ATIS-1000039

TESTING CONFIGURATION FOR IP NETWORK TO NETWORK INTERCONNECTION RELEASE 1.0

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ATIS-1000039, *Testing Configuration for IP Network to Network Interconnection Release 1.0*

Is an ATIS Standard developed by the **Next Generation Carrier Interconnection (NG-CI)** Task Force under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

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ATIS Standard on

TESTING CONFIGURATION FOR IP NETWORK TO NETWORK INTERCONNECTION RELEASE 1.0

Alliance for Telecommunications Industry Solutions

Approved August 2010

Abstract

This document provides the service under test (SUT) configurations and their operations for verifying the conformance with the desired configuration and service interoperability.

FOREWORD

The Alliance for Telecommunication Industry Solutions (ATIS) serves the public through improved understanding between providers, customers, and manufacturers. The Packet Technologies and Systems Committee (PTSC) develops and recommends standards and technical reports related to services, architectures, and signaling, in addition to related subjects under consideration in other North American and international standards bodies. PTSC coordinates and develops standards and technical reports relevant to telecommunications networks in the U.S., reviews and prepares contributions on such matters for submission to U.S. ITU-T and U.S. ITU-R Study Groups or other standards organizations, and reviews for acceptability or per contra the positions of other countries in related standards development and takes or recommends appropriate actions.

The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages. The word *may* denotes a optional capability that could augment the standard. The standard is fully functional without the incorporation of this optional capability.

Shall indicates a strict requirement to be exercised and validated. *May* indicates an optional feature that may be supported, but is not required and will not be validated.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, PTSC, 1200 G Street NW, Suite 500, Washington, DC 20005.

The Next Generation Carrier Interconnection (NG-CI) Task Force was responsible for the development of this document.

At the time of consensus on this document, PTSC, which was responsible for its development, had the following leadership:

M. Dolly, PTSC Chair (AT&T)
V. Shaikh, PTSC Vice-Chair (Telcordia)
G. Yum, PTSC NG-CI Chair (Verizon)
M. Hammer, PTSC NG-CI Vice-Chair (Cisco)
M. Desterdick, Technical Editor (Verizon)

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1 SCOPE, PURPOSE, & APPLICATION

The ATIS Next Generation Carrier Interconnection (NG-CI) Task Force (TF) TRs specify a standards-based interface for network-to-network interconnection for next generation network services.

This document provides the service under test (SUT) configurations and their operations for verifying the conformance with the desired configuration and service interoperability.

The purpose of this document is to specify the SUT configurations that shall be utilized in order to verify the settings (to support ingress and egress processing) of the network border elements for interoperability of a service between providers.

The SUT configurations are used as a framework to specify the call flows in the Test Suite document and may be used to develop test plan for service interoperability test.

It is a component of a family of documents that, taken as a whole, provides an IP network to network interconnection (NNI) guideline that supports next generation service interoperability.

This Release 1.0 addresses Basic VoIP service, Basic VoIP service with DTMF support, and Basic VoIP service with T.38 Fax support, for native IP endpoints.

Post release 1.0 will address support for RPH as well as services and capabilities such as domestic mobile-to-mobile voice service interconnect over IP and international mobile and nomadic endpoints. Other services like wireline-TDM, managed peer-to-peer, mobile-to-mobile peering, IPTV, multimedia services, gaming, fixed-mobile service convergence, etc., may also be considered.

The ATIS NG-CI TRs cover four aspects of interconnection and this specific TR has three other companion TRs that together address VoIP services Interconnection over IP-based links/networks.

The companion TRs include the following:

- The "Protocol Suites" TR (ATIS-1000040) provides the service specific protocol requirements to support service interoperability. While the other documents in this Release 1.0 set make reference to the specifications covered, the "Protocol Suites" TR identifies the specific details of protocol elements to be tested.
- The "Test Suite" TR (ATIS-1000041) provides the tests used for IP NNI interconnection testing in order to support service interoperability.
- The "Technical Parameters" (ATIS-1000038) TR provides a description of the Provider data for collection and eventual exchange for service planning in order to support service interoperability.

Establishing and specifying the fixed protocol and configuration profiles, and the variable or selectable parameters that can then be applied uniformly and consistently for interconnects, will ensure a reliable level of conformance to a standard that supports the establishment of successful interoperability.

