data Definition:</b>  <pre>&lt;?xml version="1.0" encoding="UTF-8"?&gt; &lt;xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"&gt;   &lt;xs:element name="n5gGNodeBData"&gt;     &lt;xs:complexType&gt;       &lt;xs:sequence&gt;         &lt;xs:element name="parentChassisId" type="xs:string"/&gt;         &lt;xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/&gt;          &lt;xs:element name="locationName" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="latitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="longitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="altitude" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/&gt;          &lt;!--         - gNodeBId = Globally unique identifier for the gNodeB         - gNodeBIdLength = Length of the gNodeB ID in bits         - plmnId = Public Land Mobile Network identifier         --&gt;         &lt;xs:element name="gNodeBId" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="gNodeBIdLength" type="xs:string" minOccurs="0"/&gt;         &lt;xs:element name="plmnId" type="xs:string" minOccurs="0"/&gt;          &lt;!-- NR Cells served by this gNodeB --&gt;         &lt;xs:element name="nrCells" minOccurs="0"&gt;           &lt;xs:complexType&gt;             &lt;xs:sequence&gt;               &lt;xs:element name="nrCell" minOccurs="0" maxOccurs="unbounded"&gt;</pre>	

```

 <xs:complexType>
 <xs:sequence>
 <!--
 - cellId = Unique identifier for the NR cell
 - cellName = Name of the NR cell
 - nci = NR Cell Identity
 - pci = Physical Cell Identity
 - tac = Tracking Area Code
 - arfcnDL = Absolute Radio Frequency Channel Number for downlink
 - arfcnUL = Absolute Radio Frequency Channel Number for uplink
 -->
 <xs:element name="cellId" type="xs:string"/>
 <xs:element name="cellName" type="xs:string" minOccurs="0"/>
 <xs:element name="nci" type="xs:string" minOccurs="0"/>
 <xs:element name="pci" type="xs:string" minOccurs="0"/>
 <xs:element name="tac" type="xs:string" minOccurs="0"/>
 <xs:element name="arfcnDL" type="xs:string" minOccurs="0"/>
 <xs:element name="arfcnUL" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N2 Interface connections to AMF -->
<xs:element name="n2Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n2Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedAMF" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- N3 Interface connections to UPF -->
<xs:element name="n3Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="n3Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>

```

```

 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedUPF" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<!-- Xn Interface connections to other gNodeBs -->
<xs:element name="xnInterfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="xnInterface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedGNodeB" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- GNB Functions for split architecture -->
<xs:element name="gnbFunctions" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <!-- GNBCUCP Function (Central Unit Control Plane) -->
 <xs:element name="gnbCucpFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="functionId" type="xs:string"/>
 <xs:element name="functionName" type="xs:string" minOccurs="0"/>
 <xs:element name="vendor" type="xs:string" minOccurs="0"/>
 <xs:element name="plmnId" type="xs:string" minOccurs="0"/>
 <!-- Fl-C connections to DU -->
 <xs:element name="flcConnections" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="flcConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="connectedDU" type="xs:string"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

```

```

 </xs:complexType>
 </xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- E1 connections to CU-UP -->
<xs:element name="e1Connections" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="e1Connection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="connectedCUUP" type="xs:string"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<!-- GNBCUUP Function (Central Unit User Plane) -->
<xs:element name="gnbCuupFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="functionId" type="xs:string"/>
 <xs:element name="functionName" type="xs:string" minOccurs="0"/>
 <xs:element name="vendor" type="xs:string" minOccurs="0"/>
 <xs:element name="plmnId" type="xs:string" minOccurs="0"/>
 <!-- F1-U connections to DU -->
 <xs:element name="fluConnections" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="fluConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="connectedDU" type="xs:string"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 <!-- E1 connections to CU-CP -->
 <xs:element name="e1Connections" minOccurs="0">

```

```

 <xs:complexType>
 <xs:sequence>
 <xs:element name="elConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="connectedCUCP" type="xs:string"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- GNB DU Function (Distributed Unit) -->
<xs:element name="gnbDuFunction" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="functionId" type="xs:string"/>
 <xs:element name="functionName" type="xs:string" minOccurs="0"/>
 <xs:element name="vendor" type="xs:string" minOccurs="0"/>
 <xs:element name="plmnId" type="xs:string" minOccurs="0"/>
 <!-- NR Cells managed by DU -->
 <xs:element name="nrCellsDU" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="nrCellDU" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="cellId" type="xs:string"/>
 <xs:element name="nci" type="xs:string" minOccurs="0"/>
 <xs:element name="pci" type="xs:string" minOccurs="0"/>
 <xs:element name="bandwidth" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
<!-- F1-C connections to CU-CP -->
<xs:element name="f1cConnections" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="f1cConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>

```

```

 <xs:element name="connectedCUCP" type="xs:string"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- F1-U connections to CU-UP -->
<xs:element name="fluConnections" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="fluConnection" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="connectedCUUP" type="xs:string"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## GetSaeGatewayData()

The Collector implementation of GetSaeGatewayData() is responsible for returning information relating to the SAE Gateway (System Architecture Evolution Gateway) network element of an LTE mobile communications network. A device implementing SAE Gateway functionality should be identified by returning the lteFunction value "SAEGW" as part of the extraInfo returned in the GetDeviceInfo() method invoked for that device.

<b>Method Name:</b>	GetSaeGatewayData ()
<b>Signature:</b>	(is)
<b>Parameters:</b>	- (i) integer - Data source id - (s) string - Device Id
<b>Status:</b>	Optional
<b>Usage:</b>	Called by Network Manager's LTE Collector agent. Network Manager processes the returned data to populate configuration parameters and connectivity information for the SAE Gateway.

### Data Definition:

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
 <xs:element name="lteSAEGatewayData">
 <xs:complexType>
 <xs:sequence>
 <!--
 - parentChassisId = Identifier of the physicalChassis supporting the SAE Gateway
 (as returned by GetDeviceList())
 - parentChassisDn = The distinguished name of the SAE Gateway physicalChassis as known by the
 EMS
 - locationName = Identifier for the geographic location at which the SAE Gateway is located
 - latitude = Angular distance in decimal degrees east (+) and west (-) from the
 prime meridian on the earth's surface. e.g. 35.832636 (WGS84 standard)
 - longitude = Angular distance in decimal degrees north (+) and south (-) from the
 equator on the earth's surface. e.g. -78.838753 (WGS84 standard)
 - altitude = Vertical height in metres above WGS84 datum surface (EGM96)
 - timezoneOffset = Offset of geographic location local time from UTC in format
 UTC-HH:MM or UTC+HH:MM e.g. UTC+10:30
 -->
 <xs:element name="parentChassisId" type="xs:string"/>
 <xs:element name="parentChassisDn" type="xs:string" minOccurs="0"/>
 <xs:element name="locationName" type="xs:string" minOccurs="0"/>
 <xs:element name="latitude" type="xs:string" minOccurs="0"/>
 <xs:element name="longitude" type="xs:string" minOccurs="0"/>
 <xs:element name="altitude" type="xs:string" minOccurs="0"/>
 <xs:element name="timezoneOffset" type="xs:string" minOccurs="0"/>

 <!--
 - saeGwId = Unique identifier for the SAE Gateway
 -->
 </xs:sequence>
 </xs:complexType>
 </xs:element>
</xs:schema>
```

```

- gatewayType = Type of gateway (Combined SGW/PGW, SGW-only, PGW-only)
- apn = Access Point Names supported
-->
<xs:element name="saeGwId" type="xs:string" minOccurs="0"/>
<xs:element name="gatewayType" type="xs:string" minOccurs="0"/>
<xs:element name="apn" type="xs:string" minOccurs="0" maxOccurs="unbounded"/>

<!-- S1-U Interface to eNodeB -->
<xs:element name="sluInterfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sluInterface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedENB" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- S5/S8 Interface to PGW -->
<xs:element name="s5s8Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s5s8Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedPGW" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>

<!-- S11 Interface to MME -->
<xs:element name="s11Interfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="s11Interface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>

```



```

 <xs:element name="connectedMME" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>

<!-- SGi Interface to external networks -->
<xs:element name="sgiInterfaces" minOccurs="0">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="sgiInterface" minOccurs="0" maxOccurs="unbounded">
 <xs:complexType>
 <xs:sequence>
 <xs:element name="interfaceId" type="xs:string"/>
 <xs:element name="connectedNetwork" type="xs:string" minOccurs="0"/>
 <xs:element name="ipAddress" type="xs:string" minOccurs="0"/>
 </xs:sequence>
 </xs:complexType>
 </xs:element>
 </xs:sequence>
 </xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:schema>

