

E2E Link Monitoring System Design

1 Introduction

This document describes a system for monitoring End-to-End Links in the NREN/GEANT2 and NREN/Cross-Border-Fibre supplied optical platform. The underlying operational model is defined in [1]. Detailed description about the installation and deployment of the components of the E2E Monitoring System and MP/MA is given in the Géant2 Wiki [7].

1.1 Example

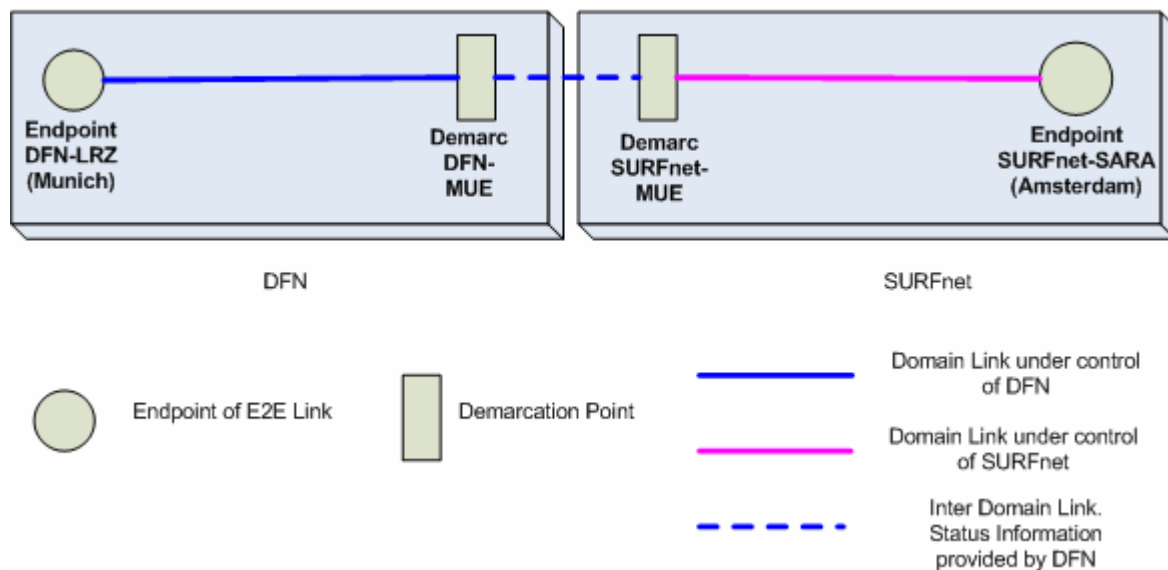


Illustration 1 - Possible E2E link between LRZ (Munich) and SARA (Amsterdam)

Illustration 1 shows a possible E2E link between two Endpoints, situated in Munich (LRZ) and Amsterdam (SARA).

The following partial links are monitored:

- Endpoint DFN-LRZ – Demarc DFN-MUE
- Demarc DFN-MUE – Demarc SURFnet-MUE
- Demarc SURFnet-MUE – Endpoint SURFnet-SARA

The connection between the two demarcation points situated in MUE (one belongs to DFN, the other belongs to SURFnet) is an Inter Domain Link (ID link). ID links could be realised by a patch cable connecting two WDM devices.

1.2 General assumptions

- This draft of the Monitoring System architecture is based on the assumption that status information about links within single domains as well as about ID links is provided by the domains (NRENs and DANTE) in a commonly agreed XML format via a Web Service.
- Each domain provides information about links within its domain as well as about ID links. In case of an ID link two ways of providing this information are supported:
 - One of the involved domains takes over the monitoring responsibility for the whole ID link and provides its complete status information. In our example DFN acts as monitoring responsible (organisation) for ID link in MUE.
 - Each of the involved domains provides status information about its part of the ID link. In this case both domains act as monitoring responsible (organisations) for their respective part of an ID link connection. They report only their view of the ID link and provide logical status information based on the measurement data given by their own equipment only (the measurement data could include a combination of Rx, Tx, PowerON, Traps,...). The E2E Monitoring System will combine the two views on the same ID link to compute its status.
- The status of an E2E link is computed by aggregation of the status information of the involved partial links. Exact description of aggregation rules is given in section 2.3.
- All involved partial links are **logical** links, which may be implemented in various ways with different physical properties (e.g. wavelength or WDM type etc.) and based on multiple physical connections. No data about physical devices are necessary for representing the status of E2E links.

1.3 Naming Conventions

All IDs are case-insensitive. They have to conform to the following conventions:

- ID of a domain should be a globally unique¹ acronym of the domain name, e.g. DFN.
- ID of a topology point (Endpoint or Demarcation Point) is composed of the domain ID and locally unique ID of the demarcation point within this domain concatenated with minus character, e.g. DFN-MUE. This composed ID is supposed to be globally unique.
- Project ID is a globally unique ID of a project, e.g. DEISA.
- The E2E link ID is composed as a combination of the two globally unique acronyms of the organisations at the Endpoints in lexicographical order, the project ID and an additional numerical index (three digits with leading zeros) to distinguish between multiple E2E links of the same project. The properties are concatenated by a minus character and must not contain spaces, eg. LRZ-SARA-DEISA-001.

¹ Globally unique names are assigned by the E2ECU

2 Data Model

This section explains the Data Model used for reporting of monitoring data to the E2E Monitoring System.