1.1 Assumptions

Due to the variety of security configurations and credentials possible between providers, the use of IPSEC or TLS to support signaling or media streams will be subject to agreement between those providers and will not be defined within this document.

The level of information presented here is intended to be sufficient to support interoperability testing events, however additional work will be required to develop actual test scripts based on the test scenarios, configurations and protocol suites presented

It is understood that test SIP device endpoint E.164 addresses will need to be exchanged prior to testing. SIP URIs converted from TEL URI format will be used to convey the E164 addresses. (See section of ATIS-1000009.2006 for example URIs.)

IPv4 is assumed unless otherwise stated.

The term Provider is used to generically represent all types of parties.

2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of this ATIS Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this ATIS Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ATIS-1000007.2006, *Generic Signaling and Control Plane Security Requirements for Evolving Networks*.[1]

ATIS-1000008.2006, *ANSI Extensions to Q.1980.1 - The Narrowband Signaling Syntax (NSS) – Syntax Definitions*.[1]

ATIS-1000009.2006, *IP Network -To-Network Interface Standard for VoIP*. [1]

ATIS-1000010.2006, *Support of Emergency Telecommunications Service (ETS) in IP Networks*.[1]

ATIS-1000011, *ETS Packet Priority for IP NNI Interfaces - Use of Existing DiffServ Per Hop Behaviors*.[1]

ATIS-1000013.2007, *Lawfully Authorized Electronic Surveillance (LAES) for Internet Access and Services*. [1]

ATIS-1000013.a.2009, *Supplement to ATIS-1000013.2007, LAES for Internet Access and Services*. [1]

ATIS-1000014, VoIP *Network-to-Network Interface Testing Framework*. [1]

ATIS-1000017.2008, *Network Interface Protocol and the Session Initiation Protocol (SIP) with ANSI Extensions to the Narrowband Signaling Syntax (NSS)*. [1]

ATIS-1000018, *NGN Architecture*. [1]

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[1] This document is available from the Alliance for Telecommunications Industry Solutions (ATIS), 1200 G Street N.W., Suite 500, Washington, DC 20005. < https://www.atis.org/docstore/default.aspx >

ATIS-1000019.2007, *Network to Network (NNI) Standard for Signaling & Control Security for Evolving VoIP/Multimedia Networks.*[1]

ATIS-1000020, *ETS Packet Priority for IP NNI Interfaces - Requirements for a Separate Expedited Forwarding Mechanism.*[1]

ATIS-1000026.2008, *Session/ Border Control Functions and Requirements.*[1]

ATIS-1000028.2008, *IP Device (SIP for UA) to Network Interface Standard.*[1]

ATIS-1000029.2008, *NGN Security Requirements.*[1]

ATIS-1000030.2008, *NGN Authenticating Requirements.*[1]

ATIS-1000035.2009, *NGN Identity Management (IdM) Framework.*[1]

ATIS-1000036, *NGN Operator Services Architectures and Interfaces.*[1]

ATIS-1000104.1991 (R2008), *Exchange-Interexchange Carrier Interfaces - Individual Channel Signaling Protocols.*[1]

ATIS-1000607.a.2006, *Supplement to T1.607-2000 (R2004).*[1]

ATIS-1000619.a.1994 (R2007), *Integrated Services Digital Network (ISDN) – Multi-Level Precedence and Preemption (MLPP) Service Capability (MLPP service domain and cause value changes).*[1]

ATIS-1000625.a.1998 (R2008), *Supplement to ATIS-1000625.1993 (R2008).*[1]

ATIS-1000627.1993 (R2009), *Broadband ISDN - ATM Layer Functionality and Specification.*[1]

ATIS-1000678.2006, *Lawfully Authorized Electronic Surveillance (LAES) for Voice over Packet Technologies in Wireline Telecommunications Networks, Version 2.*[1]

ATIS-1000678.a.2007, *Supplement to ATIS-1000678.2006.*[1]

ATIS-1000679.2004 (R2010), *Interworking between Session Initiation Protocol (SIP) and Bearer Independent Call Control or ISDN User Part.*[1]

T1.TR.76-2001, *Operation of the BICC Protocol with IP Bearer control Protocol (WD).*[1]

T1.TR.82-2003, *SIP Network Operators Implementers Guide for Pre-Paid Calling Cards, with DTMF Detection at the PSTN-IP Gateway.*[1]