```

## Extending The XML Schema

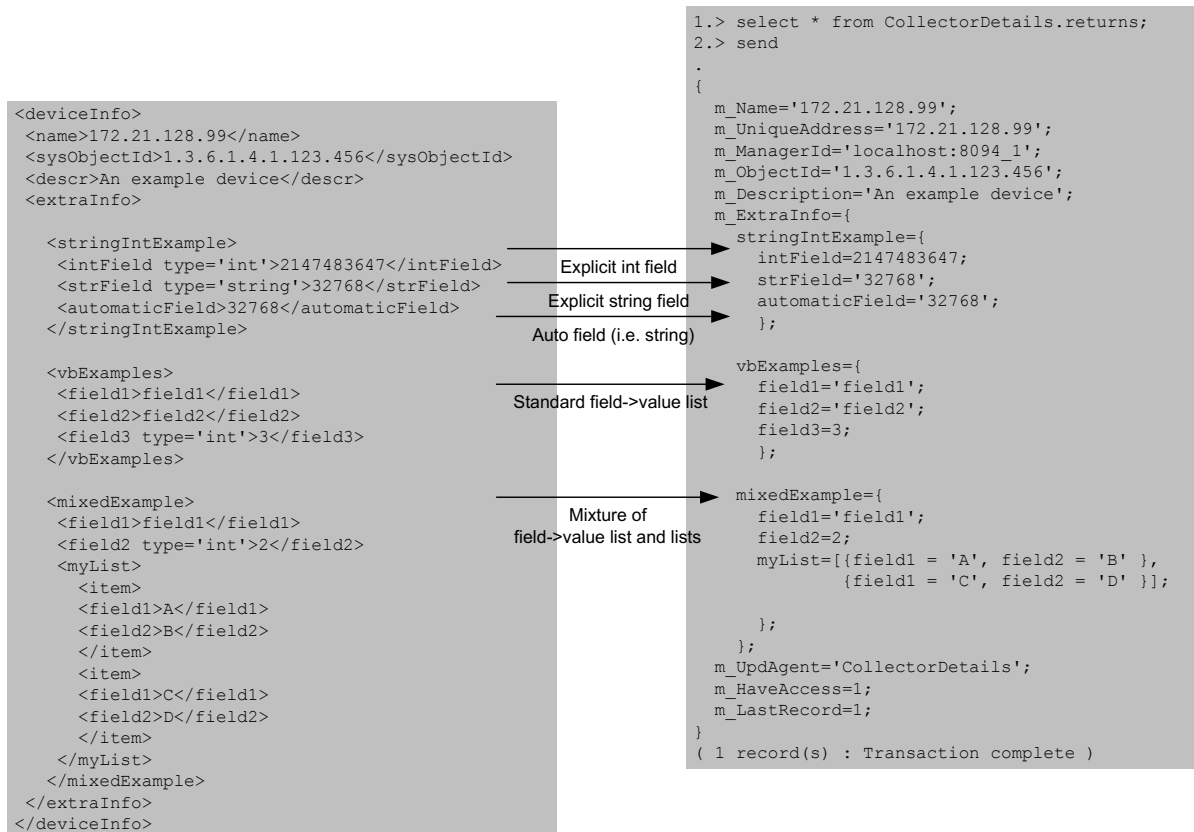
Some of the RPC method responses permit freeform data, which is denoted by the 'extraInfo' XML tag in their XML Schema. Within these tags any XML data will be converted and placed directly into the appropriate Collector agent's return table.

If no *type* attribute is specified, **Network Manager** interprets all data as strings and only treats lists as lists if there are multiple tags with the same name.

The diagrams below provide an example of how freeform XML tag structures are translated to produce an agent's return table data.



### Freeform List Data Example



## Freeform Data Example

---

## Chapter 3: Network Manager Collector Support

This section shows how Network Manager interacts with Collectors (i.e. how it acquires and processes Collector data). It is assumed that the user is familiar with the basic Network Manager architecture (finders, helpers, agents, stitchers).

Although Collectors can be developed without the user having much knowledge of this section, the user will benefit from the information presented here because it aids in debugging and testing Collectors.

---

### Collector Relevant Network Manager Processes

Network Manager's support for Collectors is provided by the following processes, which mirror the architecture for the existing Network Manager processes:

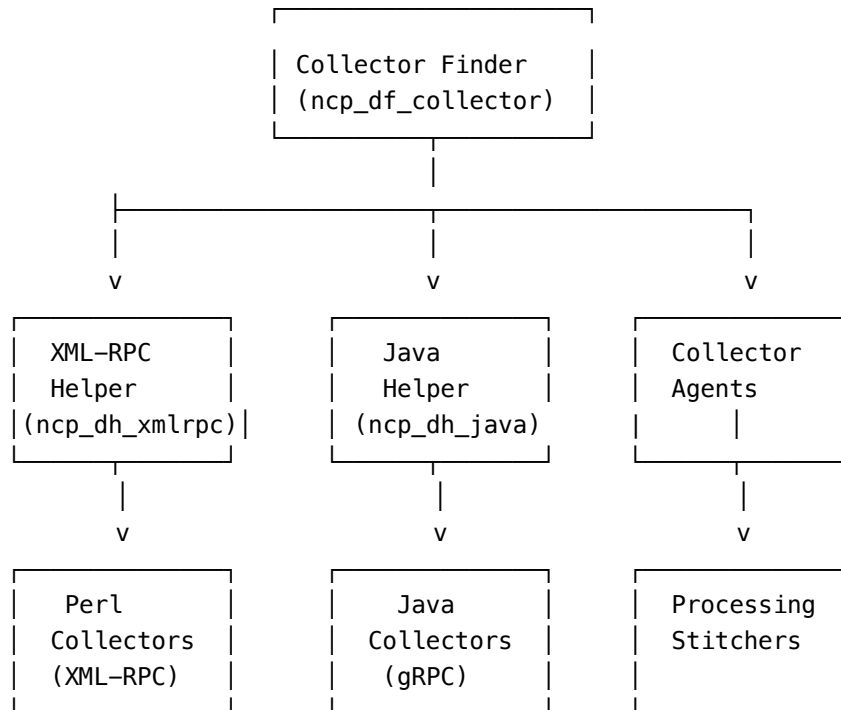
#### Collector Finder (ncp\_df\_collector)

Reads the Collector host/port seeds from DiscoCollectorFinderSeeds.cfg, and queries the Collector to get a list of managed devices. The Finder automatically detects whether the collector uses gRPC (Java) or XML-RPC (Perl) protocol.

- XML-RPC Helper (ncp\_dh\_xmlrpc)  
Relays XML-RPC requests from the Collector supporting agents to Collectors
- gRPC Helper (ncp\_dh\_java)  
Relays gRPC requests from the Collector supporting agents to Java Collectors
- Collector Agents  
The following agents support the downloading of data from Collectors:
  - CollectorDetails – Retrieves the sysObjectId, sysDescr, name data
  - CollectorInventory – Retrieves inventory, entity, and associated addresses data
  - CollectorLayer3 – Retrieves Layer 3 connectivity data
  - CollectorLayer2 – Retrieves Layer 2 connectivity data
  - CollectorLayer1 – Retrieves Layer 1 and Microwave connectivity data
  - CollectorVpn – Retrieves Layer 2 and Layer 3 VPN data
  - CollectorRAN – Retrieves RAN data
  - CollectorLTE – Retrieves LTE data (MME, eNodeB, SGW, PGW, etc.)
  - Collector5G – Retrieves 5G Core data (gNodeB, AMF, SMF, UPF, PCF, etc.)

Note: These agents work with both gRPC (Java) and XML-RPC (Perl) collectors.

- Custom Perl Agents  
Users can issue XML-RPC calls from their custom Perl Agents to Perl collectors.
- Custom Java Agents  
Users can issue gRPC calls from their custom Java Agents to Java collectors.



#### ***Note: User Defined Custom Perl Agents***

Users may wish to write their own custom Perl API based Collector Agents to gather any data from their Collectors that is not explicitly represented in the published XML Schema or that doesn't sit well within the standard XML-RPC calls.

In theory this could also be achieved by adding freeform data to the responses sent by the Collector to the standard Collector Agents, however using custom Agents and custom Collector methods can make the system easier to configure, understand and maintain.

A Perl API based Agent can issue any XML-RPC call but it will usually only make sense to issue calls that are not already covered by the existing Collector Agents: This essentially means calls to custom Collector methods via an XML-RPC call. The Perl Agent would then store the result for use in later stitching (possibly custom stitching).