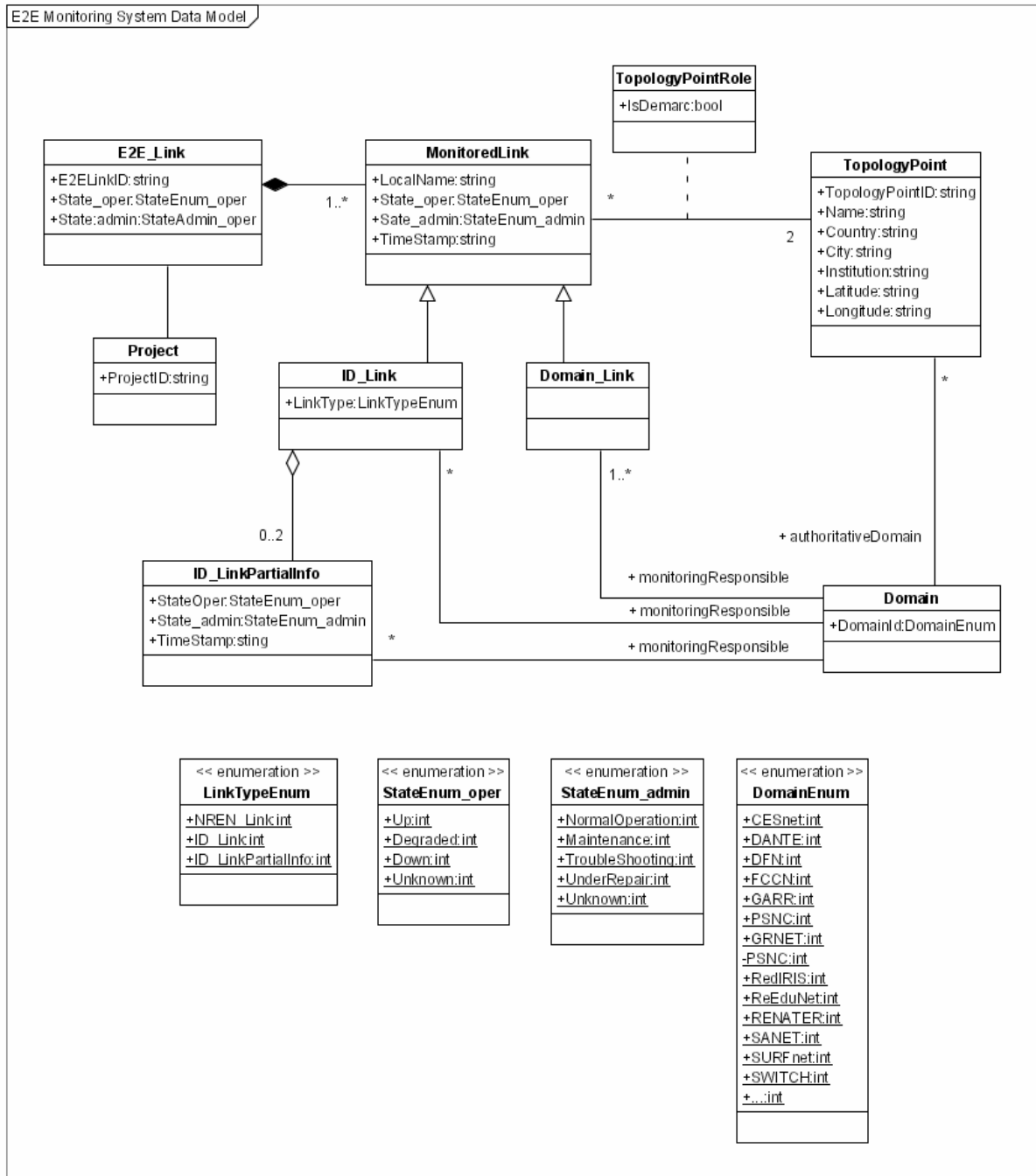


Illustration 2 - Data Model used by E2E Monitoring System

2.1 Entities

- An *E2E_Link* is a logical connection between two Endpoints and consists of 1 or more *MonitoredLinks*. It has a status attribute *State_oper*, representing the operational status of the whole connection. Every *E2E_Link* is owned by a *Project*. The link is identified by the *E2ELinkID* attribute².
- A *Project* represents the “owner” of an E2E link. It has the attribute *ProjectID*.
- A *MonitoredLink* is either a *Domain_Link* (within a single domain) or an *ID_Link* (connecting two domains). It has two status attributes (*State_oper* and *State_admin*) which reflect its operational and administrative states. The *TimeStamp* attribute reflects the actuality of data provided by the domain for this particular link.
- A *MonitoredLink* is delimited by two *TopologyPoints*. For a particular E2E link a *TopologyPoint* can either be a demarcation point or an end point of the link (described by *TopologyPointType*).
- A *TopologyPoint* is a logical representation of either an end point of an E2E link or a demarcation point. It is identified by the attribute *TopologyPointID*. The attributes *Name*, *Country*, *City*, *Institution*, *Latitude* and *Longitude* provide additional information about the *TopologyPoint*. The *Latitude* and *Longitude* attributes will be used for the graphical representation.
- Every *TopologyPoint* belongs to an *AuthoritativeDomain* (NREN or Dante).
- In the case of *ID_Links* two scenarios of providing link status information are supported:
 1. One of the involved domains takes over the monitoring responsibility and provides the status information about the whole *ID_Link*.
 2. Both involved domains provide only information given by their own equipment. In this case the status of a single Inter Domain Link (*ID_Link*) is computed as aggregation of the status information from the two involved Domains (*ID_LinkPartialInfo*). The oldest of the both *TimeStamps* will be used as a *TimeStamp* for the *ID_Link*.
- A *MonitoringResponsible* is an organisation responsible for a domain which provides status information about links. Although the domains always act as *MonitoringResponsible* for their own *Domain_Links*, the *MonitoringResponsible* is not necessarily the owner of the monitored links, especially in the case of *ID_Links*.

² Complete description of required naming convention for all IDs is given on the end of page 2.

2.2 Data Types

Remark: all Data Type IDs listed below are handled case insensitive.

