Network Service Interface

Network Service Agent Description Document

Status of This Document

Grid Working Document (GWD)

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Abstract

This document describes the Network Service Interface Network Service Agent Description Document that provides syntax for describing metadata for Network Service Agents (NSA) within the Network Services Framework (NSF) in support of NSA self-description. When used in conjunction with the protocol formally know as the NSA Discovery Service, a solution is provided to address the key issues of peer NSA interface version discovery, feature discovery, control plane connectivity discovery, and managed network discovery. Information conveyed in this document allows an NSA to perform basic protocol bootstrapping with minimal configuration by exposing an NSA’s identity, enabling version negotiation, and communicating protocol capabilities supported by that NSA.

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# Introduction

Within the Network Services Framework (NSF) [OGF NSF] the Network Services Agent (NSA) is an entity that manages network service requests. These services can vary in functionality, and an NSA does not need to offer all of the services defined within a network. For example, one NSA may offer Connection Services and Topology Services for a specific network, while a second NSA offers Monitoring Services for that same network. In addition, the versions of the services offered can vary from NSA to NSA. The NSA Description Document is a metadata schema designed to enable self-description of all NSI services and associated protocol interfaces offered by these NSA. Other information relating to the NSA itself, such as software version, administrative contacts, location, peering, and managed networks is also defined as part of the meta-data profile.

The NSA Description Document is used in conjunction with protocol formally know as the Discovery Service, a simple protocol supporting the distribution of documents throughout an interconnected network of NSA..

This type of dynamic meta-data discovery mechanism is an important aspect of any large-scale distributed system. By making the NSI protocol and its agents more self-descriptive, new features, protocols, or protocol versions can be added to agents within the network and then be discovered by peer agents through these meta-data documents. As new features come on line, agents supporting the capabilities can discover compatible peer agents, and then negotiate use of these new features, while older versions of agents within the network remain unaffected. Similarly, newer versions of agents can still negotiate features and communicate with older agent versions using mutually supported versions of the protocol as described in the discovered meta-data.

This document defines the base NSA meta-data document schema.

# Notational Conventions

The key words ‘MUST,” “MUST NOT,” “REQUIRED,” “SHALL,” “SHALL NOT,” “SHOULD,” “SHOULD NOT,” “RECOMMENDED,” “MAY,” and “OPTIONAL” are to be interpreted as described in RFC 2119 [BRADNER], except that the words do not appear in uppercase.

# Requirements

The following feature requirements have been captured for the NSA Discovery Document. Some may apply to the protocol formally know as the Discovery Service, while others will apply specifically to the NSA Description Document.

|  |  |  |
| --- | --- | --- |
| Requirement | Description | Functional Area |
| 1 | MUST be able to describe NSI interfaces and versions of interfaces supported by the NSA. | Schema |
| 2 | MUST be able to describe supported protocol features of a specific protocol version supported by the NSA. | Schema |
| 3 | MUST be able to describe new protocols, protocol versions, and features without needing to upgrade the schema or associated protocol. | Schema + Protocol |
| 4 | MUST provide support for protocol version negotiation, allowing peer NSA to negotiate a mutually supported version of the protocol. | Schema |
| 5 | Shall allow bootstrap of peer communications with minimal configuration. | Schema + Protocol |
| 6 | Transport of the NSA meta data information MUST have equivalent levels of security as existing NSI protocols. | Protocol |
| 7 | The NSA Discovery document MUST be verifiable (e.g. the agent MUST be able to determine that the contents of the NSA Description Document was not altered during delivery). | Protocol |
| 8 | MUST support the discovery of multiple independent NSA Discovery Document types (representations). | Schema + Protocol |
| 9 | * + - 1. MUST support the discovery of multiple versions of the same NSA Discovery document. | Schema + Protocol |
| 10 | MUST be able to detect when new documents or new versions of existing documents are available. | Protocol |
| 11 | MUST be able to be notified when new documents or new versions of existing documents are available. | Protocol |
| 12 | MUST be able to discover the unique NSA identifier of a peer NSA. Will reduce bootstrap provisioning requirements. | Schema + Protocol |
| 13 | MUST be able to discover the NSA software type and version running on a peer NSA. This will allow an NSA to adapt behaviors to specific version of NSA when required. | Schema |
| 14 | MUST be able to discover the time at which the peer NSA last started to provide uninterrupted service. This is effectively the last restart time of the NSA. A peer discovering a change in this value can initiate recovery procedures. | Schema |
| 15 | MUST be able to discover administrative contacts associated with the peer NSA. | Schema |
| 16 | MUST be able to discover the physical location of the peer NSA entity. This can be the location of the server hosting the NSA, or some other location related to the service being offered. This is used for visualization applications and troubleshooting. | Schema |
| 17 | MUST be able to discover the networks being managed by the peer NSA. | Schema |
| 18 | MUST be able to discover compete network control plane topology. This implies discovery of all NSA peering relationships within the network. | Schema |
| 19 | MUST be able to determine the peer NSA’s CS role within the network (Aggregator, uRA, uPA). This will allow an NSA to find a peer aggregator to service CS requests. | Schema |
| 20 | MUST be able to determine the NSA’s CS role of all NSA within the network (Aggregator, uRA, uPA). This is required to compute messaging paths in concert with control plane topology (NSA peering). | Schema |
| 21 | MUST provide an extensible mechanism to allow additional discovery data to be added to an existing NSA’s metadata without needing to upgrade the schema. | Schema |

Table – NSA Discovery requirements.

