ribbon

Secure Real-Time Communications

Ribbon's Network-to-Network Interface Solution

Lower Costs and Increase Revenues by Migrating to IP Networks

Key Takeaways:

- IP-based NNI creates new services offerings and revenue streams
- IP-based NNI lowers total cost of network ownership
- Ribbon has helped many service providers migrate their legacy NNI deployments to a cost-efficient IP solution

Introduction

Network-to-Network Interface (NNI) peering points between service providers are most often characterized as having dynamic traffic demands. These dynamic traffic demands can be ascribed to mobile operators, fixed network operators, cable providers, and wholesale service providers. Moreover, the traffic patterns are dynamic in nature, because each service provider is trying to optimize the cost of their interconnection points.

Many of those service providers are still connected to their intra-country NNI partners using legacy/TDM connections. This is rapidly changing, as service providers try to lower their network costs in order to compete effectively. In many countries, TDM connectivity is being deregulated and IP connectivity has become the new standard. In order to meet regulatory requirements and to properly monetize NNI services, most global service providers are migrating their core voice networks to IP.

Wherever possible, service providers are adopting IP due to cost advantages, the extended service reach it provides, and its proven resiliency. While IP-based communications offer many significant benefits at the interconnection point between NNI partners, IP comes with its own set of challenges. NNI operators will need to have sophisticated session routing control, comprehensive interworking capabilities to overcome the myriad complexities of IP, and scalable solutions that minimize rack space and power consumption.

This document will outline important considerations when migrating a legacy/TDM NNI infrastructure to an IP network.

Don't Bet Your Business on TDM Infrastructures

Over the past decade, NNI operators have built huge datacenters to support legacy/TDM infrastructures. Those operators are facing increased revenue and margin pressures which require new and differentiated service offerings. Unfortunately, TDM is not designed for efficient delivery of newer forms of rich traffic content such as video, content sharing, and messaging.

In addition, equipment manufacturers are not investing in their legacy product lines. This exacerbates operators' concerns, because most TDM equipment is ageing and becoming costly to maintain and operate. Operators that have not migrated away from a TDM infrastructure likely have massive unit(s) to handle the voice-only traffic. Those units are not only take a huge amount of space, they also have large power consumption requirements. And when legacy/TDM equipment eventually fails, it will take time to find and install replacement parts. The cost and risks of service disruption cannot be ignored by operators.

Whether NNI operators like it or not, the world is quickly moving to IP. To avoid the pitfalls of TDM, operators are adopting and building out IP infrastructures. IP-based infrastructures enable operators to uncover great potential new business by offering a rich communications portfolio incorporating voice, video, messaging, and collaboration. With smaller overall footprints based on "rack units" and lower power consumption requirements, operators can realize a lower Total Cost of Ownership (TCO) with IP.

With an IP-based infrastructure, NNI operators can extend their voice revenue streams by offering new services such as High Definition (HD) voice, which cannot be achieved in legacy/TDM infrastructures. HD voice has a higher audio quality, which increases end-user satisfaction and results in longer calls and lower churn. Additionally, new revenue-producing services such as WebRTC delivery and VoLTE roaming cannot be achieved in legacy/TDM environments.

Finally, IP allows operators to invest in network function virtualization (NFV) infrastructures. Operators can quickly deploy new services that require a much more flexible and adaptable network—one that can be easily and quickly installed and provisioned. They can deploy their network functions, such as SBCs, on a common set of servers, which lowers overall maintenance and operational costs.

Ribbon, a leader in NNI/peering infrastructures, has helped many service providers migrate their legacy deployments to a cost-efficient IP solution.

Summary of NNI Migration to IP Benefits
IP offers a common backbone infrastructure for different types of services (voice, video, and data)
New services offerings and revenue streams (HD voice, video, WebRTC, and messaging) attributed to IP
Lower total cost of ownership for IP (examples: racks and power consumption)
Network flexibility – IP is easily and quickly installed and provisioned
Network Function Virtualization – IP services can operate on a common server infrastructure, which lowers overall maintenance and operational costs
Scalability – IP expands service offerings quickly

Building a Successful Network-to-Network Interface Architecture

Building a successful Network-to-Network Interface (NNI) solution architecture requires four critical elements: scalability, flexibility, robust SIP interworking, and centralized intelligent session control.

Scalability

When you process large amounts of voice sessions every day, a scalable solution with high performance is critical. A scalable solution that can grow via a simple software license key and have no performance impacts when features are turned on is paramount to any deployment.

Flexibility

By having a flexible platform, a service provider has the ability to onboard a diverse set of media traffic (voice, video, messaging) when interoperating with an NNI partner that may or may not be using the same communication protocols.

SIP Interworking

SIP interworking will remain an issue for the foreseeable future, and service providers must have a solution to effectively mitigate interworking issues and deliver on the promise of any-media, any-device communications. Service providers simply need to look for solutions that reflect the reality of SIP interoperability and provide flexible, reliable methods for SIP translation between networks and network devices.

