NSI Topology v2.0

Version 1.0

John MacAuley, SURFnet

Derived from discussions with Jerry @ SC 2013

Terminology

Network

- A group of network resources managed by a single network provider and a single NSA.
- A network exposes a set of defined service types representing the services offered to a user by the network.

Intra-Network Topology

- Refers to the topology of resources within a network, and the services offered by that network.

Inter-Network Topology

- Refers to the topology of interconnected Networks and the common services offered across these interconnected Networks.
- Inter-Network Topology is concerned with describing the way in which Networks are statically interconnected by treating each Network as an aggregated set of Network capabilities and Edge Points.

Service

- A service is a “connection” between two points in a Network with certain predefined and dynamically specified characteristics that will deliver a payload from Network ingress to Network egress unmodified.

Service Type

- A predefined type of service offered by a network and specified by a Service Definition.

Terminology

Service Definition

- A document that describes the predefined characteristics and requestable elements associated with a service being offered by a Network.

Service Termination Point (STP)

- An STP names a topological location that is the ingress/egress point of a Network and is defined by a single Service Type.
- An STP can be fully specified representing a single termination point, or under specified representing a set or bundle of STP.

Service Domain

- A group of STP within a Network described by a single Service Type and can be fully interconnected without restriction.
- Service Domain is equivalent to the NSI Transfer Function as defined in the NSI Reference Architecture.

Service Demarcation Point (SDP)

- SDP are formed when a pair STPs of matching capabilities are considered adjacent (and connectable) between two Service Domains.

Service Region

- The set of interconnected Service Domains of the same Service Type. (i.e. Inter-Network Topology for that service type).

Terminology

Adaptation (Interworking)

- By definition, Service Domains of different Service Types cannot be directly connected due to the differing Service Definitions, however, an Adaptation can be defined that permits interconnection of STP from two different Service Domains using the concepts of encapsulation and adaptation.
- An Adaptation defines the (de)encapsulation or (de)adaptation of one service type into another service type if the Network is capable of offering the service.
- An Adaptation has directionality (adaptation and de-adaptation).
- Unidirectional and bidirectional Adaptations are supported, with bidirectional Adaptations containing a symmetric pair of adaptation and de-adaptation functions.
- An Adaptation can also be defined between STP of the same service type in the case where encapsulation/adaptation of the input service type results in the same output service type.
- An Adaptation has an associated Service Definition describing the Service Adaptation, parameters of the service, attributes of the service, and specifically any restrictions/ limitations.