3 ACRONYMS & ABBREVIATIONS

ANSI	American National Standards Institute
ATIS	Alliance for Telecommunications Industry Solutions
DTMF	Dual-Tone Multi-Frequency
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPSec	Internet Protocol Security
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
ITU	International Telecommunications Union

NG-CI TF	Next Generation Carrier Interconnection Task Force
NNI	Network to Network Interface
PTSC	Packet Technologies and Systems Committee
RFC	Request for Comments
SDP	Session Description Protocol
SIP	Session Initiated Protocol
SP	Service Provider
TCP	Transmission Control Protocol
TLS	Transport Layer Security
UDP	User Datagram Protocol
URI	Universal (or Uniform) Resource Identifier (or Indicator)
VoIP	Voice over Internet Protocol
VPN	Virtual Private Network

4 SERVICE UNDER TEST CONFIGURATION FOR IP NETWORK TO NETWORK INTERCONNECTION

4.1 IP-IP NNI Reference Model

4.1.1 Background

The IP-IP network to network interfaces (NNI) Reference Model shown below in Figure 1 is an enhancement of the reference model defined in ATIS-1000018. The reference model provides a framework to specify next generation carrier interconnection (NGCI) configuration. This framework model focuses on the NNI between two providers and also displays the end user devices and their access network methods.

4.1.2 Network to Network Interfaces (NNI)

The NNI is defined between two provider's networks and the traffic that flows across the NNI terminates at each provider's border elements. The NNI focuses on the functions and features at the protocol layers above the IP transport layers. The NNI consists of three types of interfaces: 1) Signaling; 2) Media; and 3) Routing & Translation. For the NGCI Release 1.0 work, the interconnect configuration addresses only the Signaling and Media interfaces. Specifications related to the Routing & Translation interfaces has been identified but is targeted for development after Release 1.0. Note the reference diagram displays the "Scope of PTSC NNI Work" in a box surrounding all but the OAM&P, and that the NGCI Task Force work represented in Release 1.0 is a subset of all NNI work addressed by the PTSC sub-committees.