Centralized Intelligent Session Control

Intelligent, network-wide policies for routing services ensure that the sessions (which can be voice, video, or data) are delivered from point A to point B via the most efficient route in order to preserve margins and incur the least amount of cost for service providers.

The Ribbon Network-Network Interface (NNI) solution offers all of these functions. It works to provide operators with intelligent, secure, reliable, and scalable IP-based interconnections.

Considerations and Recommendations when Implementing NNI

At the core of the challenge is the fact that NNI connects disparate IP networks with dynamic traffic requirements. Service providers must overcome interoperability, security, and routing challenges when connecting independent networks and still be able to reliably scale their services.

The various topics below summarize important considerations and provide recommendations based on Ribbon' 20 years of experience helping its worldwide customers to mitigate potential problems and country-specific compliance requirements when implementing NNI or migrating the NNI infrastructure to an IP network.

Charging

Charging aspects should be decided based on bilateral agreements with NNI partners. This may be based just on generation of CDRs or could follow a more elaborate procedure, as defined by various 3GPP standards.

Directory Number Representation

It is recommended that SIP, SIPS, and TEL URIs are supported, and that a single numbering format representing global DNs, e.g., +country code - 10 digit number, is used.

DNS/ENUM

Use of DNS/ENUM is strongly encouraged when determining the next-hop for a real-time communication session in an NNI-Interconnect deployment. Ribbon recommends that either:

- DNS/ENUM servers are operated/maintained by a federation/agency

or

- DNS/ENUM servers of peering partners are directly accessible and used. Otherwise any updates on peering partner DNS mapping would require changes in an operator's own equipment, which is cumbersome and error prone.

Failover

It is important that failure/recovery of network equipment is easily detected by other elements and alternate destinations are available. Ribbon recommends:

- SIP OPTIONS method is used to ping the peering partner network equipment in NNI-Interconnect deployment to determine health status. Optionally, requests/responses received as part of real-time communication session signaling can be used as additional input.
- Network equipment is identified by use of SRV records pointing to primary/alternate servers. Appropriate weight/priority values should be used, depending on network design.

Inter-Exchange Carriers

Sometimes a direct connection between two carriers is not possible. In such cases, Inter-Exchange Carriers may be utilized and this model is usually referred to as IP-Exchange (IPX). If an IPX model is used for real-time communications peering, Ribbon recommends:

- The "Roaming Architecture for Voice over IMS with Local breakout" (RAVEL) model is followed. This model would allow signaling and media for real-time communication sessions to follow the same path across NNI-Interconnect deployment toward IPX providers to correlate both aspects and allow them to charge for the session properly.

IP Version

It would be useful to mandate use of only a single IP version for increased interoperability. IPv6 should be the preferred option, but sometimes is not practical because of existing IPv4 infrastructure. When IPv4-IPv6 interworking is required, a scalable interworking solution should be used.

Legacy Networks

It is likely that most networks still will have islands of legacy/TDM deployments. Some real-time communication sessions may be originating from/terminating to these islands and that may require transfer of legacy signaling-related information on the NNI-Interconnect. Ribbon recommends:

- Transport of ISUP MIME bodies is supported.

Overload Control

Overload Control is an important aspect to prevent undesirable results, e.g., network collapse, during intense traffic or during network equipment failures. There are certain standards defined by IETF and cited by relevant 3GPP specifications pertaining to Overload Control. All network equipment from various operators should implement these standards and use/support the same mechanisms among multiple options for them to be efficient. Ribbon recommends:

- Overload Control procedures are implemented by network elements as "local algorithms".

Quality of Service

Providing an acceptable level of quality on real-time communication services from the end user's perspective is important. The quality of experience (QoE) should cover both signaling and media associated with a real-time communication session. Ribbon recommends:

- Special and well-defined DSCP values are used for real-time communication session signaling packets. The appropriate policy should be applied for packets with these DSCP values from the IP infrastructure perspective.
- Special and well-defined DSCP values are used for real-time communication session media packets. The appropriate policy should be applied for packets with these DSCP values from the IP infrastructure perspective.

Security

NNI-Interconnect deployments should be protected against various types of attacks. Ribbon recommends that service providers enable:

Defense Against Attacks

- Topology hiding on SIP/SDP signaling.
- Wire-rate protection against (D)DoS attacks on the IP packet level.

Encryption

- Signaling security can utilize TLS or IPSec. TLS with mutual authentication is recommended as the preferred option, due to its ease of manageability.
- Media security should use SRTP. "RFC4568 Security Descriptions For Media Sessions" should be used for key exchange. This mechanism has been in practical use for a long time, and it is mature and supported widely.

Session Negotiation

There are various SDP session negotiation patterns, and it is recommended that all of them are supported as they are used for realizing basic capabilities like early media, call transfer, call redirection, playing announcements, and so on. Ribbon recommends that the following patterns are supported:

- Session offer in initial INVITE with session answer in 2xx(INVITE)
- Session offer in 2xx(INVITE) with session answer in ACK
- Session offer in initial INVITE with session answer in 18x(INVITE)
- Session offer in 18x(INVITE) and session answer in PRACK
- Session offer in PRACK and session answer in 200(PRACK)
- Session offer in UPDATE and session answer in 2xx(UPDATE)

Note: The last two patterns should be used only for session re-negotiation.