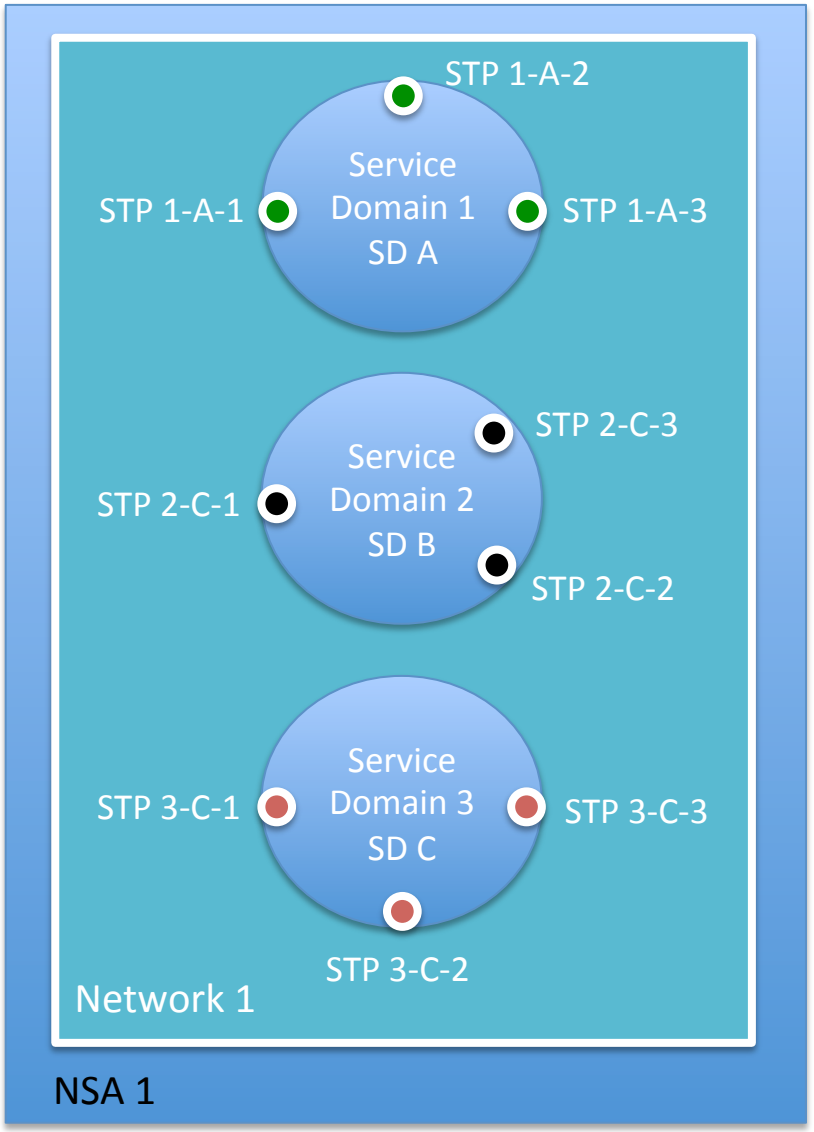
Service Domain

In a Service Domain any STP can be connected to any other STP.

A Service Domain has an associated Service Definition (SD) describing the service being offered.

Service Domains are grouped into Network topologies that can be advertised by at most one NSA.

An NSA can advertise multiple Network topologies.



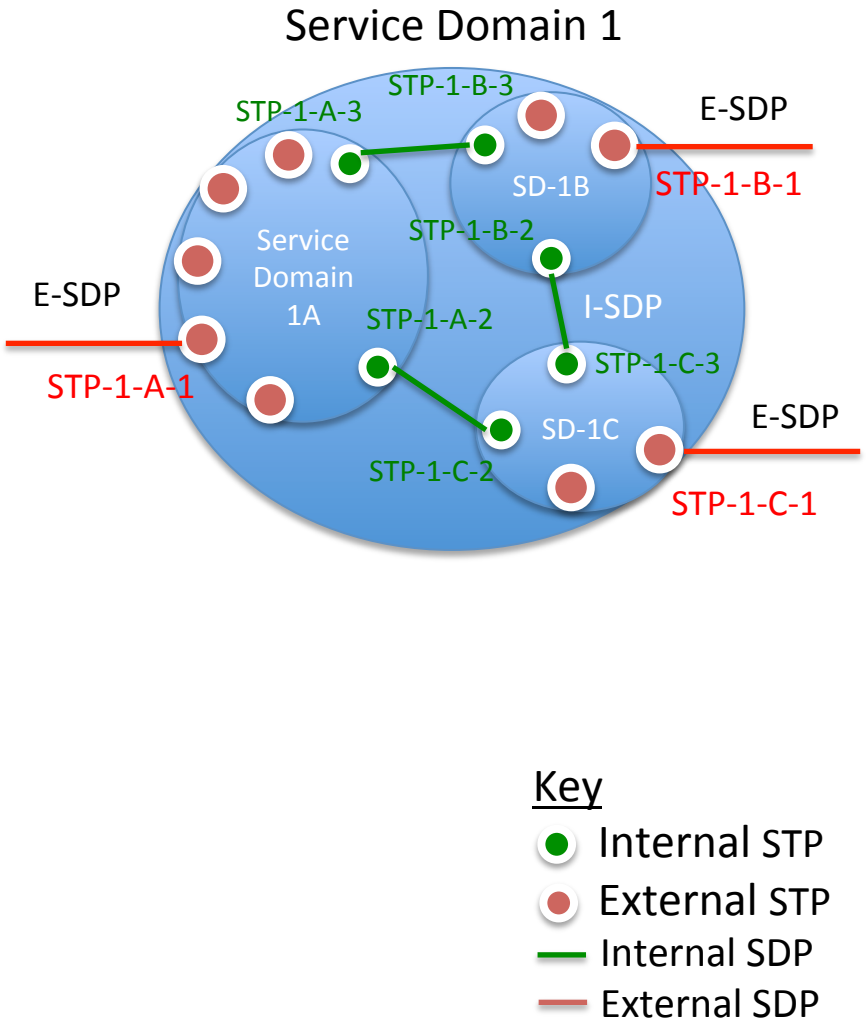
Service Domain

Service Domains can be nested to model internal structure.