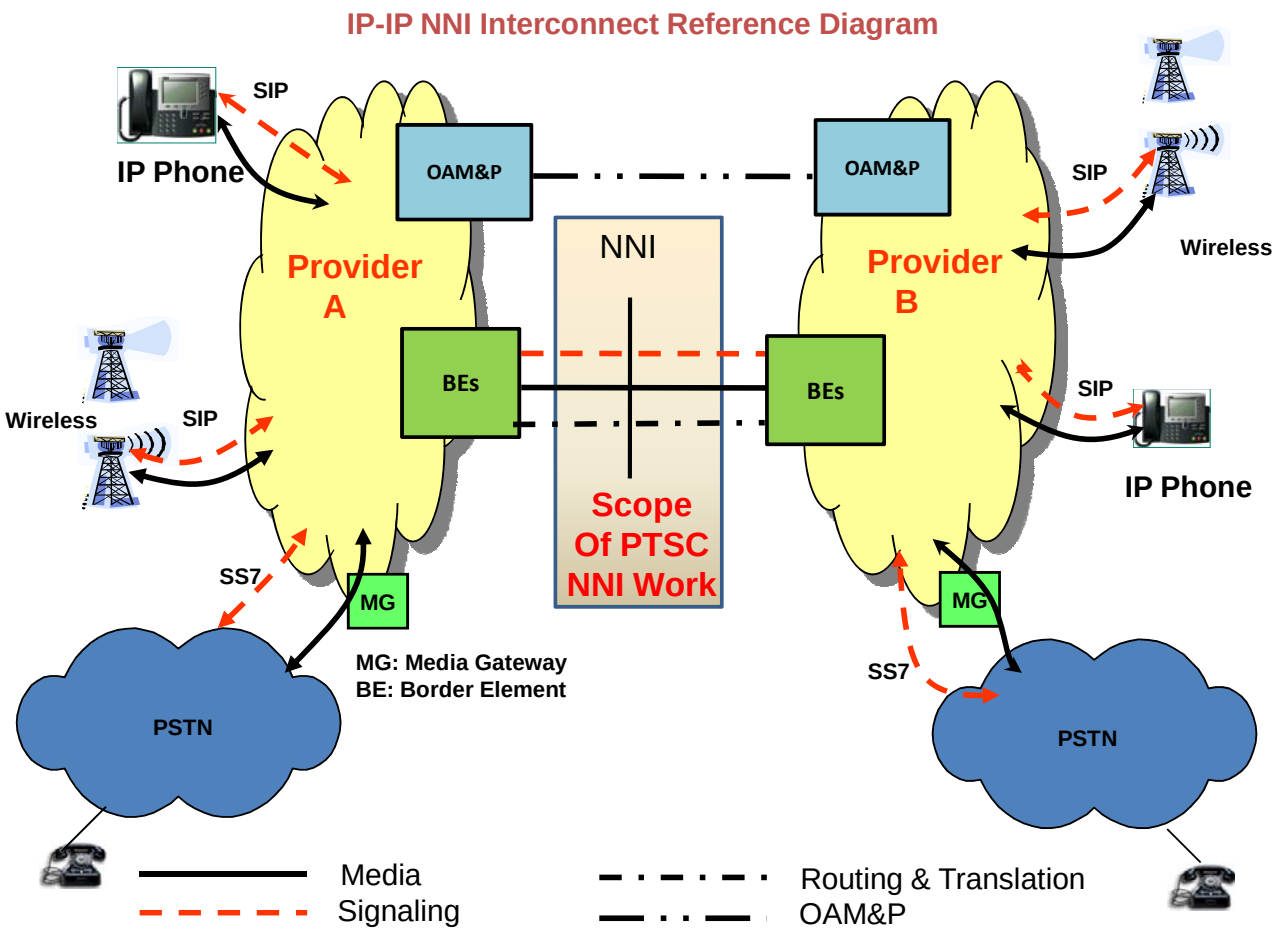

Figure 1: IP-IP NNI Interconnect Reference Diagram

4.1.3 User Devices and Access Network Methods

The three types of user devices and their corresponding access network methods described in the reference framework are:

- SIP IP Phone with SIP/Media traffic over an IP wireline access;
- Wireless SIP device with SIP/media traffic over wireless access; and
- PSTN elements with SS7/analog traffic over packet/circuit switched network access.

In NGCI Release 1.0, the focus is to define an IP NNI service interface for native IP endpoints that is independent of the types of end user devices and their network access methods. Therefore, only SIP devices with wireline access and SIP devices with wireless access are relevant for Release 1.0. Refer to clause 1 of this document for more information regarding the scope for both Release 1.0 and post-Release 1.0.

4.2 Provider Network Architecture

For Release 1.0, the NGCI test configuration assumes two basic configurations for providers' network architecture. A basic configuration offers a minimal view into a peering provider's network across the NNI. Each configuration consists of six common elements. The locations of these elements differentiate one configuration from another. The following are the six elements and the two basic configurations.

4.2.1 SIP Server

A SIP Server supports any or all of functions associated with the registration, re-direction, and proxy servers. From NGCI's perspective, the SIP Server supports the re-direct server and/or the proxy server functions. The SIP Server is the signaling element that terminates and originates signaling traffic across the signaling interface over the NNI. The network element will be known to the interconnecting provider as the "Signaling Port."

4.2.2 Media Endpoint

A Media Endpoint represents a device that originates and terminates media traffic across the NNI. However, it may also be capable of handling local signaling traffic with other network elements within the provider's own networks. However, this is outside the scope of this document.

4.2.3 Border Element

A border element represents a gateway for signaling and/or media traffic across network domains. A border element may be used to handle a provider's inter-network traffic as well as inter-provider traffic. The functional specifications of a border element can be found in ATIS-1000026.2008.

4.2.4 Peering Edge Router

A peering edge router (PER) is similar to a border element, but it is functionally confined to the IP layer processing functions. The edge router serves as an IP layer gateway and is used to peer with other providers' edge routers. However, the border elements behind the PER will be known to the interconnecting provider as the "Signaling Port" and the "Media Port."

4.2.5 Advertised Routing Domain (ARD)

An ARD is an IP network for which the routing information is advertised to peer networks. The network also shares a common address space with other connecting networks.

4.2.6 Unadvertised Routing Domain (URD)

An URD is an IP network for which the routing information is not advertised to peer networks. IP endpoints in the URD can not exchange traffic with other IP endpoints outside the URD directly. Border elements are typically located on the edge of URD to support network address translation functions in order to allow traffic exchange between the endpoints in the URD and outside networks. The IP address assignment for an URD has few limitations. Since it is not connected to any other networks, the IP endpoints in the URD can be assigned with public addresses, private addresses, or a combination of the two.