# NSA Discovery Document

The NSA Description Document encapsulates descriptive meta-data associated with an NSA. The XML schema types used to define the document format are declared in a separate namespace from the core protocol specification, allowing new versions of the NSA Description schema to be introduced without impacting the base discovery protocol itself. Figure 31 below shows the structure of the NSA Description Document, while Appendix A: NSA Discovery document schema contains the full XML schema definition.

The <*nsa>* element is the root element used in all NSA Description Documents. Each NSA Description Document MUST have a single <*nsa>* element describing the subject NSA.

## Macintosh HD:Users:hacksaw:Desktop:Screen Shot 2014-02-17 at 8.31.04 PM.png

Figure – The NSA Description Document.

The following XML is an example NSA Description Document for a fictitious NSA with globally unique identifier “*urn:ogf:network:example.com:2013:nsa:vixen*”.

<tns:nsa xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"  
 xmlns:xcard="urn:ietf:params:xml:ns:vcard-4.0"  
 xmlns:tns="http://schemas.ogf.org/nsi/2014/02/discovery/nsa"  
 id="urn:ogf:network:example.com:2013:nsa:vixen"  
 version="2014-01-04T18:13:51.0Z"

expires="2014-02-04T18:13:51.0Z">  
 <name>Example NSA</name>  
 <softwareVersion>ExampleNsa-Version-1.0</softwareVersion>  
 <startTime>2014-01-01T18:13:51.0Z</startTime>  
 <adminContact>  
 <xcard:vcard>  
 <xcard:uid>

<xcard:uri>http://www.example.com/santa.claus/santa.asc</xcard:uri>

</xcard:uid>  
 <xcard:prodid><xcard:text>OGF Example Maker // EN</xcard:text></xcard:prodid>  
 <xcard:rev><xcard:timestamp>20080424T195243Z</xcard:timestamp></xcard:rev>  
 <xcard:kind><xcard:text>individual</xcard:text></xcard:kind>  
 <xcard:fn><xcard:text>Saint Nicholas</xcard:text></xcard:fn>  
 <xcard:n>  
 <xcard:surname>Claus</xcard:surname>  
 <xcard:given>Santa</xcard:given>  
 <xcard:suffix>Saint</xcard:suffix>  
 </xcard:n>  
 <xcard:tel><xcard:text>+1 555-555-5555</xcard:text></xcard:tel>  
 <xcard:email>

<xcard:text>santa.claus@theworkshop.example.com</xcard:text>

</xcard:email>  
 </xcard:vcard>  
 </adminContact>  
 <location>  
 <name>Santa's Workshop, The North Pole</name>

<longitude>0.0000</longitude>  
 <latitude>90.0000</latitude>

<altitude>10</altitude>

<address>  
 <xcard:pobox>0001</xcard:pobox>  
 <xcard:ext></xcard:ext>  
 <xcard:street>1 Top of the world boulevard</xcard:street>  
 <xcard:locality>Polar Ice Flows</xcard:locality>  
 <xcard:region>The North Pole</xcard:region>  
 <xcard:code>CA</xcard:code>  
 <xcard:country>Canada</xcard:country>  
 </address>  
 </location>  
 <networkId>urn:ogf:network:example.com:2013:network:theworkshop</networkId>  
 <networkId>urn:ogf:network:example.com:2013:network:candycaneforest</networkId>  
 <interface>  
 <type>application/vnd.ogf.nsi.dds.v1+xml</type>  
 <href>https://nsa.example.com/dds</href>  
 <describedBy>https://nsa.example.com/dds?wadl</describedBy>  
 </interface>

<interface>  
 <type>application/vnd.ogf.nsi.topology.v1+xml</type>  
 <href>https://nsa.example.com/topology.xml</href>  
 </interface>  
 <interface>  
 <type>application/vnd.ogf.nsi.cs.v2.provider+soap</type>  
 <href>https://nsa.example.com/connectionProvider</href>  
 <describedBy>https://nsa.example.com/connectionProvider?wsdl</describedBy>  
 </interface>  
 <interface>  
 <type>application/vnd.ogf.nsi.cs.v2.requester+soap</type>  
 <href>https://nsa.example.com/connectionRequester</href>  
 <describedBy>https://nsa.example.com/connectionRequester?wsdl</describedBy>  
 </interface>  
 <feature type="org.ogf.nsi.cs.v2.role.aggregator"/>  
 <feature type="org.ogf.nsi.cs.v2.role.uPA"/>  
 <feature type="org.ogf.nsi.cs.v2.commitTimeout">120</feature>  
 <peersWith>urn:ogf:network:example.com:2013:nsa:dasher</peersWith>  
 <peersWith>urn:ogf:network:example.com:2013:nsa:dancer</peersWith>  
 <peersWith>urn:ogf:network:example.com:2013:nsa:prancer</peersWith>  
</tns:nsa>

The remainder of this section defines the XML types used within the NSA Discovery Document.