Externally visible STP are used for inter-domain interconnection to peer networks.

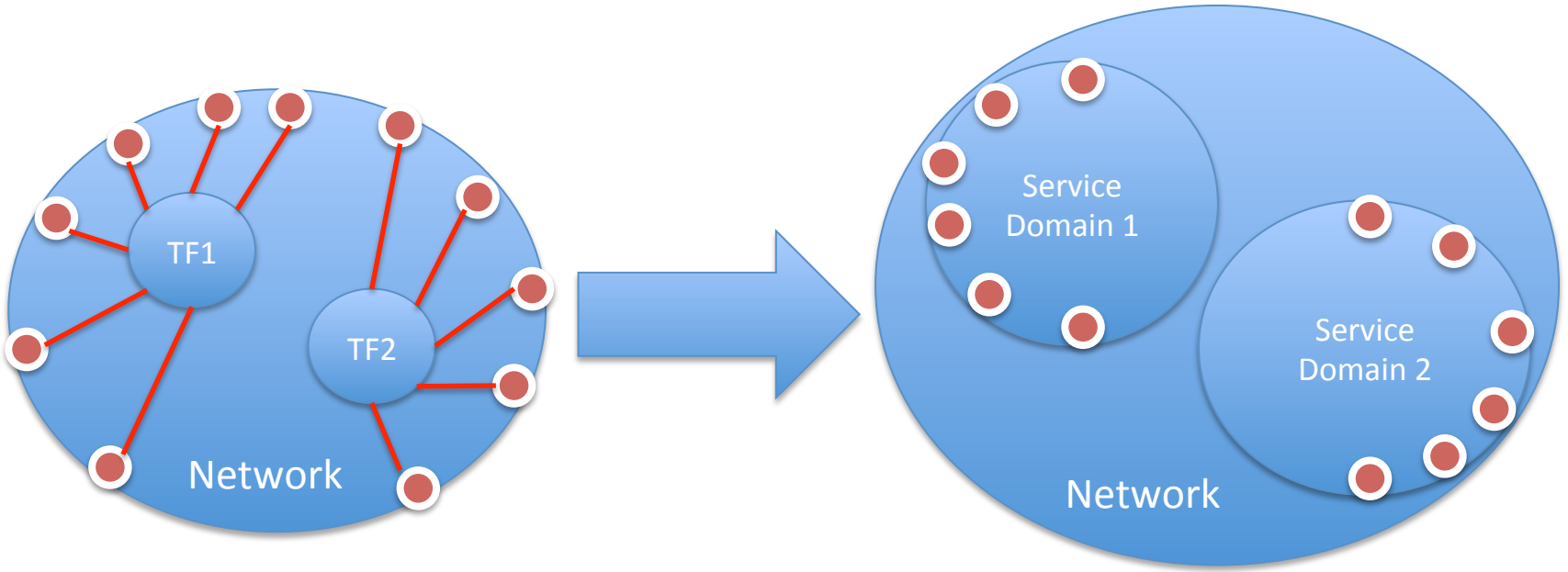
Internal STP are used to connect the internal Service subdomain as well as to the Domain's external STP points.

An external path finder could issue a request to connect STP-1-A-1 to STP-1-C-1 and delegate internal path finding to the uPA, or if the path finder would like to provide additional guidance, it could specify a more detailed path such as (STP-1-A-1, STP-1-A-3), (STP-1-B-3, STP-1-B-2), and (STP-1-C-3, STP-1-C-1).



NSI Transfer Function

- In this new model the Transfer Function is not required since similar outcomes can be achieved through the definition of separate Service Domains.
- Remember a Service Domain has the requirement for single Service Type and full interconnectivity between member STP.