4.2.7 Basic Network Configurations

A basic network configuration provides a view of a provider's network without exposing any unnecessary information about the provider's internal/local networks. The information revealed in the basic configurations however allows the providers to choose and negotiate the most appropriate option to connect to each other. The two basic network configurations considered in Release 1.0 are shown in Figure 2 and Figure 3 below. Additional configurations will be considered in future releases.

The following disscussion on the figures focuses on the elements labebed with letters "A", "B", and "C". These labels will be used to distinguish one network configuration from another across the NNI.

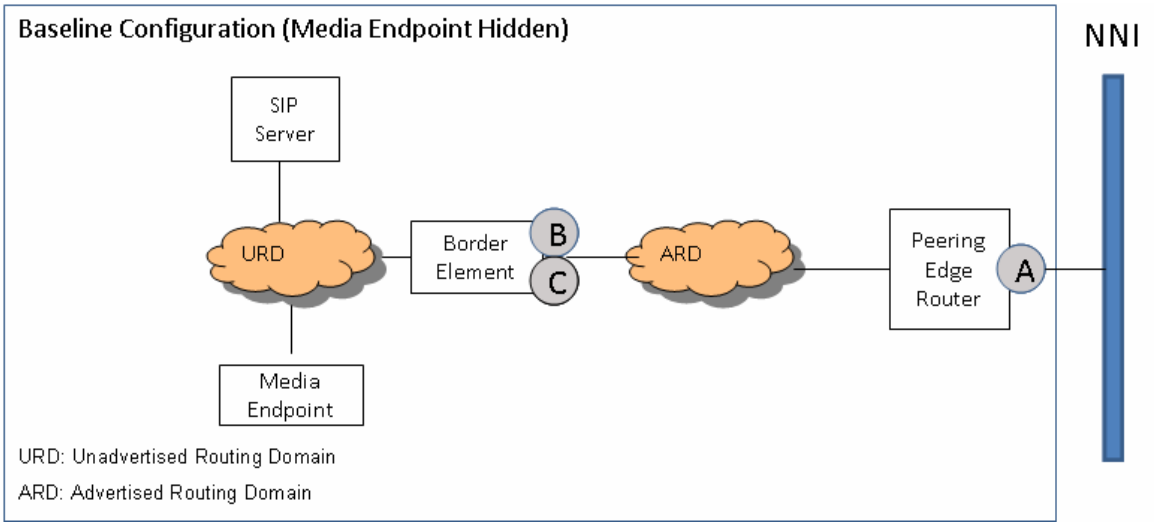

Figure 2: Baseline Configuration (Media Endpoint Hidden)

The Peering Edge Router (PER) is the front end IP network element facing the other providers' networks. It provides the IP network connectivity between the local ARD and the NNI. On the NNI side, the PER supports a port labeled as "A" in both Figures 2 and 3. Each port is assigned with one or more IP addresses. These addresses are used to exchange IP network routing information and forward IP traffic, among other PER functions.