- *StateEnum_oper* defines the allowed values of the operational state of links. Supported values are:
 - Up – link is up
 - Degraded – link is up, but has reduced performance
 - Down – link is down
 - Unknown – domain could not acquire information about operational state
- *StateEnum_admin* defines the allowed values for administrative state of links. Supported values are:
 - NormalOperation – no administrative work is performed
 - Maintenance – planned maintenance activity in progress
 - TroubleShooting – trouble shooting is in progress
 - UnderRepair – repair process is in progress
 - Unknown – Domain could not acquire information about administrative state
- *LinkTypeEnum* defines the type of monitored link as well as aggregation schema.
 - Domain_Link – link within a single domain
 - ID_Link – inter domain link completely reported by a single domain
 - ID_LinkPartialInfo – corresponds to the case when no domain takes over monitoring responsibility over the whole *ID_link* but instead both domains provide just the status information available from the own equipment.
- *DomainEnum* defines the unique IDs of the involved domains:

ACOnet	Austrian NREN
ARNES	Slovenian NREN
BELNET	Belgian NREN
CARNet	Croatian NREN
CESNET	Czech NREN
CYNET	Cypriot NREN
GEANT2	The Géant2 network is operated by DANTE (Delivery of Advanced Network Technology to Europe)
DFN	German NREN
EENET	Estonian NREN
FCCN	Portuguese NREN
GARR	Italian NREN
GRNET	Greek NREN
HEAnet	Irish NREN
ISTF	Bulgarian NREN
IUCC	Israeli NREN
JSCC	Russian NREN
LATNET	Latvian NREN
LITNET	Lithuanian NREN
NIIF	Hungarian NREN
NORDUnet	Nordic NREN
PSNC	Polish NREN
RedIRIS	Spanish NREN
RENATER	French NREN
RESTENA	The Luxembourg NREN

RoEduNet	Romanian NREN
SANET	Slovakian NREN
SURFnet	NREN in the Netherlands
SWITCH	Swiss NREN
UKERNA/JANET	United Kingdom NREN
ULAKBIM	Turkish NREN

2.3 Rules for status aggregation used by E2E Monitoring System

Aggregation is necessary for *E2E_Links* and for *ID_Links* (in case of *ID_Links* only necessary if LinkType is ID_LinkPartialInfo) .

The E2E Monitoring System uses the following rules for aggregating operational and administrative status information:

- If information from both domains is identical (including “Unknown” state), no aggregation is necessary.
- **Operational Status:** If status is different, the “worst” case will be used as aggregated status. This means:
 - Up and Down => Down
 - Up and Degraded => Degraded
 - Degraded and Down => Down
- **Administrative Status:** If status is different, the “worst” case will be used as aggregated status. This means:
 - NormalOperation and Maintenance => Maintenance
 - NormalOperation and TroubleShooting => TroubleShooting
 - NormalOperation and UnderRepair => UnderRepair
 - Maintenance and TroubleShooting => TroubleShooting
 - Maintenance and UnderRepair => UnderRepair
 - TroubleShooting and UnderRepair => TroubleShooting
- If one of the states is Unknown then the known state will be used as aggregated state. However, our monitoring system will show the user that some information is missing.

Remark: the underlying status information will be shown to the user on request.

3 Data Exchange Procedure

3.1 General Steps for Data Exchange

The general steps required for data provisioning are depicted in Illustration 3.