Adaptation

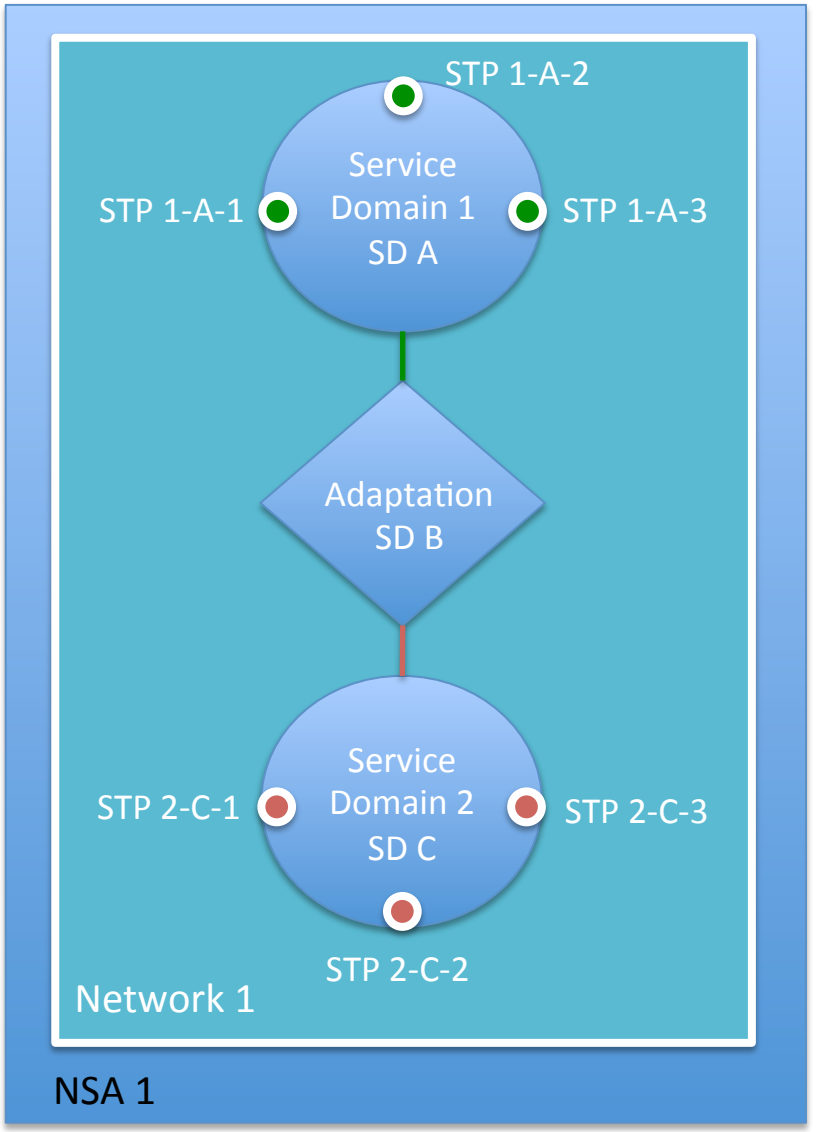
Service Domains contain a set of STP of the same Service Type that are capable of being interconnected.

Adaptations are used to connect STP from two Service Domains within the same Network, essentially allowing a path finder to determine if it is possible to “enter” an STP in one Service Domain and “exit” an STP on a different Service Domain.

Adaptations are defined with their own Service Definition, describing the capabilities of the adaptation, and the service specific parameters needed to make the reservation requests across the Adaptation.

A request to NSA 1 going from STP 1-A-2 to STP 2-C-2 can be made in a SINGLE request, however, the request parameters must specify the Service Type of the Adaptation. These parameters will contain values required by each component STP, as well as adaptation specific parameters. For example:

```
resv.req (
        serviceType=“B”,
        sourceStp=“STP 1-A-2”,
        sourceParams={Ethernet parameters},
        destStp=“STP 2-C-2”,
        destParams={SDH parameters},
        adaptParms={Adaptation specific params}
);
```