## NsaType

The ***NsaType*** definition models the primary meta-data elements of an NSA. The *id* attribute of the NSA MUST be globally unique as this is the primary identification key used across all NSA for discovery. This *id* is referred to as the NSA identifier in the NSI Connection Service (CS) protocol documents [OGF NSI-CS].

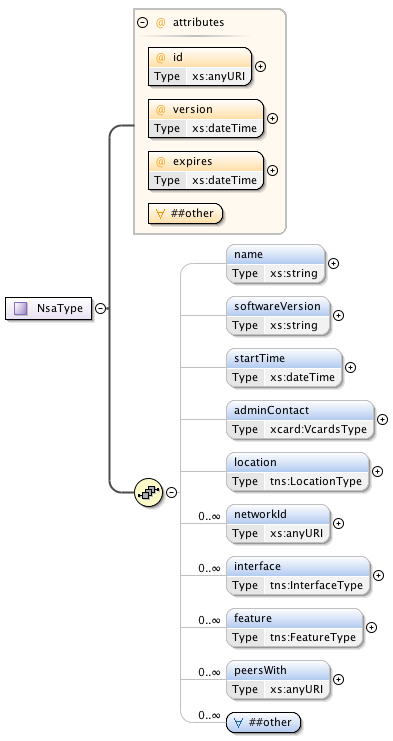


Figure – NsaType.

***Parameters***

The <*nsa>* element is defined by the complex type ***NsaType*** that has the following parameters (M = Mandatory, O = Optional):

|  |  |  |
| --- | --- | --- |
| Parameter | M/O | Description |
| *id* | M | The globally unique NSA identifier for this resource. |
| *version* | M | The version of this NSA Description Document based on the date and time the entry was created at the source NSA. This attribute can be used to compare two versions of the document for equality (same version) or to determine the new and older versions through date comparison. |
| *expires* | O | The date this version of the document expires and after which should no longer be considered valid. If this value is not present then the document should be considered to have no expire date. |
| *anyAttribute* | O | Permit inclusion of attributes from other namespaces for flexible extension without needing to update this schema definition. |
| *name* | O | A descriptive name for this NSA. This value is typically used for display purposes. |
| *softwareVersion* | O | A descriptive string describing the NSA software type and version. This value will allow a peer NSA to adapt behaviors to specific versions of an NSA when required. |
| *startTime* | O | The time at which this NSA last started to provide uninterrupted service. This is effectively the last restart time of the NSA. A peer discovering a change in this value can initiate recovery procedures. |
| *adminContact* | O | A list of zero or more administrative contacts associated with this NSA. |
| *location* | O | The physical location of the logical NSA entity. This can be the location of the server hosting the NSA, or some other location related to the service being offered. |
| *networkId* | O | A list of zero or more network identifiers for which this NSA is providing the listed service interfaces and features. These network identifiers can be mapped into network topology using the *<Topology>* element’s *id* attribute to determine the network resources being managed by this NSA. |
| *interface* | O | A list of zero or more NSI interfaces supported by the NSA. |
| *feature* | O | A list of zero or more features supported by the NSA. An NSA feature is a piece of metadata that describes a specific capability offered by this NSA, or a configuration value for this NSA, that is not specifically defined by an independent element definition within this document. |
| *peersWith* | O | A list of zero or more NSA identifiers enumerating peer NSA that have had a trusted control plane relationship provisioned with this NSA. Other NSA can use this information, combined with feature information, to build a connected graph of the NSA control plane topology within the network for use in reservation request routing (control plane reachability). |
| *any element* | O | Provides a flexible mechanism allowing additional elements to be provided from other namespaces without needing to update this schema definition. |

## VcardsType

The *adminContact* field of the ***NsaType*** definition uses the standard vCard XML Representation

[RFC 6351]. The ***VcardsType*** supports a list of *vcards* that can be used to fully model administrator contact information. Due to the size of the structure it will not be reproduced here.

## LocationType

The ***LocationType*** definition models the location elements of an NSA. A Location is a reference to a geographical location or area for the NSA.

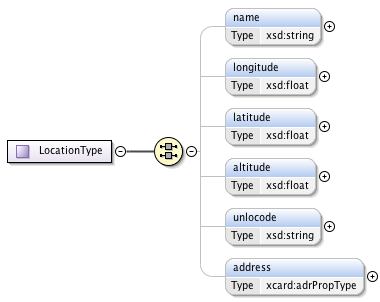


Figure – LocationType.