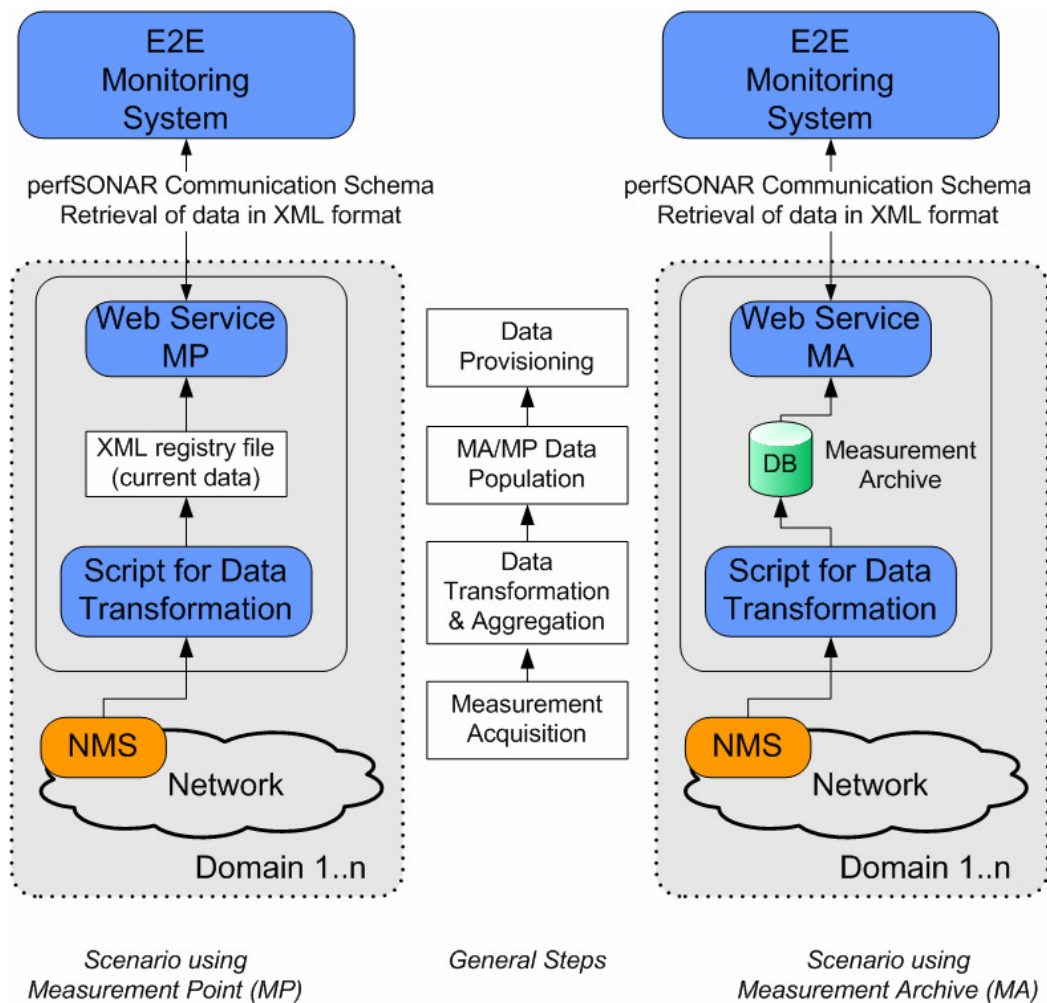


Illustration 3 - Scenarios of Data Provisioning

These steps are:

- **Measurement Acquisition:** Extract the information from the equipment. We assume that NREN has knowledge about all the hardware equipment (HW) involved in providing their section of an E2E Link and has access to status information of this HW. Because of the heterogeneity of the used HW we make no assumption, or proposals about this step.
- **Data Transformation and Aggregation:**
 - Data Transformation: the acquired data measurements may not be directly usable by the E2E Monitoring System, which requires the data complying with the data model. Therefore the data have to be analysed and transformed into logical status information. This mapping depends on the HW used.

- **Data Aggregation:** The status information required for E2E Monitoring System is given not for single devices but instead for the whole logical link crossing the NREN network between Demarcation Points (POP). The different status of the segments constituting the logical link needs thus to be concatenated.
- **Data Population:** The NREN has to populate a data structure of the perfSONAR web-service. The naming of E2E Links is coordinated by the E2ECU.
- **Data Provisioning:** The data are provided for E2E Monitoring System via a perfSONAR Web Service.³ Two alternative scenarios are supported: using a *Measurement Point* (MP) or a *Measurement Archive* (MA). The scenarios are described below in this document.

3.2 XML Message Format

This chapter describes the XML format in which status information is reported by the NRENs via a perfSONAR Web Service.

3.2.1 Schema Description (RELAX-NG Compact Syntax):

```
# #####  
#  
# File:      XML_Schema_v03_final.rnc - Schema to describe  
#           topological features for DFN.  
# Version:   $Id$\br/># Purpose:   This file lays out the requirements for the DFN  
#           schema.  
# Reference: http://books.xmlschemata.org/relaxng/page2.html  
#  
# #####  
  
default namespace nmwg = "http://ggf.org/ns/nmwg/base/2.0/"  
namespace nmtm         = "http://ggf.org/ns/nmwg/time/2.0/"  
namespace nmwgtopo3    = "http://ggf.org/ns/nmwg/topology/base/3.0/"  
namespace nmtl2        = "http://ggf.org/ns/nmwg/topology/l2/3.0/"  
namespace nmtl3        = "http://ggf.org/ns/nmwg/topology/l3/3.0/"  
namespace nmtl4        = "http://ggf.org/ns/nmwg/topology/l4/3.0/"  
namespace ifevt        = "http://ggf.org/ns/nmwg/event/status/base/2.0/"  
  
# #####  
#  
# The nmwg:message is the first element  
#  
# #####  
  
start = element nmwg:message {  
  MessageContent  
}
```

³ A perfSONAR web-service is by definition a web service using SOAP and making use of XML messages described by the Global Grid Forum (GGF) Network Monitoring Working Group (NM-WG). For more information about perfSONAR see [5].


```
# #####  
#  
# Inside of the message, we have a set type  
# a single set of parameters, and then  
# multiple metadata and data blocks.  
#  
# #####  
  
MessageContent =  
  Identifier? &  
  attribute type { "E2E_Link_status_information" } &  
  MessageParameters &  
  MessageMetadata* &  
  MessageData*  
  
# #####  
#  
# The parameters are well known.  
#  
# #####  
  
MessageParameters =  
  element nmwg:parameters {  
    attribute id { "messageId" } &  
    element nmwg:parameter {  
      attribute name { "DomainName" } &  
      xsd:string  
    }  
  }  
  
# #####  
#  
# The metadata consists of a single subject  
# that contains either a node, or a link  
# structure.  
#  
# #####  
  
MessageMetadata =  
  element nmwg:metadata {  
    Identifier &  
    MetadataIdentifierRef? &  
    element nmwg:subject {  
      Identifier &  
      SubjectIdRef? &  
      (  
        MessageNode |  
        MessageLink  
      )  
    }  
  }  
  
# #####  
#  
# The node is a lesser version of the  
# nmwg version 3 topology node.  
#  
# #####  
  
MessageNode =  
  element nmwgtopo3:node {
```

```
Identifier? &
NodeIdRef? &
MessageRole? &
element nmwgtopo3:name {
  attribute type { "logical" } &
  xsd:string
} &
element nmwgtopo3:type { xsd:string } &
element nmwgtopo3:country { xsd:string } &
element nmwgtopo3:city { xsd:string } &
element nmwgtopo3:institution { xsd:string } &
element nmwgtopo3:latitude { xsd:string } &
element nmwgtopo3:longitude { xsd:string }
}

# #####
#
# The link is a lesser version of the
# nmwg version 3, layer 2 link.
#
# #####

MessageLink =
  element nmtl2:link {
    Identifier? &
    LinkIdRef? &
    element nmtl2:type { "NREN_Link" | "ID_Link" | "ID_LinkPartialInfo" } &
    element nmtl2:name {
      attribute type { "logical" }? &
      xsd:string
    } &
    element nmtl2:globalName {
      attribute type { "logical" }? &
      xsd:string
    } &
    (
      element nmwgtopo3:node {
        NodeIdRef &
        (
          attribute role { "EndPoint" | "DemarcPoint" } |
          element nmwgtopo3:role { "EndPoint" | "DemarcPoint" }
        )
      },
      element nmwgtopo3:node {
        NodeIdRef &
        (
          attribute role { "EndPoint" | "DemarcPoint" } |
          element nmwgtopo3:role { "EndPoint" | "DemarcPoint" }
        )
      }
    )
  }

# #####
#
# The data consists of information wrapped
# in result namespace datums.
#
# #####

MessageData =
  element nmwg:data {
```

```
Identifier &
MetadataIdentifierRef &
element ifevt:datum {
  attribute timeType { "ISO" | "unix" } &
  attribute timeValue { xsd:string } &
  element ifevt:stateOper { "Up" | "Degraded" | "Down" | "Unknown" } &
  element ifevt:stateAdmin { "NormalOperation" | "Maintenance" |
    "TroubleShooting" | "UnderRepair" | "Unknown" }
}
}

# #####
#
# Misc. elements
#
# #####

Identifier =
  attribute id { xsd:string }

MetadataIdentifierRef =
  attribute metadataIdRef { xsd:string }

SubjectIdRef =
  attribute subjectIdRef { xsd:string }

LinkIdRef =
  attribute linkIdRef { xsd:string }

NodeIdRef =
  attribute nodeIdRef { xsd:string }

MessageRole =
  (
    attribute role { xsd:string } |
    element nmwgtopo3:role { xsd:string }
  )
```