Adaptation within Service Domains

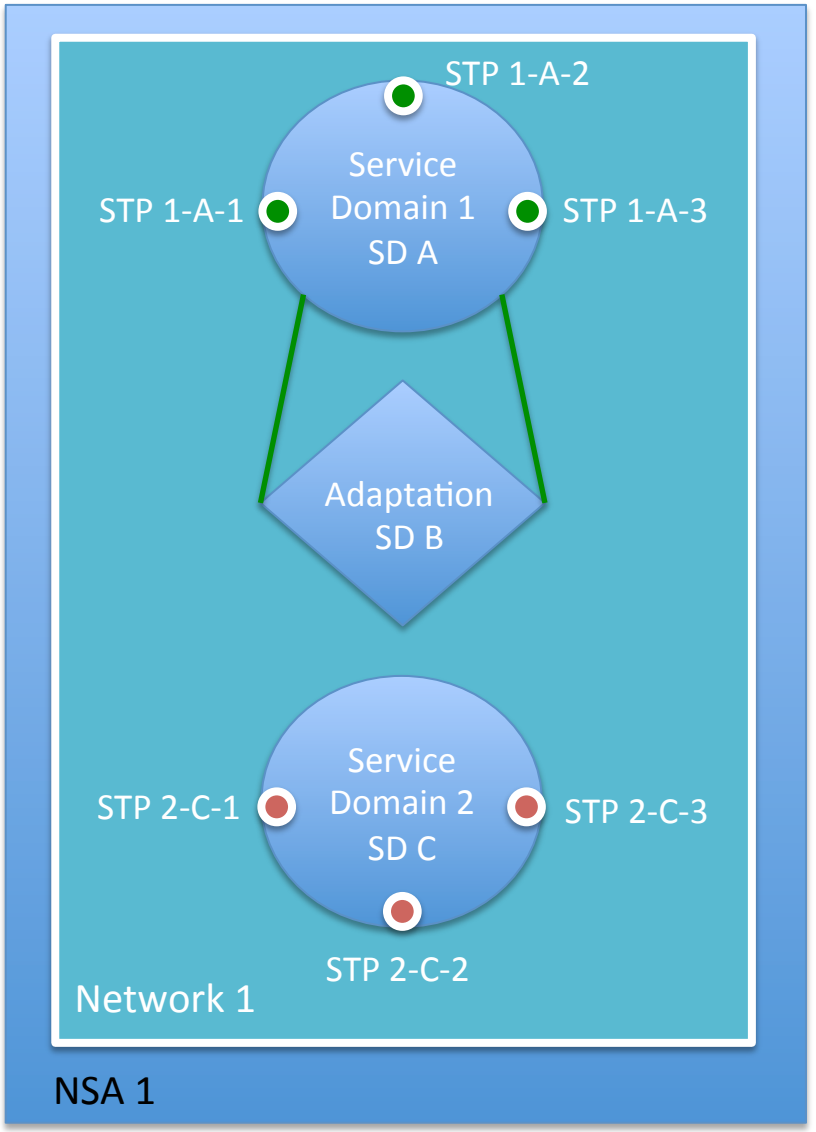
Adaptations can be defined between STP of the same type, resulting in an adaptation occurring between two STP within the same Service Domain.

A service request of this type would require specification of the Service Definition for the adaptation, and not the Service Definition associated with the Service Domain.

A request to NSA 1 going from STP 1-A-1 to STP 1-A-3 can be performed using the Service Type of the Adaptation allowing for manipulation of the ingress service. These parameters will contain values required by each component STP, as well as adaptation specific parameters. For example, we define SD B to allow the encapsulation of the ingress service PDU with the addition of a VLAN identifier:

```
resv.req (
        serviceType="B",
        sourceStp="STP 1-A-1",
        destStp="STP 1-A-3",
        EthernetParams={Ethernet parameters},
        adaptParms={Push vlan=1790}
);
```

The path finder can then "pop" the added VLAN identifier later in the path using the reverse Adaptation.