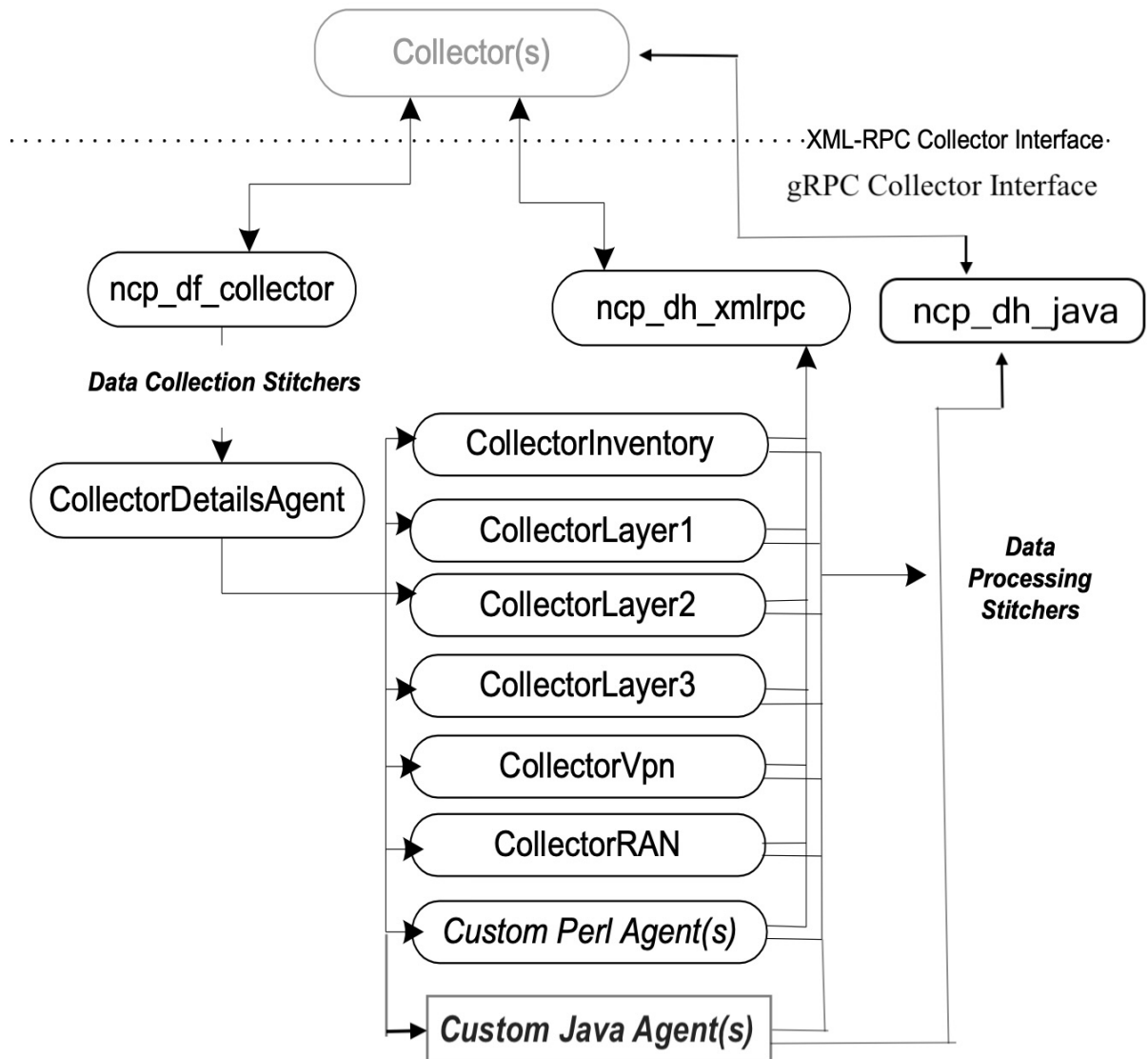
See GetXMLRPCData() and GetXMLRPCEntityData() in the Perl API documentation.

#### ***Note: User Defined Custom Java Agents***

Users may wish to write their own custom Java API based Collector Agents to gather any data from their Java gRPC Collectors that is not explicitly represented in the published XML Schema or that doesn't sit well within the standard gRPC calls.

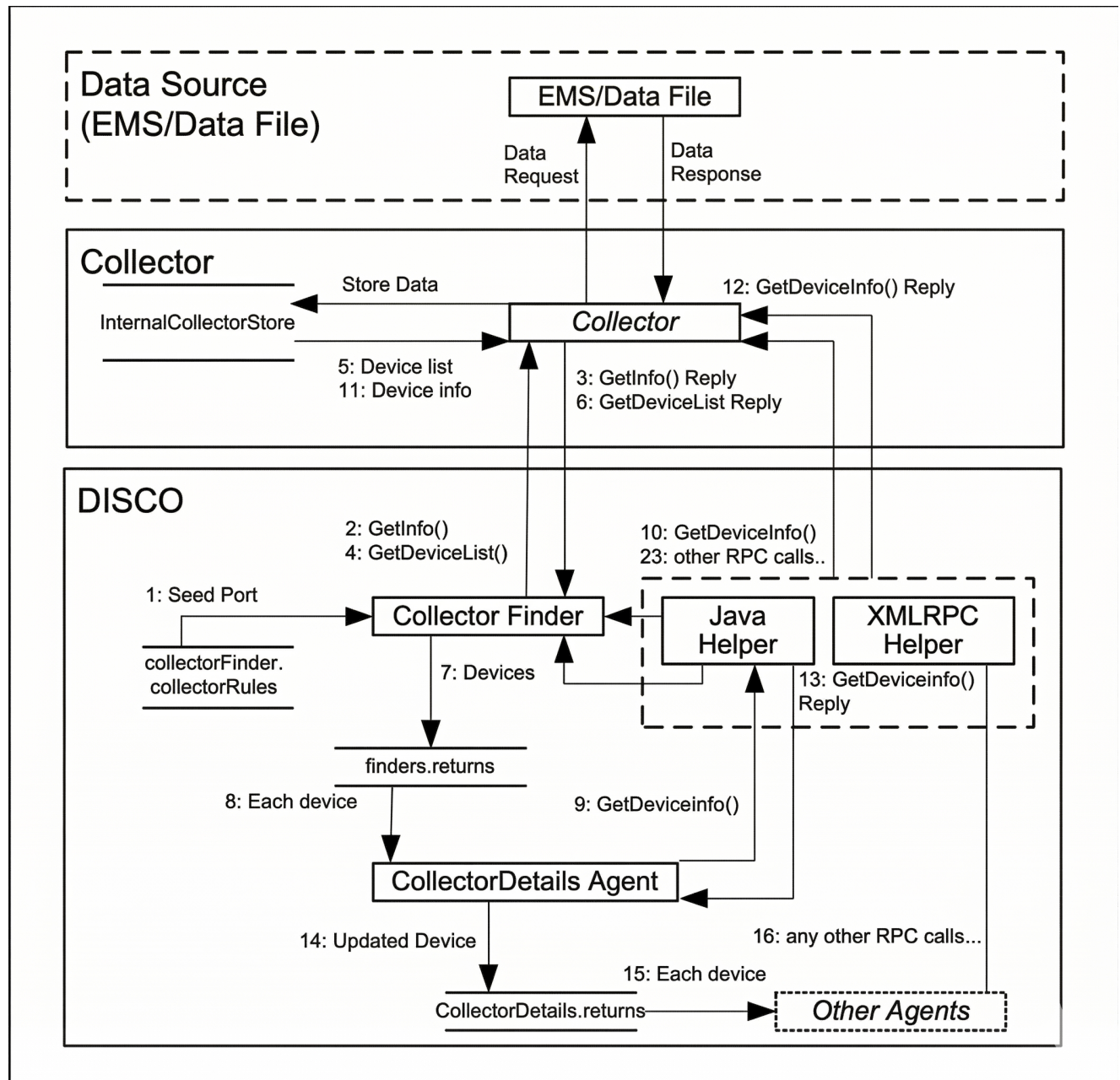
A Java API based Agent can issue any gRPC call but it will usually only make sense to issue calls that are not already covered by the existing Collector Agents. This essentially means calls to custom Collector methods via a gRPC call. The Java Agent would then store the result for use in later stitching (possibly custom stitching).

The interaction between these processes is shown in the figure below:



High Level View of Network Manager Collector Support

The sequence of events that occur during a Collector based discovery are shown in the following diagram.



Collector Discovery Sequence

The behavior is the same as in a standard **Network Manager** discovery, i.e.

- The user configures discovery seed(s)

The Collector Finder reads the seed(s) and automatically detects the collector protocol (gRPC for Java collectors, XML-RPC for Perl collectors). It then issues:

- UpdateData() request (to refresh the Collector's data)
- GetInfo() request (to get the data source(s) supported by the Collector)
- GetDeviceList() request (to list the devices managed by the Collector)

For Java collectors, these requests are sent via gRPC using Protocol Buffers.

For Perl collectors, these requests are sent via XML-RPC.

- The Collector Finder adds all Collector managed devices to finders, returns, noting the managing Collector/data source
- The CollectorDetails agents requests further information on the each device, and passes the updated device records to all Collector supporting agents
- Each Collector supporting agents requests data from the Collector,
  - For Java collectors: via the gRPC Helper
  - For Perl collectors: via the XML-RPC Helper (ncp\_dh\_xmlrpc)
- The agent outputs records in its returns table based on the Collector response. The XML data format is the same for both gRPC and XML-RPC responses.
- The data from all agents is used by the data processing stitchers to construct the topology

Each process is now described from the perspective of a collector development.

## The Collector Finder

Called RPC Methods: GetInfo(), UpdateData(), GetDevice()