***Parameters***

The <*location>* element is defined by the complex type ***LocationType*** that has the following parameters (M = Mandatory, O = Optional):

|  |  |  |
| --- | --- | --- |
| Parameter | M/O | Description |
| *name* | O | A human readable string naming this location. |
| *longitude* | O | The longitude of the NSA in WGS84 coordinate system (in decimal degrees). |
| *latitude* | O | The latitude of the NSA in WGS84 coordinate system (in decimal degrees). |
| *altitude* | O | The altitude of the NSA in WGS84 coordinate system (in decimal meters). |
| *unlocode* | O | The UN/LOCODE location identifier for the NSA location. |
| *address* | O | The address of the NSA location specified in vCard address format. |

## InterfaceType

The ***InterfaceType*** definition models an NSA protocol interface. This type encapsulates the meta-data needed to determine the version, location, and schema associated with a specific NSA interface.

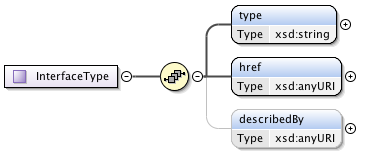


Figure – InterfaceType.

For example, the first <*interface>* element below identifies the proposed NSI Document Distribution Service Version 1 [OGF NSI-DS] XML encoded representation. The <*type>* element describes the specific version of the DDS interface, as well as the media encoding used on the interface. The <*href*> element provides the protocol endpoint used to access this interface. The optional <*describedBy>* element provides a reference to the meta-data document formally describing the interface. In this case, a WADL document is available describing the discovery REST interface.

<interface>  
 <type>application/vnd.ogf.nsi.dds.v1+xml</type>  
 <href>https://nsa.example.com/dds</href>  
 <describedBy>https://nsa.example.com/dds?wadl</describedBy>  
</interface>

This second entry also defines an interface for the proposed NSI Document Distribution Service Version 1, but instead of XML, this is a definition for a JSON representation:

<interface>  
 <type> application/vnd.ogf.nsi.dds.v1+json</type>  
 <href>https://nsa.example.com/dds</href>  
 <describedBy>https://nsa.example.com/dds?wadl</describedBy>  
</interface>

It is also possible to define an *<interface>* element that does not contain the *<describedBy>* element. This can be used in situations where dynamically discovering the interface description is not required or available:

<interface>  
 <type> application/vnd.ogf.nsi.topology.v1+xml</type>  
 <href>https://nsa.example.com/topology.xml</href>  
</interface>

***Parameters***

The <*interface>* element is defined by the complex type ***InterfaceType*** that has the following parameters (M = Mandatory, O = Optional):

|  |  |  |
| --- | --- | --- |
| Parameter | M/O | Description |
| *type* | M | The unique string identifying the type and version of the NSA interface. Application Internet media types (Content-types) are used to identify the NSI interface, version, and supported encoding type. |
| *href* | M | Contains the protocol endpoint for the interface identified in this interface reference. |
| *describedBy* | O | This attribute contains a reference to the WSDL or WADL file corresponding to this interface's version (if available). |

## FeatureType

The **FeatureType** definition is a simple type value pair used to model an NSA feature within the network. This type is left underspecified so that external values can be defined as additional features as protocol interfaces are introduced.

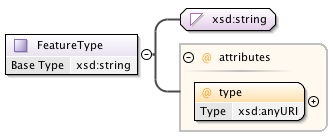


Figure - FeatureType

An NSA feature is a piece of metadata attached to the NSA Description Document that describes a specific capability offered by that NSA, or configuration value on that NSA, that is not specifically defined by an element in the NSA Description Document schema, but still needs to be communicated to requester agents within the network. These features may be specifically associated with an instance of NSI protocol interface on the NSA, or may be associated with the NSA entity itself. Features associated with an NSI protocol should be defined in that protocol’s specification document, while more generic features should be captured in this document as they are defined.

We formally define three values to model an NSA's CS "role" within the network as shown below:

<feature type="org.ogf.nsi.cs.v2.role.aggregator"/>

An NSA MUST include in its Description Document a *<feature>* element of this type if the NSA is performing an aggregator NSA role as defined in the NSI CS Version 2 specification. Presence of this *<feature>* element type communicates the NSA’s willingness to perform reservation path finding and CS protocol message forwarding through to connected peers on the control plane. In addition, the NSA must populate all control plane peered NSA using the *<peersWith>* element. This will allow a remote NSA to determine control plane paths to this aggregator, and control plane reachability through the aggregator to other networks.

<feature type="org.ogf.nsi.cs.v2.role.uPA"/>

An NSA MUST include in its Description Document a *<feature>* element of this type if the NSA is performing uPA NSA role as defined in the NSI CS Version 2 specification. In addition, the NSA must populate all control plane peered NSA using the *<peersWith>* element. This will allow a remote NSA to determine control plane paths to the uPA.

<feature type="org.ogf.nsi.cs.v2.role.uRA"/>

An NSA MUST include in its Description Document a *<feature>* element of this type if the NSA is performing uRA NSA role as defined in the NSI CS Version 2 specification. In addition, the NSA must populate all control plane peered NSA using the *<peersWith>* element.