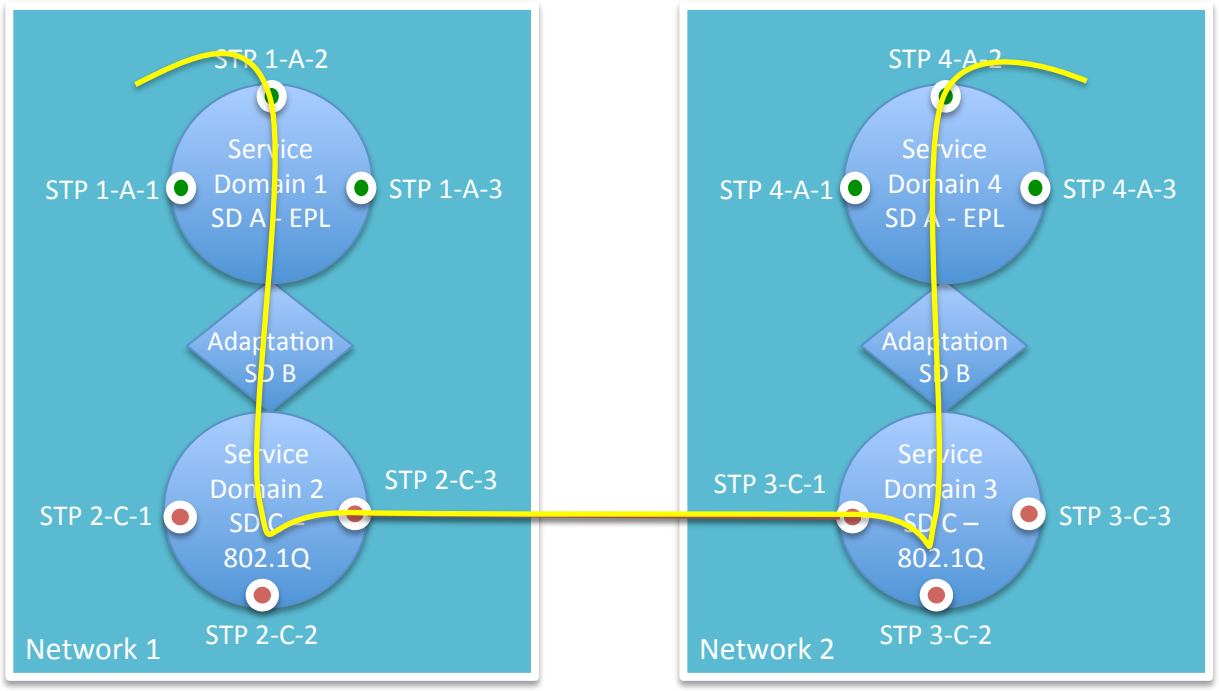
Adaptation in action

In this example we have an EPL service offered in Service Domain 1 defined by Service Description A, and an 802.1Q Trunk service in Service Domain 2 defined by Service Description C.

The EPL service offered in Service Domain 1 could be implemented using a number of technologies, however, from an end user perspective this is not important as they are interested in the service being offered, and not the technology behind the service.

For adaptation between Service Domain 1 (Service Definition A) and Service Domain 2 (Service Definition C) in Network 1 we require a transform from the EPL service, to the 802.1Q Trunk compliant service. For this example, we define an Adaptation (Service Definition B) that interconnects STPs in Service Domain 1 to STPs in Service Domain 2 through encapsulation of the original EPL service Ethernet frames using 802.1AH. The 802.1AH frame is compatible with Service Domain 2, using the S-TAG from the 802.1AH frame as the switching VID. Where this encapsulation occurs in the network is irrelevant from a path finder perspective, and is left up to the supporting NSA to worry about the details.

Similarly, in Network 2 we must reverse the encapsulation performed in Network 1 to get back the original service type to deliver to the end user. In this case the paired Adaptation (Service Definition B) in Network 2 is used to remove the 802.1AH header allowing an STP in Service Domain 3 (Service Definition C) to be connected to an STP in Service Domain 4 (Service Definition A) getting us back to the original Service Type.



Terminology Alignment

Framework Terminology	New Terminology	Notes
Inter-Network Topology		The full interconnectivity of all defined networks.
	Service Region	A Service Region is a single Service Type subset of the Inter-Network Topology.
Network Service Agent (NSA)	Network Service Agent (NSA)	
Network	Network	A network object collects a set of Service Domains (Transfer Functions), STP, SDP, and Adaptations.
Transfer Function	Service Domain	A Service Region has equivalent functionality and behaviors to the Transfer Function minus any implied adaptation.
Service Termination Point (STP)	Service Termination Point (STP)	
	Adaptation	Provides ability to connect services using STP of different Service Types, or adapt between two STP of the same service type.
Service Demarcation Point (SDP)	Service Demarcation Point (SDP)	
Service Type	Service Type	
Service Definition	Service Definition	