Related Databases: finders.returns / finders.processing

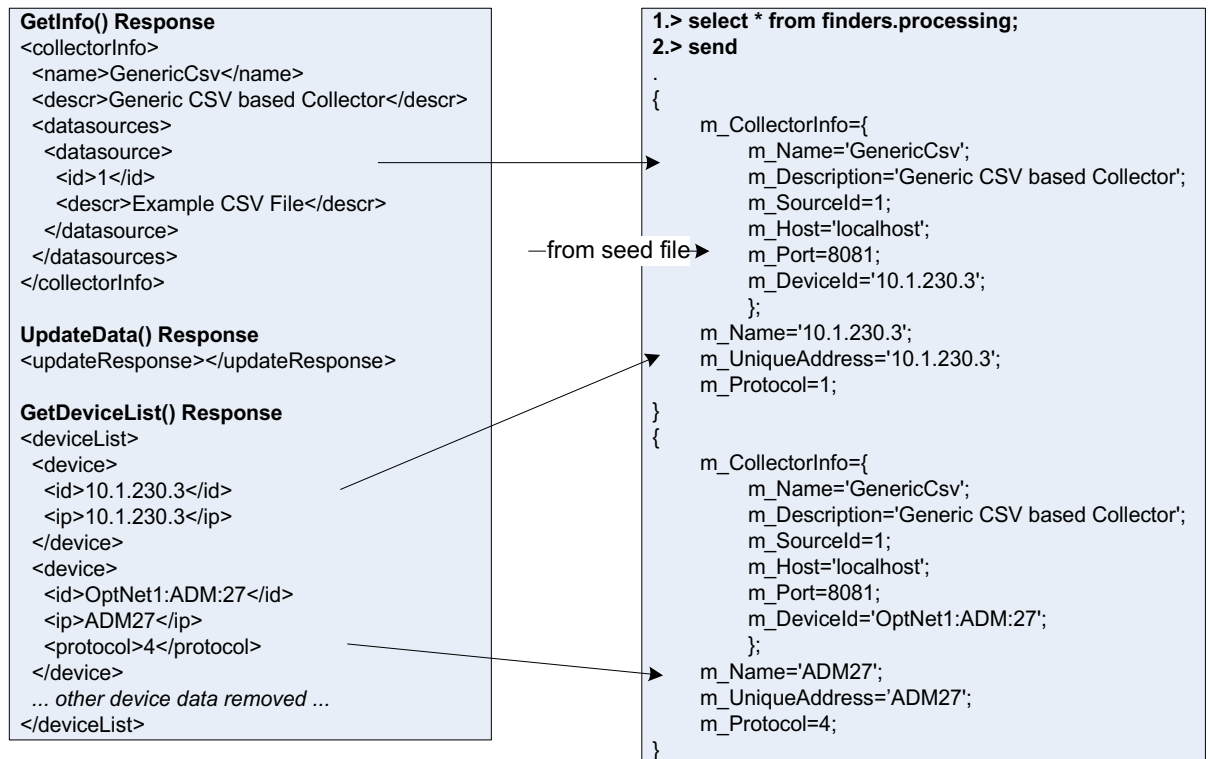
The Collector Finder, `ncp_df_collector`, is responsible for contracting all Collectors defined in the Collector seed file (`DiscoCollectorFinderSeeds.cfg`, which contains inserts into the `collectorFinder.collectorRules` database) and requesting a list of their supported data sources and a list of managed devices for each data source.

The Collector Finder populates the `finders.returns` table with a record for each managed device. Each record will include an `m_CollectorInfo` field that specifies the Collector and data source that manage the device.

The Figure below shows how the Collector's XML response maps to the records produced by this process.

Note: records in `finders.returns` are immediately moved to `finders.processing`. Therefore, only `finders.processing` is shown here.





XML to Network Manager Database Mapping

## The XML-RPC Helper

Called RPC Methods: relays all agent issued calls

Related Databases: n/a – use debug log output

The XML-RPC Helping, `ncp_dh_xmlrpc`, enables the **Network Manager** agents to communicate with the Collectors via XML-RPC using the **Network Manager Helper** system.

The Helper is configured via `DiscoXmlRpcHelperSchema.cfg` (`xmlRpcHelper.configuration`), and `DiscoHelperServerSchema.cfg` (`XmlRpcHelper.XmlRpcHelperConfig` table). Debug level 2 is recommended for basic issue investigation.

Note: the Collector Finder does not use this Helper to issue XML-RPC method calls.

## The Java Helper

Called RPC Methods: relays all agent issued calls

Related Databases:n/a – use debug log output

The gRPC Helper, `ncp_dh_java` (Java Helper), enables the **Network Manager** agents to communicate with the Collectors via gRPC using the **Network Manager Helper** system.

The Helper is configured via DiscoHelperServerSchema.cfg (JavaHelper.JavaHelperConfig table) and grpc-tls.properties(for TLS/SSL configuration).

The m\_GrpcPropertiesFile parameter specifies the path to the TLS properties file (default: /precision/platform/java/grpc-tls.properties).

Debug level 2 is recommended for basic issue investigation.

**Note:**The Collector Finder does not use this Helper to issue gRPC method calls. The gRPC Helper supports both secure (TLS) and insecure communication modes, and automatically handles protocol detection for backward compatibility with XML-RPC collectors.

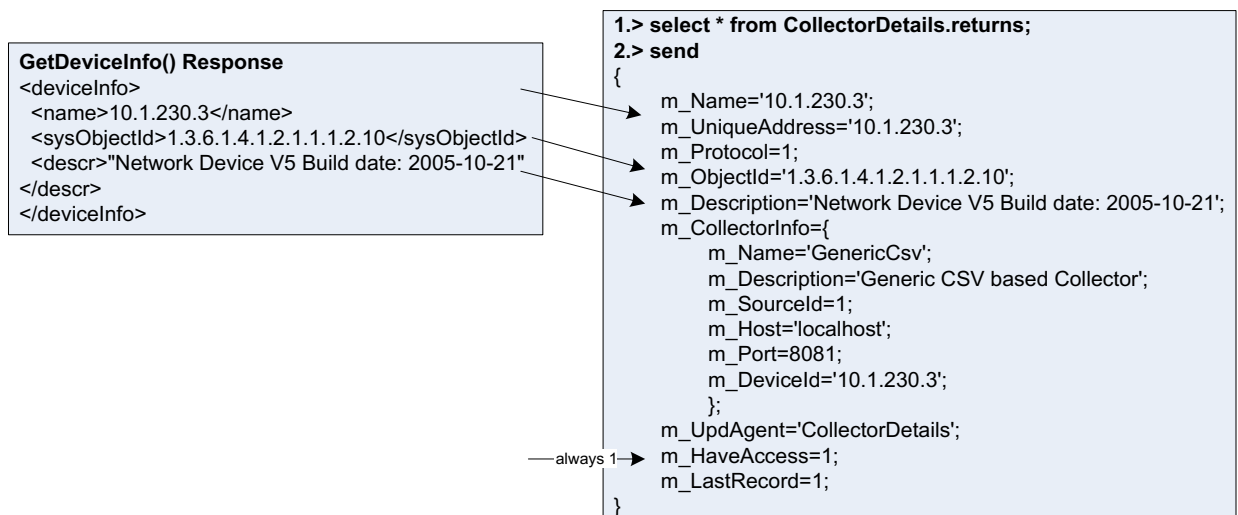
## The Collector Details Agent

Called RPC Method: GetDeviceInfo()

Related Databases: CollectorDetails.despatch, CollectorDetails.returns

The Collector Details agent, CollectorDetails, is the equivalent of the SNMP-based Details agent. It is responsible for gathering basic device information to enable **Network Manager** to decide which agents should process the device.

The agent's fields are populated from the Collector's XML data, as shown below.



### Collector XML to Network Manager Database Mapping

## The Collector Inventory Agent

Called RPC Methods: GetInventory(), GetEntities(), GetAssociatedAddresses()

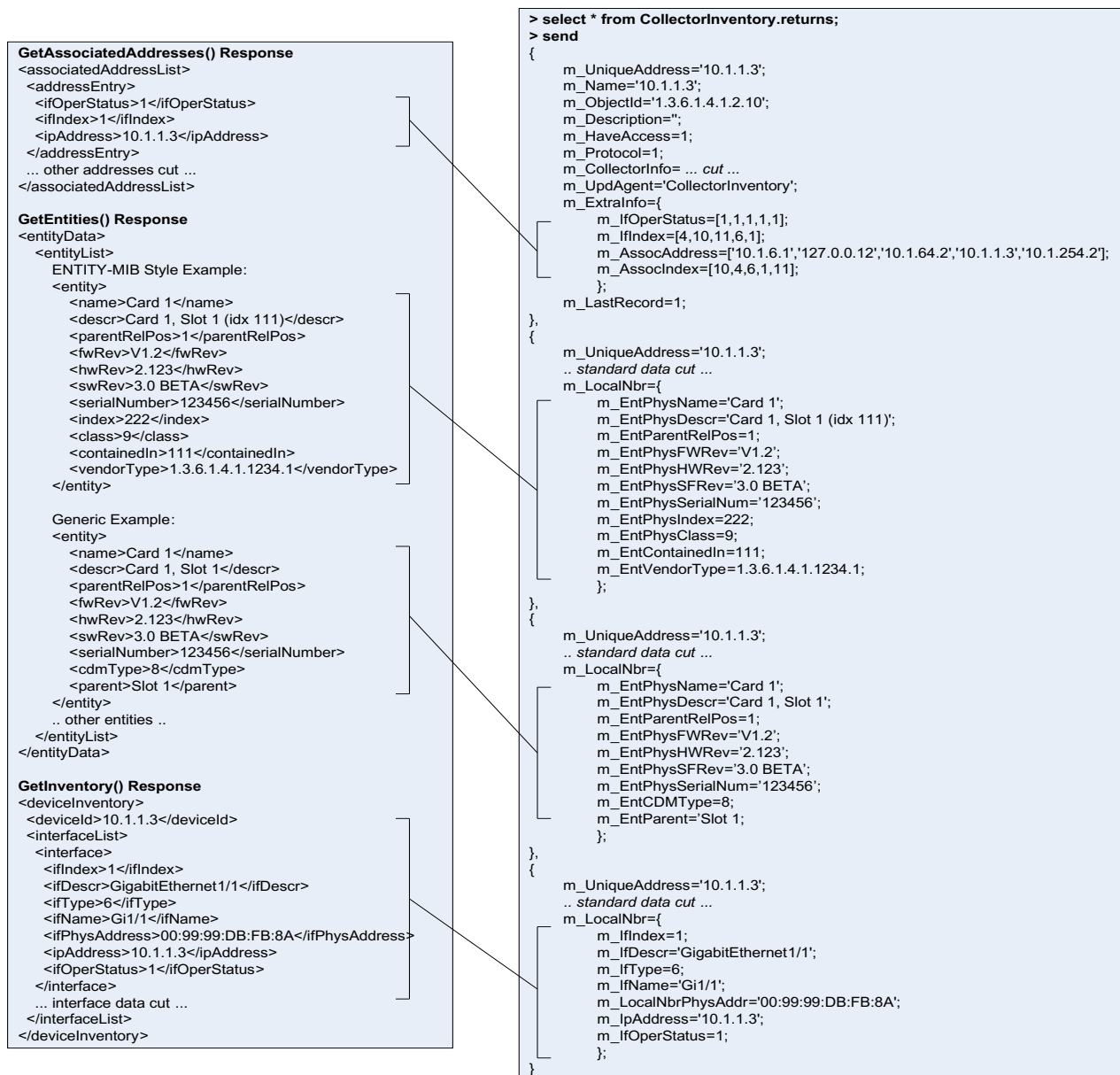
Related Databases: CollectorInventory.despatch, CollectorInventory.returns

The Collector Inventory agent, CollectorInventory, is the equivalent of the SNMP based Interface, Entity and AssocAddress agents.