Notice that in these previous *<feature>* definitions there is no value associated with the feature type. To illustrate a type/value combination, we could model the NSI CS 2.0 reservation commit timeout value for an NSA as follows:

<feature type="org.ogf.nsi.cs.v2.commitTimeout">120</feature>

***Parameters***

The <*feature>* element is defined by the simple type ***FeatureType*** that has the following parameters (M = Mandatory, O = Optional):

|  |  |  |
| --- | --- | --- |
| Parameter | M/O | Description |
| *type* | M | Identifies the type of role modeled by the supplied value. |
| *value* | O | The optional string value associated with the type. |

# Interface Versioning

Versioning within the NSI suite of protocols utilizes Internet Assigned Numbers Authority (IANA) MIME Media Types as a standard mechanism for distinguishing between releases of each protocol. For the REST protocol specifications based on HTTP these media types are used directly in the protocol via the *Content-Type* and *Accept*header parameters, where in other cases the values are used in a protocol version field. Which of the two mechanisms are used is left up to the protocol profile itself. For example, the current NSI CS 2.0 profile [OGF NSI-CS] utilizes SOAP over HTTP as a transport that has a standard MIME Media Type of “application/soap+xml”. We have created a custom Media Type for the NSI CS 2.0 SOAP profile to distinguish this protocol, however, it is only used in the *protocolVersion* field of the SOAP header and not the *Content-Type* field of the HTTP header that still remains “application/soap+xml”.

**Table 3** below enumerates the MIME Media Types defined for versions of the NSI protocol suite, and the specific protocol interface role the NSA supports. An NSA will populate values in the interface elements (*InterfaceType*) of their NSA Description Document.

|  |  |  |
| --- | --- | --- |
| Version | Interface | MIME Media Type |
| NSI CS version 1.0 | Provider | “application/vnd.ogf.nsi.cs.v1.provider+soap” |
| NSI CS version 1.0 | Requester | “application/vnd.ogf.nsi.cs.v1.requester+soap” |
| NSI CS version 1.1 | Provider | “application/vnd.ogf.nsi.cs.v1-1.provider+soap” |
| NSI CS version 1.1 | Requester | “application/vnd.ogf.nsi.cs.v1-1.requester+soap” |
| NSI CS version 2.0 | Provider | “application/vnd.ogf.nsi.cs.v2.provider+soap” |
| NSI CS version 2.0 | Requester | “application/vnd.ogf.nsi.cs.v2.requester+soap” |
| NSI Topology version 1.0 | Provider | “application/vnd.ogf.nsi.topology.v1+xml” |
| NSI Topology version 2.0 | Document | “application/vnd.ogf.nsi.topology.v2+xml” |
| NSA Description Document version 1.0 | Document | “application/vnd.ogf.nsi.nsa.v1+xml” |
| NSI Document Distribution Service version 1.0 | Requester/Provider | “application/vnd.ogf.nsi.dds.v1+xml” |

**Table 3 – NSI CS protocol version MIME Media Types.**

# Optionality

An NSA Description Document should be created and made available via the protocol formally know as the NSA Discovery Service to all interested NSA within the interconnected network. However, the NSA Description Document contains information that would typically be considered configuration information, or may have been previously hard coded within NSA implementations, so there can be situations where this information may be manually provisioned on NSA. The following statements are made to help guide implementations.

An Ultimate Provider NSA (uPA) MUST participate in the protocol formally know as the NSA Discovery Service and make available an NSA Description Document describing the available interfaces, capabilities, and networks managed. The uPA will only participate in the provider role within the protocol formally know as the NSA Discovery Service as it does not contain a requester component, and therefore, will not need to discover documents from other NSAs. This will allow peer NSA (Requester roles) to dynamically bootstrap communications.

An Aggregator NSA (AG) MUST participate in the protocol formally know as the NSA Discovery Service and make available an NSA Description Document describing the available interfaces and capabilities (AG do not have directly manages networks). An AG contains both a requester and provider component, so SHOULD support the requester roles within the protocol formally know as the NSA Discovery Service. This will allow peer NSA (Requester roles) to dynamically bootstrap communications with the AG’s provider role, and allow the AG to dynamically bootstrap communications with its peers in the requester role.

An Ultimate Requester NSA (uRA) may participate in the protocol formally know as the NSA Discovery Service as a requester to bootstrap communications with an AG or uPA, but will never participate as a provider, so does not need to make an NSA Description Document available. The uRA may decide not to participate in the protocol formally know as the NSA Discovery Service, but instead choose to statically provision all information required to bootstrap communications with the target AG or uPA.

# Security Considerations

This document describes the information modeled within the NSA Description Document, but does not define the specific mechanism that is used by NSA to get access to all documents within the network. It is assumed that the NSA Description Document MUST be verifiable (e.g. the agent MUST be able to determine that the contents of the NSA Description Document was not altered during delivery). It is also assumed that exchange of documents between NSA is secured to the level of other protocols within the NSI protocol suite. This security MUST include authentication, authorization, and confidentiality.