3.2.2 Description of Schema Elements:

- The XML Schema is compliant to the NMWG schema used in the perfSONAR framework (see [3] for more information). The schema describes a NMWG message for a single domain (NREN or GEANT2). It consists of three sections: Two sections contain metadata information about *TopologyPoints* (a logical representation of either an end point of an E2E link or a demarcation point; in XML message: `nmwgtopo3:node`) and *MonitoredLinks* (a part of an E2E link, in XML message: `nmtl2:link`). The XML message provides information about all *MonitoredLinks* the domain has the monitoring responsibility for. The third section contains the actual monitoring data for the *MonitoredLinks*.
- We use the *TopologyPoints* as nodes to represent one or more E2E links as contiguous paths in a graph representing the topology of E2E connections. Thus, the same *TopologyPoint* can be used in multiple *MonitoredLinks*. In the XML message, the *TopologyPointID* is given as attribute `id` of the element `nmwgtopo3:node`. It is referenced within the link definition (`nmtl2:link`) by the attribute `nodeIfRef`.
- A `nmwg:data` element contains the monitoring data of an arbitrary *MonitoredLink*. It is bound to the description of the *MonitoredLink* by the `metadataIdRef` Attribute, which has to be identical with the `id` Attribute of the `nmwg:metadata` element of the corresponding *MonitoredLink*.
- The *TimeStamp* elements (in XML: `ifevt:datum`) are expected in ISO format “yyyy-mm-ddThh:mm:ss+hh:mm” (e.g. “2006-04-06T13:06:02+1:00”) or UNIX format.
- The *Latitude* and *Longitude* elements are necessary for a graphical representation of the topology. They are expected in a format similar to RFC 1876 [6], e.g. “50 08 00.01 N” for latitude and “39 59.51 E” for longitude.

3.2.3 Examples for XML messages provided by domains

Example 1: This example presents the section of the XML message provided by DFN covering the E2E link between LRZ and SARA. In this example DFN has monitoring responsibility for the complete ID link between the demarcs DFN-MUE and SURFnet-MUE.