It is responsible for gathering the following data:

- Interface information via the GetInventory() call. A new record is created in the returns table for each interface on the device
- ENTITY-MIB style entity information via the GetEntities() call. A new record is created in the returns table for each entity on the device. Note a more flexible generic form of entity information is also supported which relaxes the requirement for entities to have indexes (relationships are represented by names instead) and which supports a CDM entity type rather than class type.
- The IP addresses associated with the device, via the GetAssociatedAddresses() call. Associated address information is only added to the last record in the returns table (the one with m\_LastRecord = 1)

The agent's fields are populated from the Collector's XML data as shown in the Figure below.



## Collector XML to Network Manager Database Mapping

### ***Note: Where is my GetEntities() Chassis/Interface data going?***

Data from the GetEntities() response may be subject to some movement during post-Agent, pre-NCIM Network Manager containment stitching. This is not usually of any interest but when issue investigation requires a step through analysis of the dataflow it can be confusing to the uninitiated.

Data for all the entity types supported by GetEntities() will appear in the m\_LocalNbr fields of records in the CollectorInventory.returns table. From here for all types except Chassis and Port (interface) the data will be copied into the m\_ExtraInfo field of new entity records in workingEntities.finalEntity that represent the entity. Finally that data will be transferred to the relevant NCIM table.

For Chassis and Port(interface) entities it is slightly different as data records may already exist thanks to the GetDeviceInfo() and GetInventory() methods (see the note in the XML Schema reference as to why this is). Where possible

Network Managers containment stitching attempts to move the Chassis/Port(Interface) data from GetEntities() and merge it with the existing data record.

For chassis records the GetEntities() data will get copied from the m\_LocalNbr field of CollectorInventory.returns to the m\_ExtraInfo field of the existing Type 1 (main entity) record for the device in workingEntities.finalEntity.

For Ports (interfaces) the containment stitchers attempt to resolve the associated GetInventory() interface data record by matching the interface's RFC1213 ifName or ifDescr to the port's ENTITY-MIB entPhysicalName or entPhysicalDescr. Where the an interface and port cannot not be tied up a new port entity is created for the ENTITY-MIB data to represent the port/interface. In either case the GetEntities() data will be placed in under the m\_LocalNbr field (NOT m\_ExtraInfo) of the Type 2 (interface) record in workingEntities.finalEntity (wether that be the existing records or newly created one).

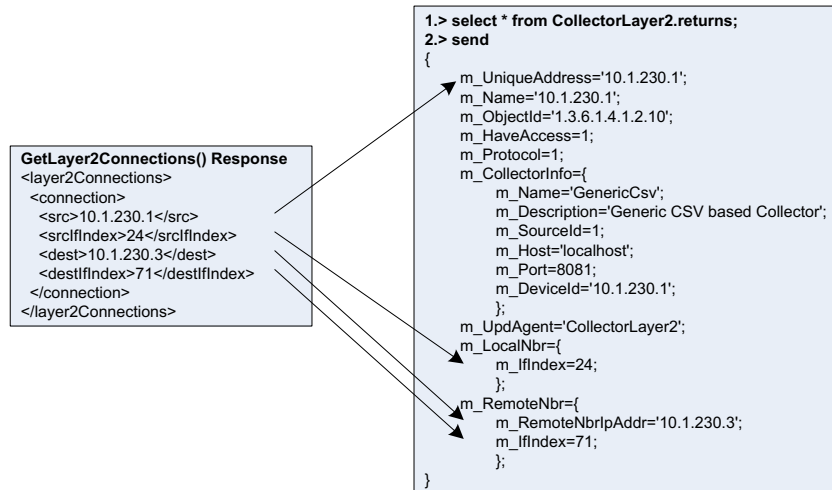
## **The Collector Layer 2 Agent**

Called RPC Method: GetLayer2Connections()

Related Databases: CollectorLayer2.despatch, CollectorLayer2.returns, CollectorSwitchLayer.entityByNeighbor

The Collector Layer 2 agent, CollectorLayer2, is the equivalent of the SNMP-based layer 2 connectivity agents. It is responsible for gathering all Collector layer 2 connectivity data and outputting that data in its returns table as standard Network Manager local and remote neighbor data.

The agent's fields are populated from the Collector's XML data as shown below.



## Collector XML to Network Manager Database Mapping

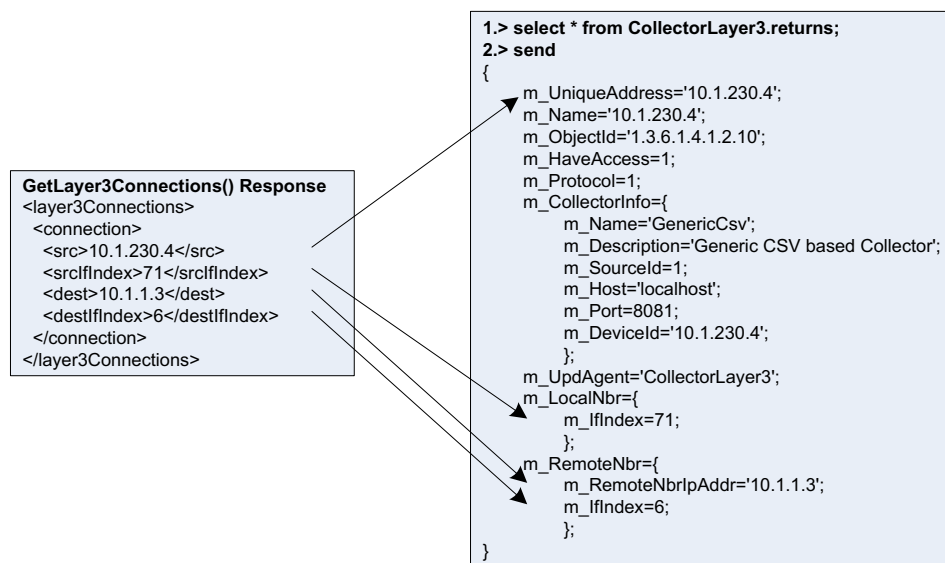
### The Collector Layer 3 Agent

Called RPC Method: GetLayer3Connections()

Related Databases: CollectorLayer3.despatch, CollectorLayer3.returns

The Collector Layer 3 agents, CollectorLayer3, is the equivalent of the SNMP-based layer 3 connectivity agents. It is responsible for gathering all Collector layer 3 connectivity data and outputting that data in its returns table as standard Network Manager local and remote neighbor data.

The agent's fields are populated from the Collector's XML data as shown below.