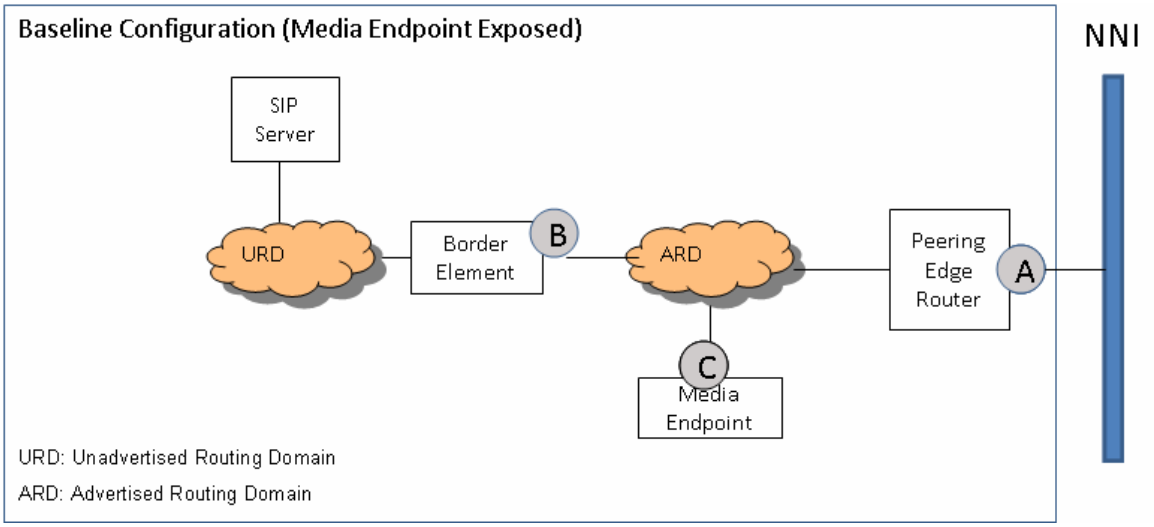

Figure 3: Baseline Configuration (Media Endpoint Exposed)

In both Figure 2 and Figure 3, the SIP Server is always connected to a URD behind a Border Element. The Border Element in both cases serve as a gateway to external SIP servers. . To ensure the SIP signaling messages across the ARD and NNI, providers may require the use of a secure protocol such as IPSec tunnel to transport the traffic. The IPSec tunnel or connection can terminate either in the border element or in a security gateway (not shown) adjacent to the Border Element. The signaling address to be advertised across the NNI is hosted by a port on the Border Element, and is represented by the letter "B" in both configurations.

The Media Endpoint may be connected to an URD hidden behind a Border Element, in which case the Border Element would be known to the interconnecting providers as the Media Port as shown in Figure 2. Or, the Media Endpoint may not be hidden behind a separate border element, and therefore exposed by being direclty connected to an ARD and the Peering Edge Router as shown in Figure 3. In this case, the Media Port "C" in Figure 3 is the attached to the Media Endpoint. In summary, the Media Port address to be advertised (and known as the Media Port to the other providers) across the NNI may either be a port on the Border Element (Figure 2), or if the Media Endpoint is not behind a border element, then it will be a port on the (actual) Media Endpoint(s) as shown in Fgure 3. In both figures, this port is labled with a letter "C".

4.3 Service Under Test (SUT) Configurations

The Test configurations are used by providers to conduct tests to verify the technical service agreement. The agreement (among other things outside the scope of this TR) consists of service scenarios, protocol requirements, and parameters, which are covered in the other three companion NGCI TR documents.

For Release 1.0 specifications, the test configurations on each side of the NNI are defined by a set of "logical" service ports (or ports):

1. Peering Edge Router Port;
2. SIP Signaling Port; and
3. Media Port.

This set of ports and the basic network configurations are identified in the previous section. The information required to specify a test configuration is therefore reduced to the specification of these logical ports for voice services.

The complete specification of these ports includes the protocol profiles and the selectable parameters and their values as specified during interconnection negotiation between providers. These port configuration parameters are documented in the companion NGCI TRs, including ATIS-1000040 and ATIS1000038. The values of the fixed and selectable parameters will be specified by the providers per service agreement, which will finalize the actual design of the configuration for each test.