# Glossary

|  |  |
| --- | --- |
| Aggregator NSA (AG) | The Aggregator NSA is a Provider Agent that acts as both a requester and provider NSA. It can service requests from other NSA, perform path finding, and distribute segment requests to child NSA for processing. |
| Connection Service (CS) | The NSI Connection Service is a service that allows an RA to request and manage a Connection from a PA. See [OGF NSI-CS]. |
| The protocol formally know as the NSA Discovery Service | Is a protocol for the exchange and propagation of NSA meta data between NSA throughout the interconnected control plane. The NSA Discovery document is an example of information exchanged using this protocol. |
| Network Service Agent (NSA) | The Network Service Agent is a concrete piece of software that sends and receives NSI Messages. The NSA includes a set of capabilities that allow Network Services to be delivered. |
| Network Service Interface (NSI) | The NSI is the interface between RAs and PAs. The NSI defines a set of interactions or transactions between these NSAs to realize a Network Service. |
| Network Services Framework (NSF) | The Network Services framework describes an NSI message-based platform capable of supporting a suite of Network Services such as the Connection Service and the Topology Service. See [OGF NSF]. |
| NSA Discovery document | The NSA Discovery document encapsulates descriptive meta-data associated with an NSA such as all NSI services and associated protocol interfaces offered by the NSA. |
| NSI Topology | The NSI Topology defines a standard ontology and a schema to describe network resources that are managed to create the NSI service. The NSI Topology as used by the NSI CS (and in future other NSI services) is described in [OGF NSI-TS]. |
| Requester/Provider Agent (RA/PA) | An NSA acts in one of two possible roles relative to a particular instance of an NSI. When an NSA requests a service, it is called a Requester Agent (RA). When an NSA realizes a service, it is called a Provider Agent (PA). A particular NSA may act in different roles at different interfaces. |
| NSI Service Definition | A document describing the service offered by an NSA and it’s underlying network. A network can offer multiple services, and therefore, have multiple Service Definitions defined. |
| Simple Object Access Protocol (SOAP) | SOAP is a protocol specification for exchanging structured information in the implementation of Web Services in computer networks. |
| Ultimate PA (uPA) | The ultimate PA is a Provider Agent that has an associated NRM. |
| Ultimate RA (uRA) | The Ultimate RA is a Requester Agent is the originator of a service request. |
| XML Schema Definition (XSD) | XSD is a schema language for XML. See [W3C XSD] |
| eXtensible Markup Language (XML) | XML is a markup language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable. |

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# References

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[OGF NSF] Guy Roberts, et al. “OGF Network Service Framework v2.0”, Group Working Draft (GWD), candidate Recommendation Proposed (R-P), January 28, 2014.

[OGF NSI-CS] Guy Roberts, et al. “OGF NSI Connection Service v2.0”, Group Working Draft (GWD), candidate Recommendation Proposed (R-P), January 12, 2014.

[OGF NSI-TS] Jeroen van der Ham, GWD-R-P Network Service Interface Topology Representation, Group Working Draft (GWD), candidate Recommendations Proposed (R-P), January 2013.

[OGF NSI-DS] John MacAuley, et al. “Network Service Interface Document Distribution Protocol v1.0”, Group Working Draft (GWD), candidate Recommendation Proposed (R-P), February 18, 2014.

[OGF NML] OGF GFD.206: Network Markup Language Base Schema version 1, <http://www.gridforum.org/documents/GFD.206.pdf>

[W3C XSD] W3C XML “Schema Definition Language (XSD) 1.1 Part 2: Datatypes”, [http://www.w3.org/TR/xmlschema11-2/#anyURI](http://www.w3.org/TR/xmlschema11-2/" \l "anyURI)

# Appendix A: NSA Description Document schema

The following XSD is captured from the *ogf\_nsi\_nsa\_description\_v1\_0.xsd* schema file that is the official source for the NSA Description Document schema.

<?xml version="1.0" encoding="UTF-8"?>  
<!--  
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Open Grid Forum NSI NSA Description Document v1.0.  
  
Description: This is the NSA Description Document schema defined for use in the  
OGF NSI Document Distribution Service v1.0. Comments and questions can be directed  
to the mailing list group mailing list (nsi-wg@ogf.org).  
-->  
<xsd:schema targetNamespace="http://schemas.ogf.org/nsi/2014/02/discovery/nsa"  
 xmlns:xsd="http://www.w3.org/2001/XMLSchema"  
 xmlns:xcard="urn:ietf:params:xml:ns:vcard-4.0"  
 xmlns:tns="http://schemas.ogf.org/nsi/2014/02/discovery/nsa"  
 version="1.0">  
 <!--xmlns:kml="http://www.opengis.net/kml/2.2"-->  
 <xsd:annotation>  
 <xsd:appinfo>ogf\_nsi\_nsa\_description\_v1\_0.xsd 2014-09-09</xsd:appinfo>  
 <xsd:documentation xml:lang="en">  
 This is an XML schema document defining the format for meta data  
 contained in the the NSA Description Document.  
   
 Within the NSI reference architecture the Network Services Agent  
 (NSA) is an entity that offers network services. These services  
 can be varied in functionality, and an NSA does not need to offer  
 all services defined within a network. For example, one NSA may  
 offer Connection Services and Topology Services for a specific  
 network, while a second NSA offers Monitoring Services for that  
 same network. In addition, the versions of the services offered  
 can vary from NSA to NSA. The NSA Description Document is meta   
 data designed to enable self-description of all NSI services and  
 associated protocol interfaces offered by these NSA.  
   