## Collector XML to Network Manager Database Mapping

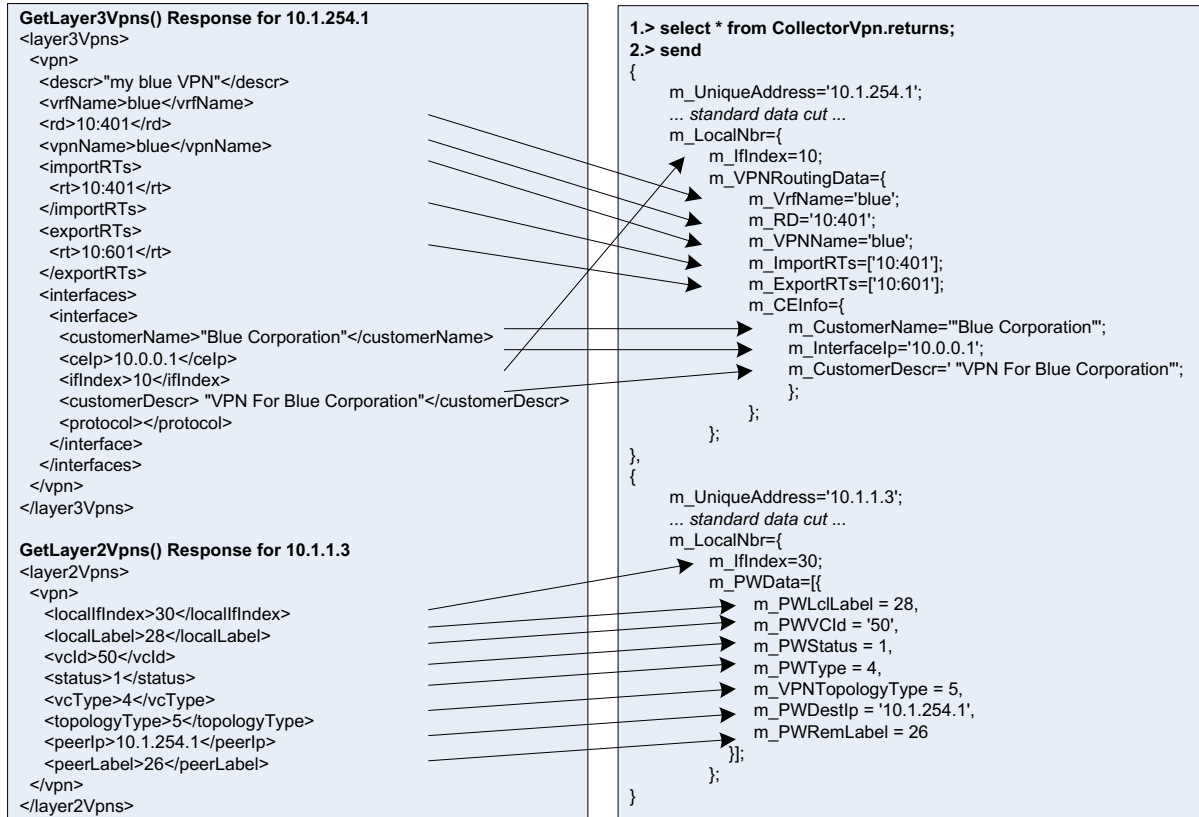
## The Collector VPN Agent

Called RPC Methods: GetLayer2Vpns(), GetLayer3Vpns()

Related Databases: CollectorVpn.despatch, CollectorVpn.returns

The Collector VPN agent, CollectorVpn, is the equivalent of the SNMP-based MPLS VPN agents. The agent is responsible for gathering all Collector VPN data and outputting it in its returns as standard Network Manager VPN data.

The agent's fields are populated from the Collector's XML data as shown below.



### Collector XML to Network Manager Database Mapping

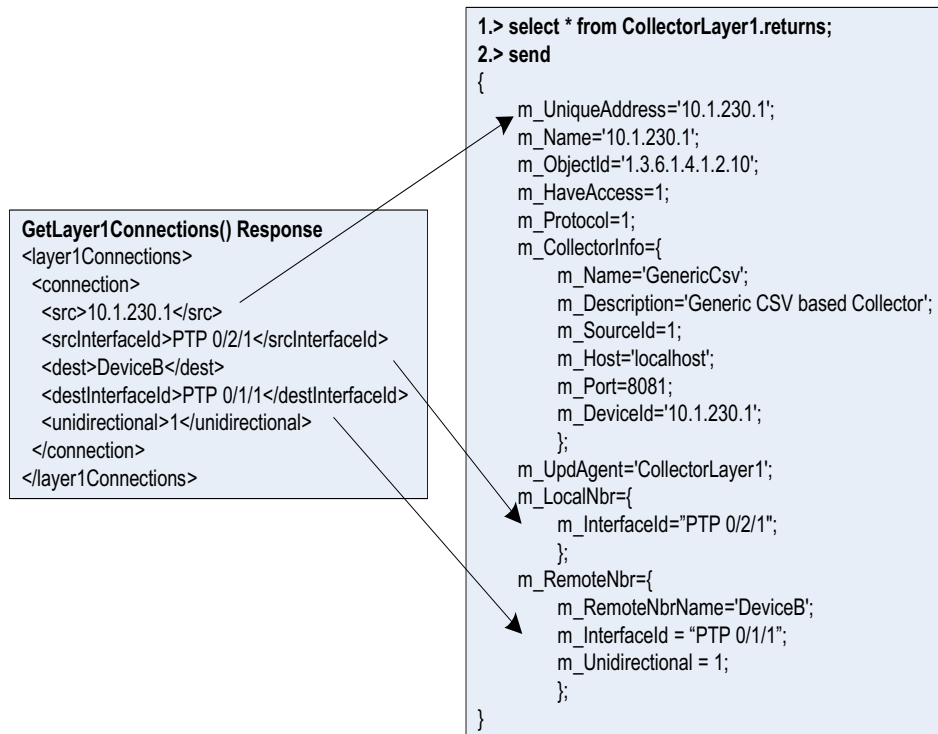
## The Collector Layer 1 Agent

Called RPC Method: GetLayer1Connections(), GetConnections(<Microwave>)

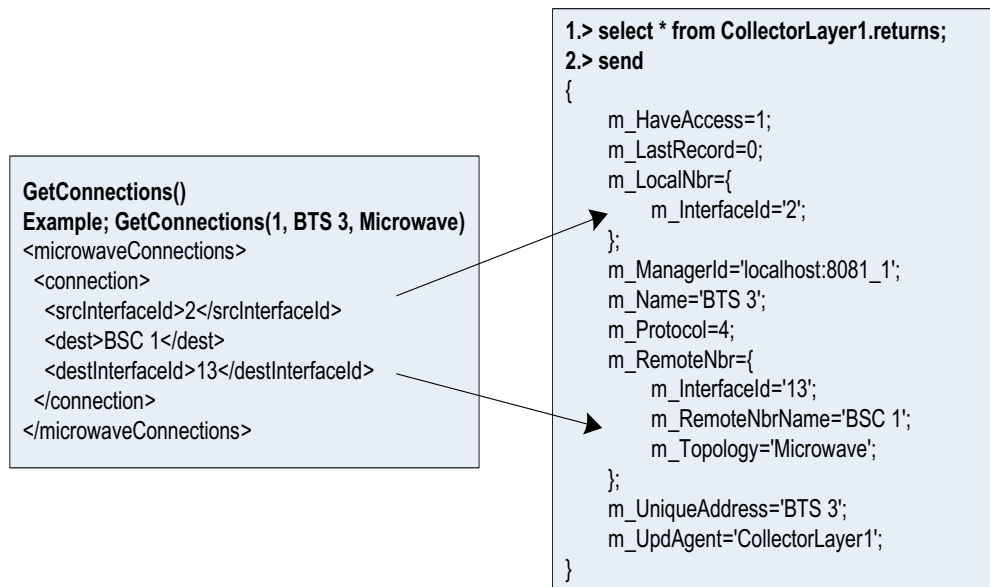
Related Databases: CollectorLayer1.despatch, CollectorLayer1.returns, CollectorL1Layer.entityByNeighbor, MicrowaveLayer.entityByNeighbor

The Collector Layer 1 agent, CollectorLayer1, is responsible for gathering all Collector layer 1 connectivity data and outputting that data in its returns table as standard Network Manager local and remote neighbor data.

The agent's fields are populated from the Collector's XML data as shown below.



Collector XML to Network Manager Database Mapping



Collector XML to Network Manager Database Mapping

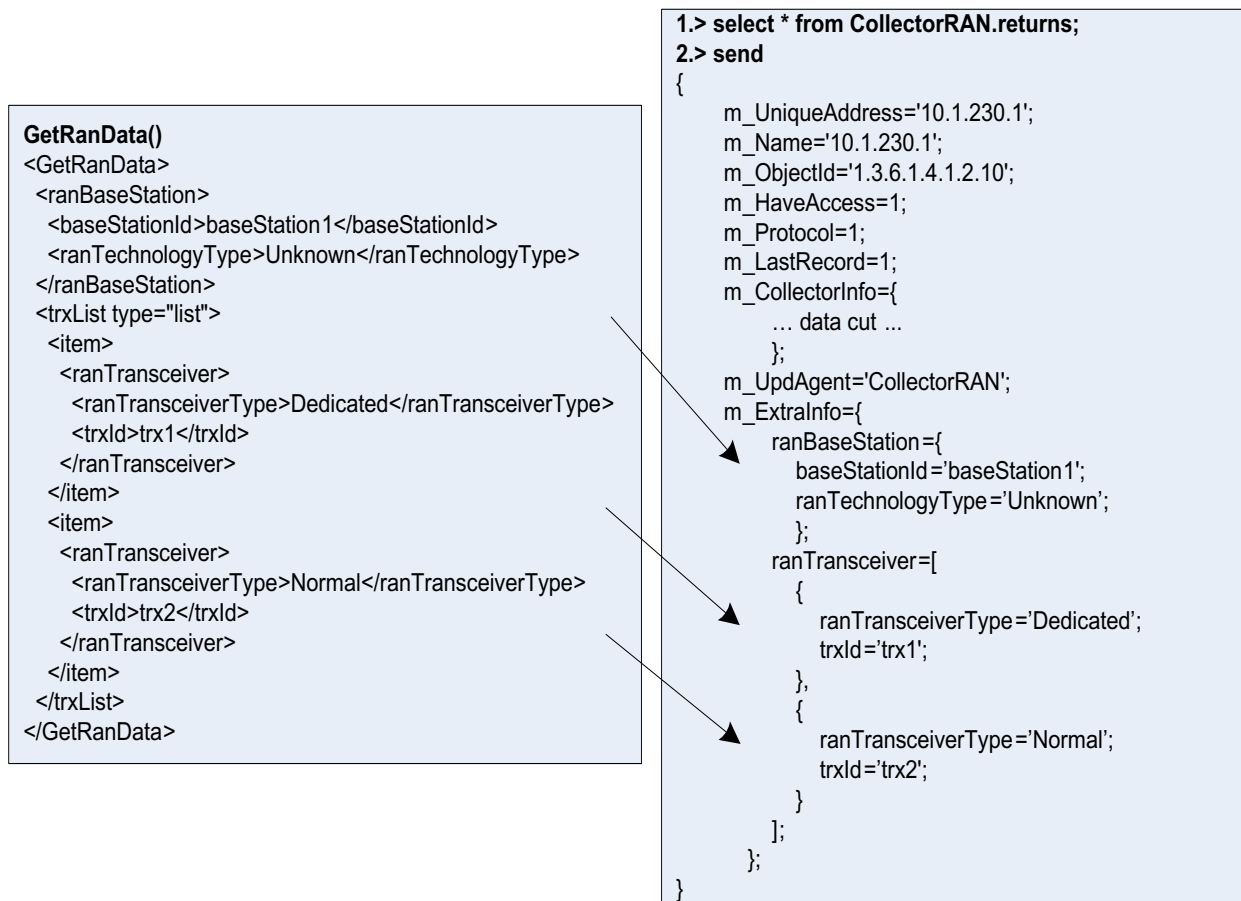
## The Collector RAN Agent

Called RPC Method: GetRanData(), GetConnections(<RAN>)