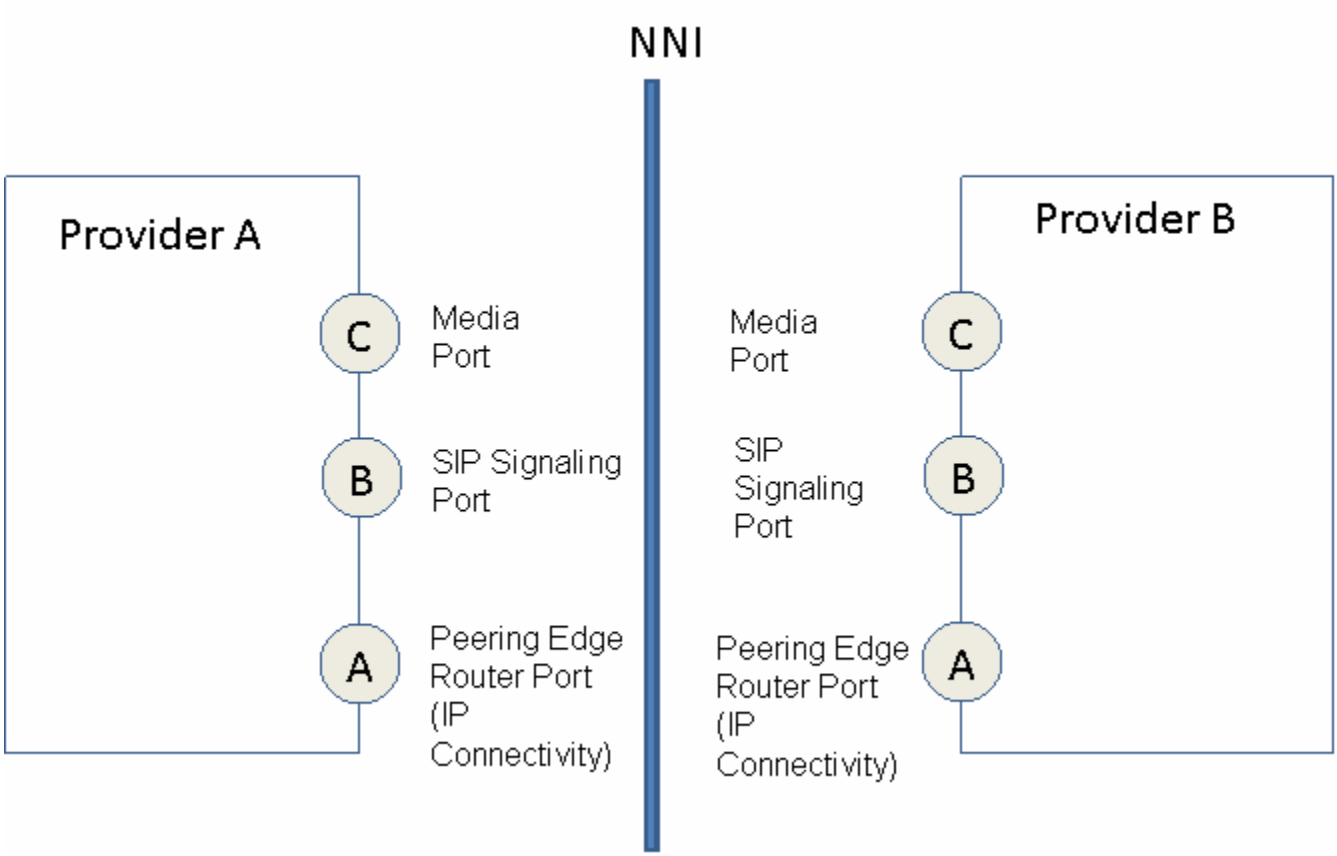

Figure 4: Port Visibility at the NNI

4.3.1 Peering Edge Router Port

This port supports IP peering functionality covering (for example) routing, control, and forwarding functions that a provider supports across an NNI. The port consists of one or more IP addresses and separate IP addresses may be assigned to handle signaling/control traffic and to forward VoIP signaling/media traffic.

Facing the NNI, the port can configured using one of the two following general configurations based upon the Interconnection Method agreed upon by the two providers:

1. *Private Interconnection*: This configuration allows two providers to use a private dedicated layer 2 and/or layer 3 mechanism (Private Interconnection Method) to transport IP traffic across the

NNI between their Peering Edge Routers via a private IP network (e.g., via a VPN). The connection will be used exclusively for the exchange of the interconnection service traffic. One or more physical links may be used to support the connection.

2. *Public Interconnection*: This configuration allows two providers to use a public IP network to exchange service traffic. A public network refers to a routing domain shared by a large number of parties, as in the case of the Public Internet. Each provider specifies its own network links to connect to the public network. As such, peering providers using this interconnection method may not use the same set of configuration parameters for their respective network links to connect to the public internet (or a public network). While a public network is used to support transporting of service traffic, the providers will likely choose to specify the use of some tunneling mechanism like IPSec to protect the privacy and security of the service data transported over a public network.

4.3.2 SIP Signaling Port

This port is same as the Signaling Port in the IP-IP NNI Reference Model. It is used to exchange SIP messages between two providers over an NNI independent of interconnection type. The protocol requirements for the SIP traffic is specified in a companion document ATIS-1000040.

Depending on the agreement between two providers, a point-to-point secured transport mechanism between their SIP Signaling Ports may be used to support the privacy, authentication, authorization functions for the signaling traffic. This port consists of one or more IP addresses in an ARD -- i.e., a routing domain that will be advertised across the NNI to the other provider.

A provider, however, can choose to advertise only the portion of the IP routes necessary to support the service traffic to the peering providers. Additional configuration parameters such as bandwidth, message handling rate, load-balancing mechanism, etc., should also be considered, but are outside the scope of Release 1.0.