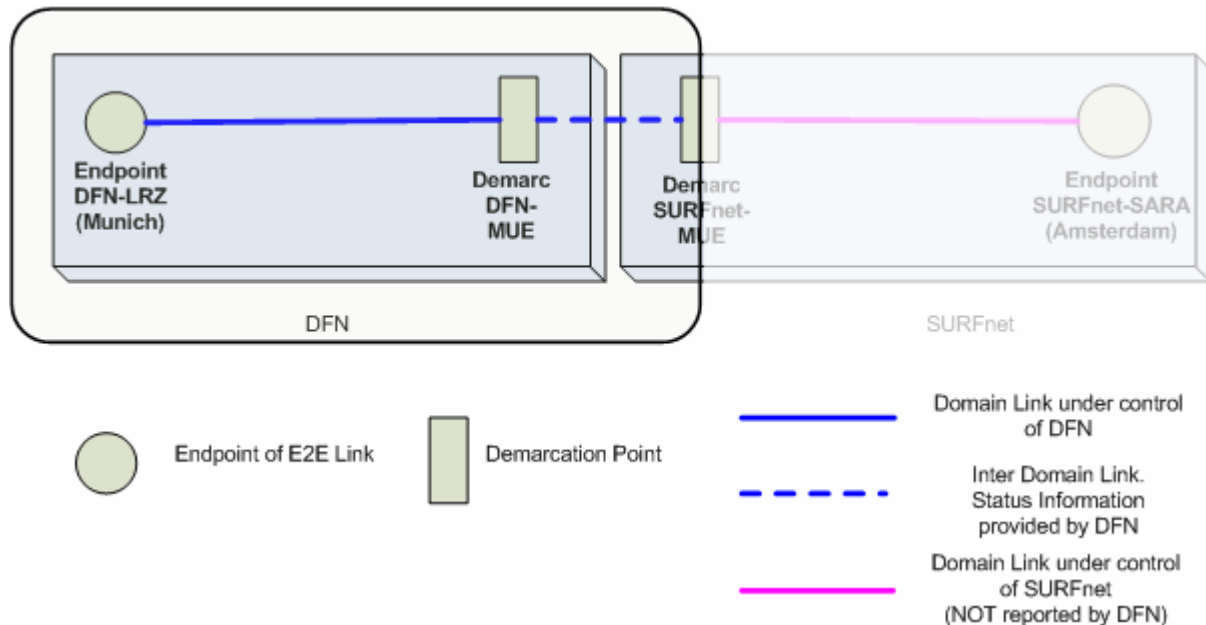


Illustration 4 - Section of E2E link between LRZ and SARA reported by DFN

XML message provided by DFN (extract related to Example 1):

```
<nmwg:message
  type="E2E_Link_status_information"
  xmlns:nmwg="http://ggf.org/ns/nmwg/base/2.0/"
  xmlns:nmtm="http://ggf.org/ns/nmwg/time/2.0/"
  xmlns:nmwgtopo3="http://ggf.org/ns/nmwg/topology/base/3.0/"
  xmlns:nmtl2="http://ggf.org/ns/nmwg/topology/12/3.0/"
  xmlns:nmtl3="http://ggf.org/ns/nmwg/topology/13/3.0/"
  xmlns:nmtl4="http://ggf.org/ns/nmwg/topology/14/3.0/"
  xmlns:ifevt="http://ggf.org/ns/nmwg/event/status/base/2.0/">

  <nmwg:parameters id="storeId">
    <nmwg:parameter name="DomainName">DFN</nmwg:parameter>
  </nmwg:parameters>

  <nmwg:metadata id="mdl">
    <nmwg:subject id="sub-DFN-LRZ">
      <nmwgtopo3:node id="DFN-LRZ">
        <nmwgtopo3:type>TopologyPoint</nmwgtopo3:type>
        <nmwgtopo3:name type="logical">DFN-LRZ</nmwgtopo3:name>
        <nmwgtopo3:country>Germany</nmwgtopo3:country>
        <nmwgtopo3:city>Munich</nmwgtopo3:city>
        <nmwgtopo3:institution>Leibniz Rechenzentrum
          </nmwgtopo3:institution>
        <nmwgtopo3:latitude>48 15 42.20 N</nmwgtopo3:latitude>
        <nmwgtopo3:longitude>11 39 59.51 E</nmwgtopo3:longitude>
      </nmwgtopo3:node>
    </nmwg:subject>
  </nmwg:metadata>
</nmwg:message>
```

```
<nmwg:metadata id="md2">
  <nmwg:subject id="sub-DFN-MUE">
    <nmwgtopo3:node id="DFN-MUE">
      <nmwgtopo3:type>TopologyPoint</nmwgtopo3:type>
      <nmwgtopo3:name type="logical">DFN-MUE</nmwgtopo3:name>
      <nmwgtopo3:country>Germany</nmwgtopo3:country>
      <nmwgtopo3:city>Muenster</nmwgtopo3:city>
      <nmwgtopo3:institution>DFN-Verein</nmwgtopo3:institution>
      <nmwgtopo3:latitude>50 8 00.01 N </nmwgtopo3:latitude>
      <nmwgtopo3:longitude>8 27 47.94 E </nmwgtopo3:longitude>
    </nmwgtopo3:node>
  </nmwg:subject>
</nmwg:metadata>

<nmwg:metadata id="md3">
  <nmwg:subject id="sub1">
    <nmt12:link>
      <nmt12:name type="logical">DFN-link-1234</nmt12:name>
      <nmt12:globalName type="logical">LRZ-SARA-DEISA-001
        </nmt12:globalName>
      <nmt12:type>NREN_Link</nmt12:type>

      <nmwgtopo3:node nodeIdRef="DFN-LRZ">
        <nmwgtopo3:role>EndPoint</nmwgtopo3:role>
      </nmwgtopo3:node>

      <nmwgtopo3:node nodeIdRef="DFN-MUE">
        <nmwgtopo3:role>DemarcPoint</nmwgtopo3:role>
      </nmwgtopo3:node>

    </nmt12:link>
  </nmwg:subject>
</nmwg:metadata>

<nmwg:metadata id="md4">
  <nmwg:subject id="sub2">
    <nmt12:link>
      <nmt12:name type="logical">DFN-Surfnet-Link-5678</nmt12:name>
      <nmt12:globalName type="logical">LRZ-SARA-DEISA-001
        </nmt12:globalName>
      <nmt12:type>ID_Link</nmt12:type>

      <nmwgtopo3:node nodeIdRef="DFN-MUE">
        <nmwgtopo3:role>DemarcPoint</nmwgtopo3:role>
      </nmwgtopo3:node>

      <nmwgtopo3:node nodeIdRef="SURFnet-MUE">
        <nmwgtopo3:role>DemarcPoint</nmwgtopo3:role>
      </nmwgtopo3:node>

    </nmt12:link>
  </nmwg:subject>
</nmwg:metadata>

<nmwg:data id="d1" metadataIdRef="md3">
  <ifevt:datum timeType="ISO" timeValue="2006-04-20T17:20:00.0+1:00">
    <ifevt:stateOper>Up</ifevt:stateOper>
    <ifevt:stateAdmin>NormalOperation</ifevt:stateAdmin>
  </ifevt:datum>
</nmwg:data>
```

```

<nmwg:data id="d2" metadataIdRef="md4">
  <ifevt:datum timeType="ISO" timeValue="2006-04-20T17:20:00.0+1:00">
    <ifevt:stateOper>Down</ifevt:stateOper>
    <ifevt:stateAdmin>Maintenance</ifevt:stateAdmin>
  </ifevt:datum>
</nmwg:data>
</nmwg:message>

```

Example 2:

In example 1 we assume that DFN has the monitoring responsibility over the ID Link in Münster (MUE). There are also cases where it is not possible for a single domain to take over the monitoring responsibility over an ID Link, for example the Cieszyn – Ostrava connection. In this case both involved domains provide just the status information available from their own equipment. In the following we show extracts of two XML messages, one of them provided by PSNC and the other by CESnet. Both XML sections cover the ID link shown in **Fehler! Verweisquelle konnte nicht gefunden werden.** Note that the link type has to be set to ID_LinkPartialInfo in this case.