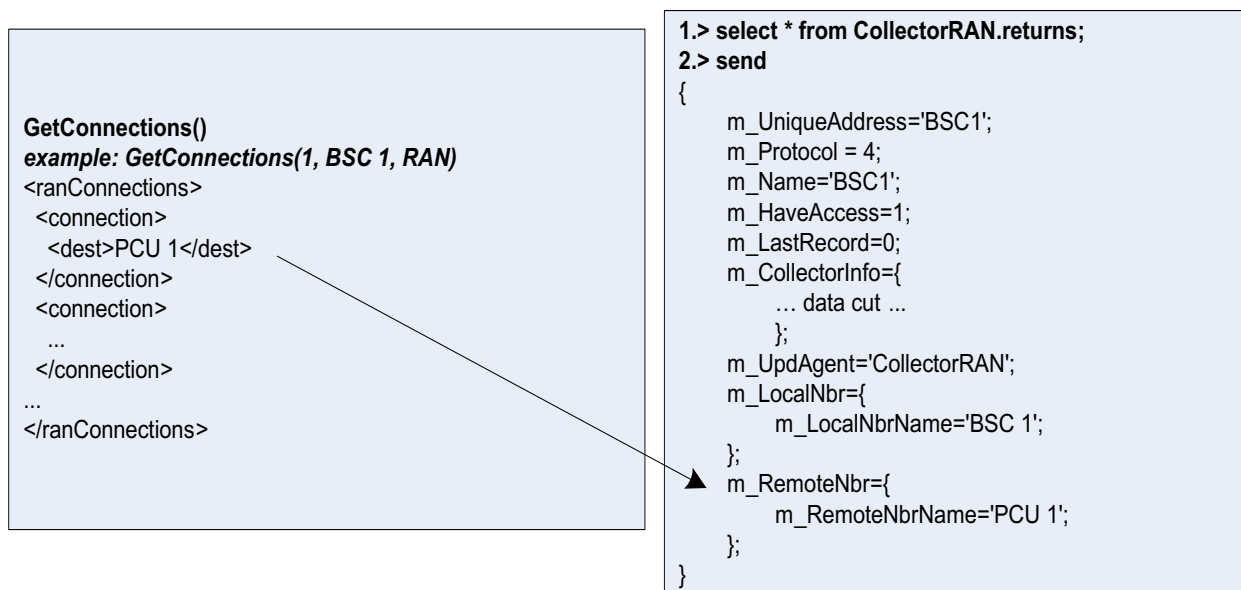
Related Databases: CollectorRAN.despatch, CollectorRAN.returns

The Collector RAN agent, CollectorRAN, is responsible for gathering all Collector RAN data and outputting that data in its returns table. It also gathers logical RAN connectivity data and outputs that data in its returns table as standard Network Manager local and remote neighbor data.

The agent's fields are populated from the Collector's XML data as shown below.



### Collector XML to Network Manager Database Mapping



### Collector XML to Network Manager Database Mapping



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## Collector-Relevant Network Manager Data Flow

While the previous section detailed which process databases hold certain data, this section shows how that data flows through those databases during a discovery, enabling a more efficient pinpointing of any issues.

Network Manager's data stitching works in two stages

- Data collection stitching (finders to agents)
- Data processing stitching (agents to scratchTopology)

You are most likely be interested in the data collection stitching when **Network Manager** does not appear to be discovering anything. If the agents are known to be returning the correct data but the end result in, for example, the GUI is incorrect then you will be more interested in the data processing stitching.

In addition to these stages, there are different modes of discovery that can alter stitching behavior:

- Full Discovery (discover all devices according to the configured seeds and scope)
- Partial Re-discovery (rediscover a subnet or device)

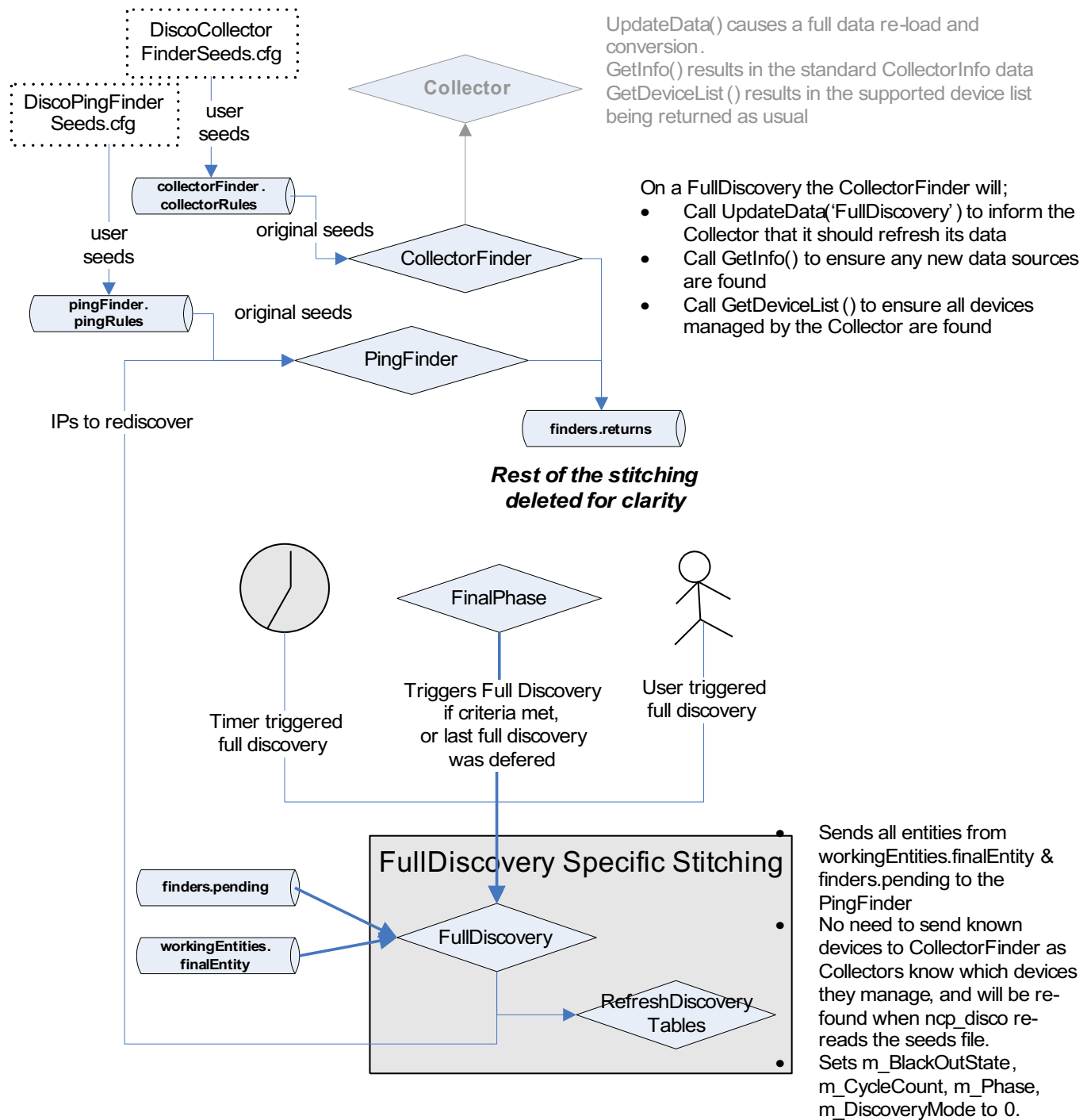
First the data collection and processing stitching for a full discovery will be presented, followed by a section on partial re-discovery, which, for convenience, will cover both partial rediscovery stitching.

It should be noted that the information presented here does not cover every stitcher, nor does it detail everything that the stitchers do; only relevant information is presented.

### Full Discovery Mode Stitching

Before presenting the collection and processing stitching, the method of triggering a full discovery is shown.

Full discovery triggering occurs in the data processing stitching and involves a loop back to the finders and initial data collection stitching as shown below.



Once a triggered full discovery has resulted in data being inserted into finders.returns, the data collection stitching is employed to get the records to the agents.

The Figure below shows the most relevant database table stitchers involved in collection stitching. SNMP-based discovery processing has been grayed out.