 The NSI Description Document schema allows an NSA to describe the  
 interfaces and versions of interfaces that it supports. Through  
 the REST API access methods defined, an NSA can dynamically  
 discover interfaces and capabilities supported by a peer NSA,  
 perform protocol version negotiation based on the supplied  
 metadata, identify protocol endpoints, and bootstrap peer  
 communications with minimal configuration.  
   
 This document encapsulates the types used to model meta-data  
 associated with an NSA. By defining these type in a separate  
 namespace, it is hoped that new versions of the meta-data will not  
 impact the base discovery protocol.  
 </xsd:documentation>  
 </xsd:annotation>  
   
 <!-- Import additional standard name spaces. -->  
 <xsd:import namespace="urn:ietf:params:xml:ns:vcard-4.0"  
 schemaLocation="xCard.xsd"/>  
   
 <!-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  
 \* XML element types \*  
 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* -->  
   
 <!-- NSA resource definition. -->  
 <xsd:element name="nsa" type="tns:NsaType" />  
   
 <!-- \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*  
 \* XML base types \*  
 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* -->  
   
 <xsd:complexType name="NsaType">  
 <xsd:annotation>  
 <xsd:documentation xml:lang="en">  
 This is the type definition for meta-data associated with an  
 NSA resource.  
   
 Attributes:  
   
 id - The globally unique NSA identifier for this resource.  
   
 version - The version of this NSA resource based on the date  
 and time the entry was created at the source NSA. This  
 attribute can be used to compare two versions of the document  
 for equality (same version) or to determine the new and older  
 versions through date comparison.  
   
 expires - The date this version of the document expires and should  
 no longer be used.  
   
 anyAttribute - Permit inclusion of attributes from other namespaces  
 for flexible extension without needing to update this schema  
 definition.  
   
 Elements:  
   
 name - A descriptive name for this NSA resource. This value is  
 typically used for display purposes.  
   
 softwareVersion - A descriptive string describing the NSA software  
 type and version. This value will allow a peer NSA to adapt  
 behaviors to specific versions of an NSA when required.  
   
 startTime - The time at which this NSA last started to provide  
 uninterrupted service. This is effectively the last restart  
 time of the NSA. A peer discovering a change in this value  
 can initiate recovery procedures.  
   
 adminContact - A list of zero or more administrative contacts  
 associated with this NSA.  
   
 kml - The physical location of the logical NSA resource.  
 This can be the location of the server hosting the NSA, or  
 some other location related to the service being offered. A  
 KML element is used top model this coordinate information.  
   
 networkId - A list of zero or more network identifiers for which  
 this NSA is providing the listed service interfaces and  
 features. These network identifiers can be mapped into network  
 topology to determine the network resources being managed by  
 this NSA.  
   
 interface - A list of zero or more service interfaces supported  
 by the NSA.  
   
 feature - A list of zero or more features supported by the NSA.   
 An NSA feature is a piece of metadata that describes a specific  
 capability offered by this NSA, or a configuration value for this  
 NSA, that is not specifically defined by an independent element  
 definition within this document.  
   
 peersWith - A list of zero or more NSA identifiers enumerating  
 the peer NSA that have set up a trusted control plane relationship  
 with this NSA.  
   
 other - Provides a flexible mechanism allowing additional elements  
 to be provided from other namespaces without needing to update  
 this schema definition.  
 </xsd:documentation>  
 </xsd:annotation>  
 <xsd:sequence>  
 <xsd:element name="name" type="xsd:string" minOccurs="0" />  
 <xsd:element name="softwareVersion" type="xsd:string" minOccurs="0" />  
 <xsd:element name="startTime" type="xsd:dateTime" minOccurs="0" />  
 <xsd:element name="adminContact"type="xcard:VcardsType" minOccurs="0" />  
 <xsd:element name="location" type="tns:LocationType" minOccurs="0" />  
 <xsd:element name="networkId" type="xsd:anyURI" minOccurs="0"  
 maxOccurs="unbounded" />  
 <xsd:element name="interface" type="tns:InterfaceType" minOccurs="0"  
 maxOccurs="unbounded" />  
 <xsd:element name="feature" type="tns:FeatureType" minOccurs="0"  
 maxOccurs="unbounded" />  
 <xsd:element name="peersWith" type="xsd:anyURI" minOccurs="0"  
 maxOccurs="unbounded" />  
 <xsd:element name="other" type="tns:HolderType" minOccurs="0"  
 maxOccurs="unbounded" />  
 </xsd:sequence>  
 <xsd:attribute name="id" use="required" type="xsd:anyURI" />  
 <xsd:attribute name="version" use="required" type="xsd:dateTime" />  
 <xsd:attribute name="expires" use="optional" type="xsd:dateTime" />  
 <xsd:anyAttribute namespace="##other" processContents="lax" />  
 </xsd:complexType>  
  
 <xsd:complexType name="LocationType">  
 <xsd:annotation>  
 <xsd:documentation xml:lang="en">  
 This is a type definition modeling the location of an NSA. A  
 Location is a reference to a geographical location or area for  
 the NSA.  
   