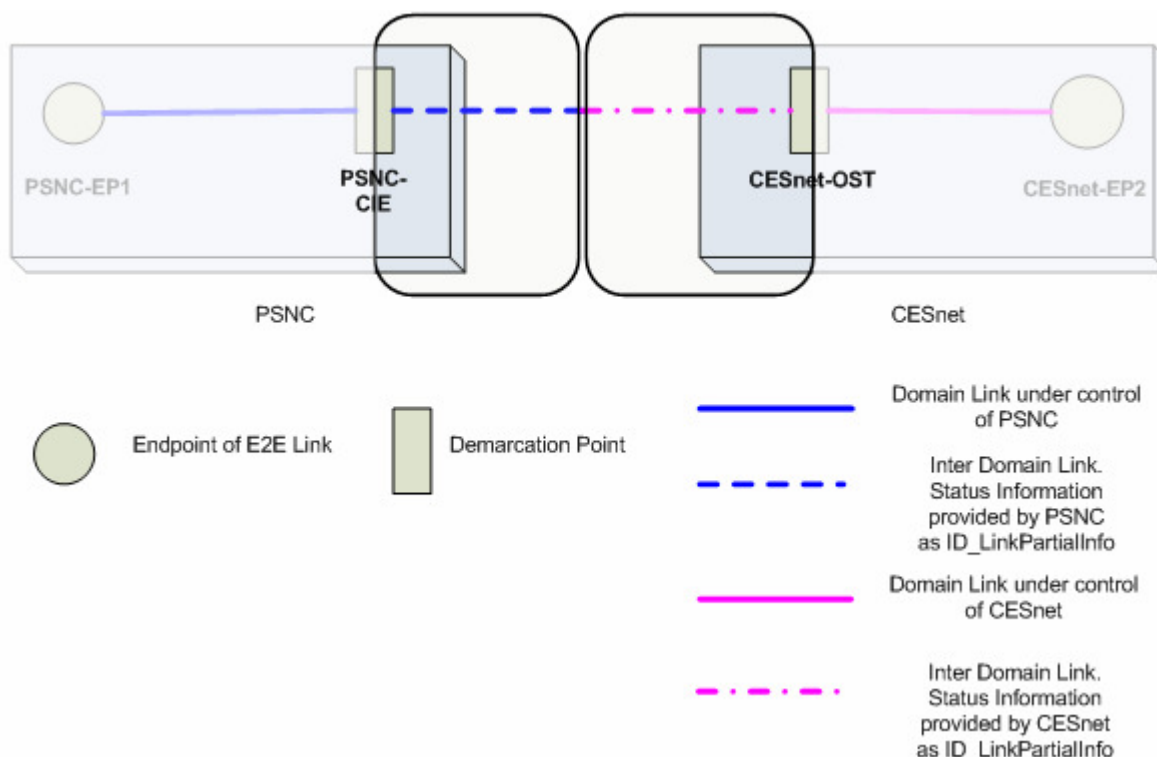


Illustration 5- Section of E2E link reported by two involved domains

XML message provided by PSNC (extract related to Example 2):

```
<nmwg:message
  type="E2E_Link_status_information"
  xmlns:nmwg="http://ggf.org/ns/nmwg/base/2.0/"
  xmlns:nmtm="http://ggf.org/ns/nmwg/time/2.0/"
  xmlns:nmwgtopo3="http://ggf.org/ns/nmwg/topology/base/3.0/"
  xmlns:nmtl2="http://ggf.org/ns/nmwg/topology/12/3.0/"
  xmlns:nmtl3="http://ggf.org/ns/nmwg/topology/13/3.0/"
  xmlns:nmtl4="http://ggf.org/ns/nmwg/topology/14/3.0/"
  xmlns:ifevt="http://ggf.org/ns/nmwg/event/status/base/2.0/">

  <nmwg:parameters id="storeId">
    <nmwg:parameter name="DomainName">PSNC</nmwg:parameter>
  </nmwg:parameters>

  ...

  <nmwg:metadata id="md3">
    <nmwg:subject id="sub1">
      <nmtl2:link>
        <nmtl2:name type="logical">CESnet-link-XY5w</nmtl2:name>
        <nmtl2:globalName type="logical"> EP1-EP2-PrjID-004
          </nmtl2:globalName>
        <nmtl2:type>ID_LinkPartialInfo</nmtl2:type>

        <nmwgtopo3:node nodeIdRef="CESnet-OST">
          <nmwgtopo3:role>DemarcPoint</nmwgtopo3:role>
        </nmwgtopo3:node>

        <nmwgtopo3:node nodeIdRef="PSNC-CIE">
          <nmwgtopo3:role>DemarcPoint</nmwgtopo3:role>
        </nmwgtopo3:node>

      </nmtl2:link>
    </nmwg:subject>
  </nmwg:metadata>

  ...

  <nmwg:data id="d1" metadataIdRef="md3">
    <ifevt:datum timeType="ISO" timeValue="2006-04-20T17:18:30.0+1:00">
      <ifevt:stateOper>Down</ifevt:stateOper>
      <ifevt:stateAdmin>TroubleShooting</ifevt:stateAdmin>
    </ifevt:datum>
  </nmwg:data>

  ...

</nmwg:message>
```