Key data collection stitching database tables for issue investigations are;

- Finders.processing: has the device been found via a Collector at all?

```
select * from finders.processing
where m_CollectorInfo <> NULL and m_UniqueAddress = <ip>;
```

- **CollectorDetails.despatch:** has the device passed scoping/detection filter checks?

```
select * from CollectorDetails.despatch
where m_UniqueAddress = <ip>;
```

- **CollectorXXX.despatch:** has the device been passed to the agents?

```
select * from <agent>.despatch
where m_UniqueAddress = <ip>;
```

The data processing stitching is responsible for taking data from the agent's returns table and processing it to get connectivity, containment data, and other relationships. The Data processing Figure below shows the stitching performed during data processing stitching during a full discovery.

Key data processing stitching database tables for issue investigation are;

- **CollectorXXX.returns:** has the device data been discovered?

```
select * from <agent>.returns
where m_UniqueAddress = <ip>;
```

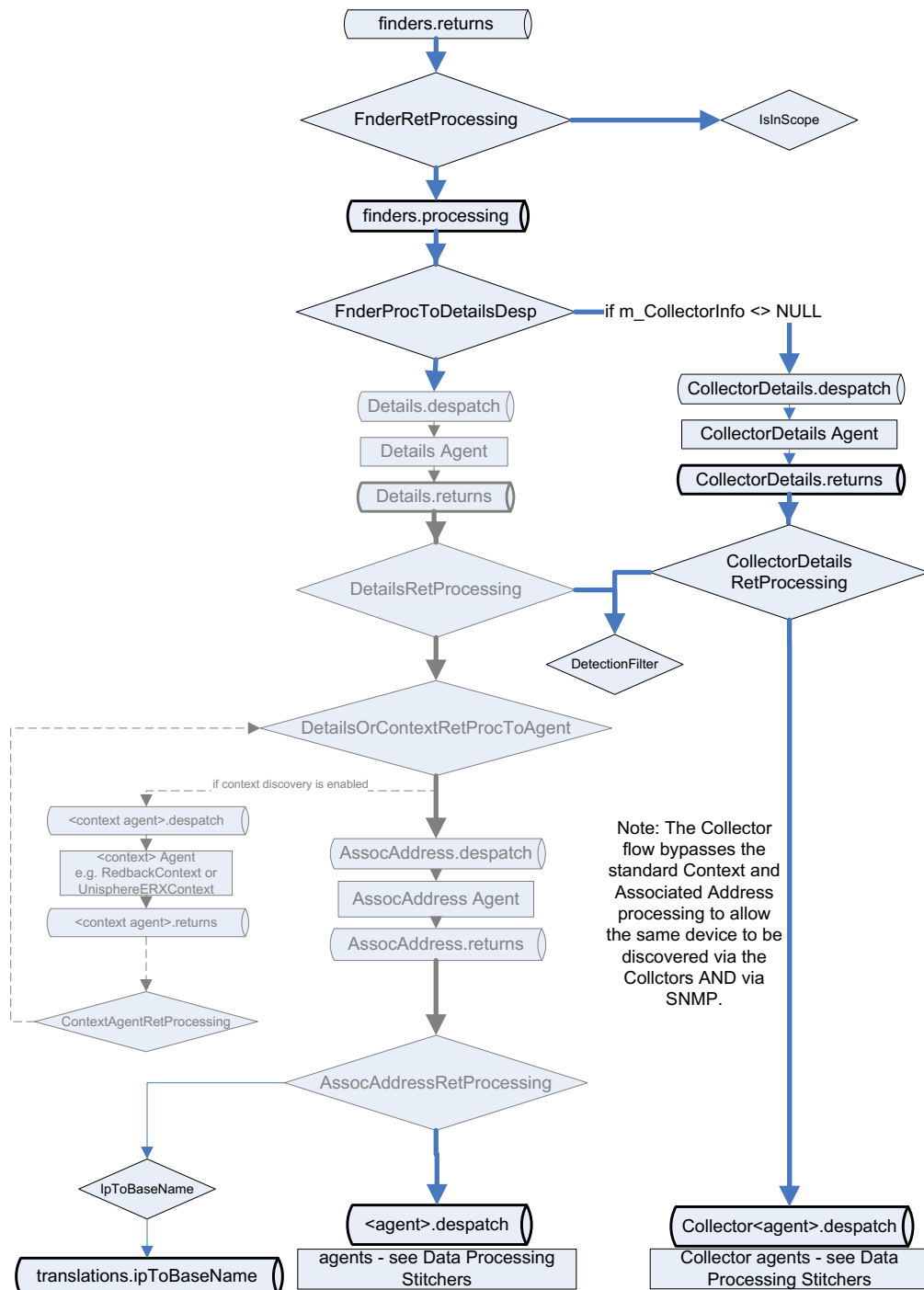
- **Translations.uniqueAddressToWorkAddress:**
- Is Network Manager aware which address is used to represent the device in the Collector agents?
- Is Network Manager aware how this address maps to the main m\_WorkAddress?
- Is Network Manager aware how the main m\_WorkAddress maps to the m\_BaseName used by the later tables?

```
select m_WorkAddress from translations.uniqueAddressToWorkAddress
where m_UniqueAddress = <ip>;
```

```
select m_BaseName from translations.ipToBaseName
where m_WorkAddress = <work address from earlier query>
```

- **scratchTopology.entityByName:** has the device made it to the final data table?

```
select * from scratchTopology.entityByName
where m_Name like <base name obtained from last query>;
```



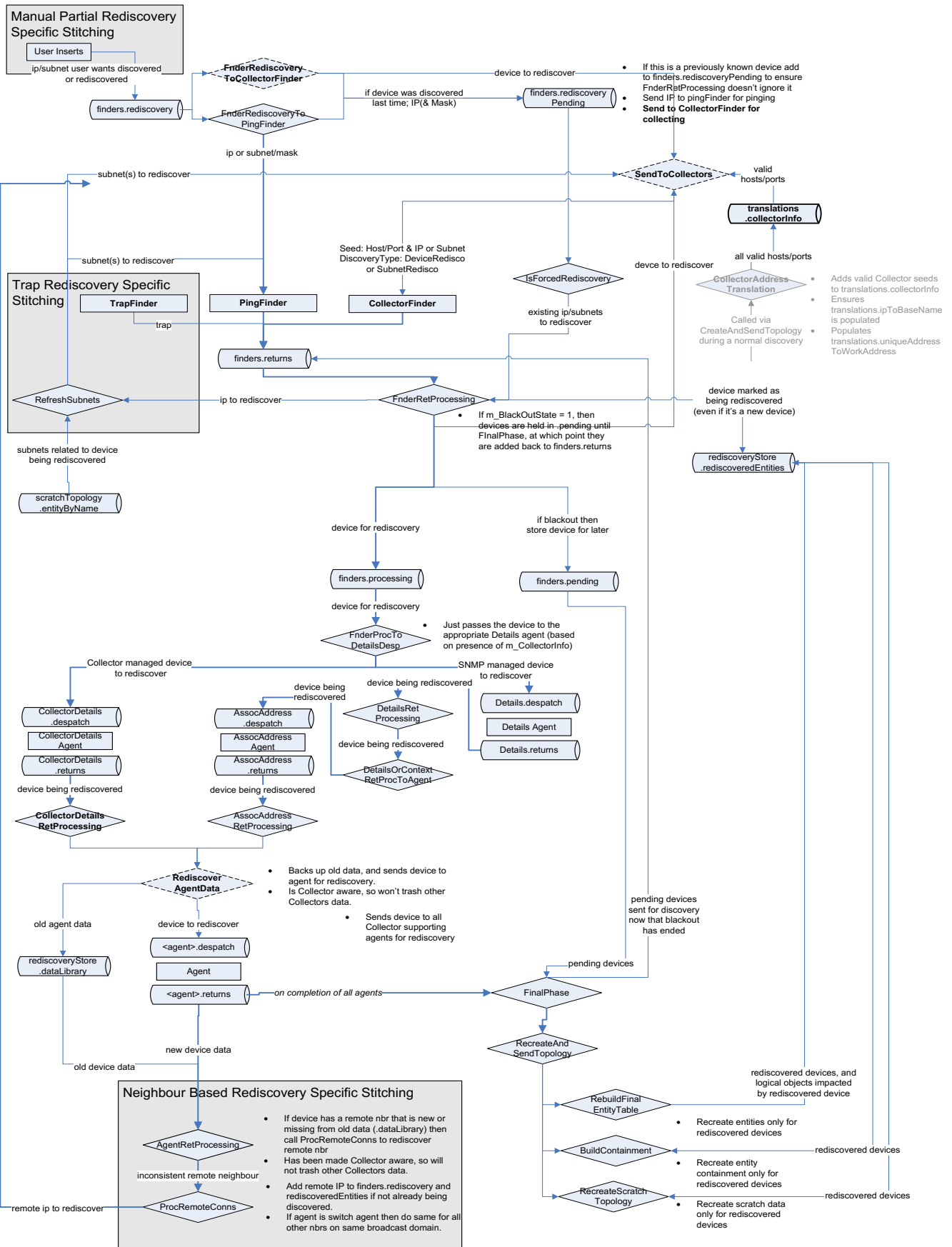
Data Collection Stitching (Full Discovery)

## Partial Rediscovery Stitching

Partial rediscovery stitching allows the partial discovery of a network to be merged with an earlier discovery.

The stitching is more complex than during a full discovery and is more easily understood if both the data collection and data processing stitching are presented as one set of stitching.

The Figure below shows the data collection and data processing stitching performed during a partial rediscovery. It also shows the various ways in which a partial rediscovery can be triggered (the grey boxes).



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