 Elements:  
   
 name - A human readable string naming this location.  
   
 longitude - The longitude of the NSA in WGS84 coordinate system  
 (in decimal degrees).  
   
 latitude - The latitude of the NSA in WGS84 coordinate system (in  
 decimal degrees).  
   
 altitude - The altitude of the NSA in WGS84 coordinate system (in  
 decimal meters).  
   
 unlocode - The UN/LOCODE location identifier for the NSA  
 location.  
   
 address - The address of the NSA location specified using the  
 vCard address format.  
 </xsd:documentation>  
 </xsd:annotation>   
 <xsd:all>  
 <xsd:element name="name" type="xsd:string" minOccurs="0" />  
 <xsd:element name="longitude" type="xsd:float" minOccurs="0" />  
 <xsd:element name="latitude" type="xsd:float" minOccurs="0" />  
 <xsd:element name="altitude" type="xsd:float" minOccurs="0" />  
 <xsd:element name="unlocode" type="xsd:string" minOccurs="0" />  
 <xsd:element name="address" type="xcard:adrPropType" minOccurs="0" />  
 </xsd:all>  
 </xsd:complexType>  
   
 <xsd:complexType name="InterfaceType">  
 <xsd:annotation>  
 <xsd:documentation xml:lang="en">  
 Type definition that models an NSA protocol interface. This  
 type encapsulates the meta-data needed to determine the version,  
 location, and schema associated with a specific NSA interface.  
   
 Elements:  
   
 type - The unique string identifying the type and version of  
 the NSA interface. Application Internet media types  
 (Content-types) are used to identify the NSI interface,  
 version, and supported encoding type. For example, the  
 first string below identifies the NSI Document Distribution  
 Service Version 1 XML encoded representation, while the  
 second string identifies the same protocol and version, but  
 the JSON representation:  
   
 type="application/vnd.ogf.nsi.dds.v1+xml"  
 type="application/vnd.ogf.nsi.dds.v1+json"  
   
 href - This attribute contains the protocol endpoint for the  
 interface identified in this interface reference. For example, the  
 following URL provides the protocol endpoint for the interface type  
 identified in this interface reference.  
   
 href="https://nsa.ogf.org/dds"   
   
 describedBy - This attribute contains a reference to the WSDL  
 or WADL file corresponding to this interface's version (if  
 available). For example, the following URL provides the  
 location for a WADL description of the NSI Interface Discovery  
 Protocol Version 1.  
   
 describedBy="https://nsa.ogf.org/dds?wadl"   
 </xsd:documentation>  
 </xsd:annotation>  
 <xsd:sequence>  
 <xsd:element name="type" type="xsd:string" />  
 <xsd:element name="href" type="xsd:anyURI" />  
 <xsd:element name="describedBy" type="xsd:anyURI" minOccurs="0" />  
 </xsd:sequence>  
 </xsd:complexType>  
   
 <xsd:complexType name="FeatureType">  
 <xsd:annotation>  
 <xsd:documentation xml:lang="en">  
 Type definition for an NSA feature within the network. This type  
 is left underspecified so that external values can be defined  
 as additional features and protocol interfaces are introduced.  
   
 As an example we can model the NSA's CS "role" within the network  
 as shown below:  
   
 <feature type="org.ogf.nsi.cs.v2.role.aggregator"/>  
 <feature type="org.ogf.nsi.cs.v2.role.uPA"/>  
 <feature type="org.ogf.nsi.cs.v2.role.uRA"/>  
   
 We could also model the NSI CS 2.0 reservation commit timeout  
 value for an NSA:  
   
 <feature type="org.ogf.nsi.cs.v2.commitTimeout">120</feature>  
   
 Attributes:  
   
 type - Identifies the type of role modeled by the supplied  
 value.  
   
 value - The optional string value associated with the type.  
 </xsd:documentation>  
 </xsd:annotation>  
 <xsd:simpleContent>  
 <xsd:extension base="xsd:string">  
 <xsd:attribute name="type" type="xsd:anyURI" use="required"/>  
 </xsd:extension>  
 </xsd:simpleContent>  
 </xsd:complexType>  
   
 <xsd:complexType name="HolderType">  
 <xsd:annotation>  
 <xsd:documentation xml:lang="en">  
 A simple holder type for inclusion of elements and attributes  
 from external namespaces. This separate type is required to  
 get around bugs in Libxml2 library used by command line tools  
 like xmllint.  
 </xsd:documentation>  
 </xsd:annotation>  
 <xsd:sequence>  
 <xsd:any namespace="##other" processContents="lax" minOccurs="0"  
 maxOccurs="unbounded"/>  
 </xsd:sequence>  
 <xsd:anyAttribute namespace="##other" processContents="lax" />  
 </xsd:complexType>  
</xsd:schema>