XML message provided by CESnet (extract related to Example 2):

```
<nmwg:message
  type="E2E_Link_status_information"
  xmlns:nmwg="http://ggf.org/ns/nmwg/base/2.0/"
  xmlns:nmtm="http://ggf.org/ns/nmwg/time/2.0/"
  xmlns:nmwgtopo3="http://ggf.org/ns/nmwg/topology/base/3.0/"
  xmlns:nmtl2="http://ggf.org/ns/nmwg/topology/12/3.0/"
  xmlns:nmtl3="http://ggf.org/ns/nmwg/topology/13/3.0/"
  xmlns:nmtl4="http://ggf.org/ns/nmwg/topology/14/3.0/"
  xmlns:ifevt="http://ggf.org/ns/nmwg/event/status/base/2.0/">

  <nmwg:parameters id="storeId">
    <nmwg:parameter name="DomainName">CESnet</nmwg:parameter>
  </nmwg:parameters>

  ...

  <nmwg:metadata id="md3">
    <nmwg:subject id="sub1">
      <nmtl2:link>
        <nmtl2:name type="logical">CESnet-link-XY5w</nmtl2:name>
        <nmtl2:globalName type="logical"> EP1-EP2-PrjID-004
          </nmtl2:globalName>
        <nmtl2:type>ID_LinkPartialInfo</nmtl2:type>

        <nmwgtopo3:node nodeIdRef="CESnet-OST">
          <nmwgtopo3:role>DemarcPoint</nmwgtopo3:role>
        </nmwgtopo3:node>

        <nmwgtopo3:node nodeIdRef="PSNC-CIE">
          <nmwgtopo3:role>DemarcPoint</nmwgtopo3:role>
        </nmwgtopo3:node>

      </nmtl2:link>
    </nmwg:subject>
  </nmwg:metadata>

  ...

  <nmwg:data id="d1" metadataIdRef="md3">
    <ifevt:datum timeType="ISO" timeValue="2006-04-20T17:20:00.0+1:00">
      <ifevt:stateOper>Down</ifevt:stateOper>
      <ifevt:stateAdmin>Unknown</ifevt:stateAdmin>
    </ifevt:datum>
  </nmwg:data>

  ...

</nmwg:message>
```

3.3 Web Service interface

This chapter describes the Web Service interface which is used in the communication between the E2E Monitoring System and the MP or MA Web Services provided by the domains.

The web services have to support the following request/response model:

SOAP Request (generated by E2E Monitoring System):

```
<nmwg:message type="SetupDataRequest"
  xmlns:nmwg="http://ggf.org/ns/nmwg/base/2.0/">

  <nmwg:metadata id="meta1">
    <nmwg:eventType>Path.Status</nmwg:eventType>
  </nmwg:metadata>

  <nmwg:metadata id="meta2">
    <select:parameters>
      <select:parameter name="time">now</select:parameter>
    </select:parameters>
  </nmwg:metadata>

</nmwg:message>
```

SOAP Response (generated by MP/MA Web Service):

The XML schema of the SOAP Response was described above.

Note: The SOAP envelope is not described in this document. The perfSONAR framework proposes to use SOAP messages using a *document literal* payload encoding format. i.e. the message is not encoded additionally. Please refer to the perfSONAR documentation for more information.

3.4 Scenarios for Data Provisioning

There are currently two types of perfSONAR web-services: Measurement Point (MP) and Measurement Archive (MA). In Illustration 3 the two alternative scenarios are depicted.

Web-Service Selection: The NRENs can choose which of the supported Web Services they want to use for Data Provisioning:

- **Measurement Point (MP):** A lightweight perfSONAR web-service which provides the latest status information made available in an XML registry file.
- **Measurement Archive (MA):** A perfSONAR web-service which can provide both the latest status as well as historical information of the links.

Both methods have their own data structure that contains the status information. The data structures are respectively an XML file or SQL database. The NREN need to populate the data structure with the aggregated status information they are retrieving from their

equipments. Both type of web-services receive the same requests and export the data in the same way (as expected by the E2E Monitoring System).

3.5 Measurement Point (MP)

A Measurement Point provides actual status information. A stand alone MP is sufficient for providing the measurement data required for basic functionality of the E2E Monitoring System. In this scenario the NREN provides an XML Registry File which is transferred to the E2E Monitoring System by the MP Web Service.

3.5.1 XML Registry File

The XML Registry File is almost identical to the schema of the NMWG Message described in section 3.2. However, it is a store, thus the main element has to be `nmwg:store` instead of `nmwg:message`. The remaining elements are identical.

```
<nmwg:store type="SetupDataResponse"
  xmlns:nmwg="http://ggf.org/ns/nmwg/base/2.0/"
  xmlns:nmtm="http://ggf.org/ns/nmwg/time/2.0/"
  xmlns:nmwgtopo3="http://ggf.org/ns/nmwg/topology/base/3.0/"
  ...
</nmwg:store>
```

3.6 Measurement Archive (MA)

An MA also provides historical data and uses a database for data storage. The development of the MA is independent from the E2E Monitoring System. Please refer to corresponding documents for more information.

3.7 Deployment of Software Components

Detailed description about the installation and deployment of the components of the E2E Monitoring System and MP/MA is given in the Géant2 Wiki [7].

References:

[1] K. Ullmann, K. Schauerhammer: Operational Model for E2E links in the NREN/GEANT2 and NREN/Cross-Border-Fibre supplied optical platform. (Version 0.18, 27.03.2006)

[2] Deliverable DJ.1.2.1:GEANT2 General Monitoring Framework Design
URL: <http://monstera.man.poznan.pl/jra1-wiki/images/9/95/GN2-05-057v5.pdf>

[3] NMWG Schema Developers Guide.
URL: <http://stout.pc.cis.udel.edu/NMWG/devguide.pdf>

[4] URL:
http://www.perfsonar.net/jra1-wiki/index.php/MAService_For_Path_Alarms_Requests_and_Replies

[5] URL: http://wiki.perfsonar.net/jra1-wiki/index.php/JRA1_Main

[6] URL: <http://www.ckdhr.com/dns-loc/rfc1876.txt>

[7] URL: <http://wiki.geant2.net/bin/view/JRA4/E2EMonSoft>