Service Level Assertion

Service Level Assertion (SLA) between peering partners across NNI-Interconnect deployments should be enforced. This is a local policy and capability, which does not need to be standardized among network equipment operated by different service providers. Ribbon recommends that SLA are enforced for:

- Maximum Number of Active Sessions
- Maximum Bandwidth Used by Active Sessions
- Maximum Sustained Rate for New Sessions

SIP Signaling

There are several SIP/SDP signaling-related capabilities, which may cause interoperability issues. Ribbon recommends:

- INVITE, ACK, BYE, UPDATE, PRACK, CANCEL, OPTIONS SIP methods are supported.
- It is recommended that JOIN method is not used.
- Use of other SIP methods, particularly REFER, can be considered depending on requirements and level of trust in NNI-Interconnect partner.
- P-Asserted-ID is used to convey information about Calling Party Identity
- Privacy is used for restricted use of Calling Party Identity information
- History-Info is used to carry retargeting related information
- Resource-Priority is used to indicate the priority of a session. Namespaces to be used should be clearly defined as well.
- P-Early-Media is used to indicate consent for early media.

Supplementary Services

The strategy to support supplementary services, such as Malicious Communication Identification, Origination Identity Presentation, Originating Identity Restriction, Anonymous Call Rejection, Communication Waiting, Communication Hold, Message Waiting Indication, Communication Barring, and Completion of Call to Busy Subscriber, should rely on use of SIP SUBSCRIBE, NOTIFY methods, and relevant event packages and message bodies per corresponding 3GPP standards.

Whether such services should be supported across NNI-Interconnect is a decision to be made by the involved NNI peering parties.

Transfer of Digit Information

Digits are used by end users to convey information such as personal identification numbers (PINs) and menu choices. Supporting the transfer of digits across NNI-Interconnect deployments is essential. Ribbon recommends:

- RTP Payload for DTMS Digits as defined by RFC4733 is used.

Transparency/Blocking

It is preferable that non-relevant information is not exposed on an NNI-Interface. The receipt and attempt to process such information may result in unsuccessful establishment of a real-time communication session. Furthermore, it is also preferable that elements in the NNI-Interconnect deployment are easily adaptable for future extensions. Ribbon recommends:

- The ability to remove SIP/SDP information elements based on dynamic configuration is provided.
- The ability to pass through SIP/SDP information elements based on dynamic configuration is provided.

Transport Protocol

Either UDP or TCP can be used as a transport protocol. It is recommended to use TCP, as it wouldn't suffer from IP fragmentation. Use of SCTP is explicitly not recommended by Ribbon, as support for it is still not ubiquitous.

Wireless Networks

There are certain items which are unique to wireless deployments. The approach to each of them should be determined among the involved parties.

Roaming can rely on a model where the visited network is aware of real-time communication sessions (IMS-Roaming) or is only involved from the IP bearer perspective. The latter model is called "S8 Home Routed Architecture" (S8HR). Both models are defined by 3GPP.

Ribbon recommends:

- S8HR model is used as it eliminates complexity, is less error-prone, and reduces time-to-market as the visited network is not involved in the real time session semantics.
- If S8HR model is used, fallback to a circuit-switched call is recommended for emergency calls. In this mode, the call would be renewed as a circuit-switched call in the visited network. The alternative is to initiate an IMS emergency call on the visited network.
- If IMS-Roaming is used, REGISTER, SUBSCRIBE, NOTIFY, PUBLISH SIP methods should be supported. There also would be a need to support SOS-URNs, certain event packages, message bodies and relevant 3GPP specifications should be used.
- If IMS-Roaming is utilized, using over-the-air bearer resource reservations based on "SIP preconditions" procedures should be considered. It is recommended that these procedures are followed in a way that lack of support on one of the parties does ot prevent establishment of the real-time service and does not require interworking. Alternatively, it may be preferred to allocate resources before a session offer/answer is generated, making use of this mechanism unnecessary at the cost of some additional delay.

NNI Deployment Success with Ribbon

Ribbon' NNI solution provides industry-leading security such as network topology hiding, Distributed Denial of Service (DDoS) protection, and per-session encryption, as well as providing reliable connectivity between Time-Division Multiplexing (TDM), Session Initiation Protocol (SIP)-based, and IP Multimedia Subsystem (IMS)/Voice over Long-Term Evolution (VoLTE) networks. Ribbon' intelligent session control enables enhanced Least Cost Routing (LCR)—routing based on connection quality, as well as routing based on over 200 parameters such as origination number/gateway, partition, holidays, and codec type.

Moreover, any NNI solution must be able to enable tracking and billing for any minutes traversing the network. The Ribbon solution provides reliable, scalable call detail record (CDR) generation, and can easily integrate into any billing system.

The Ribbon NNI solution (Figure 1) is designed to sit at the network border between operators and provide an intelligent interconnection between partner networks.

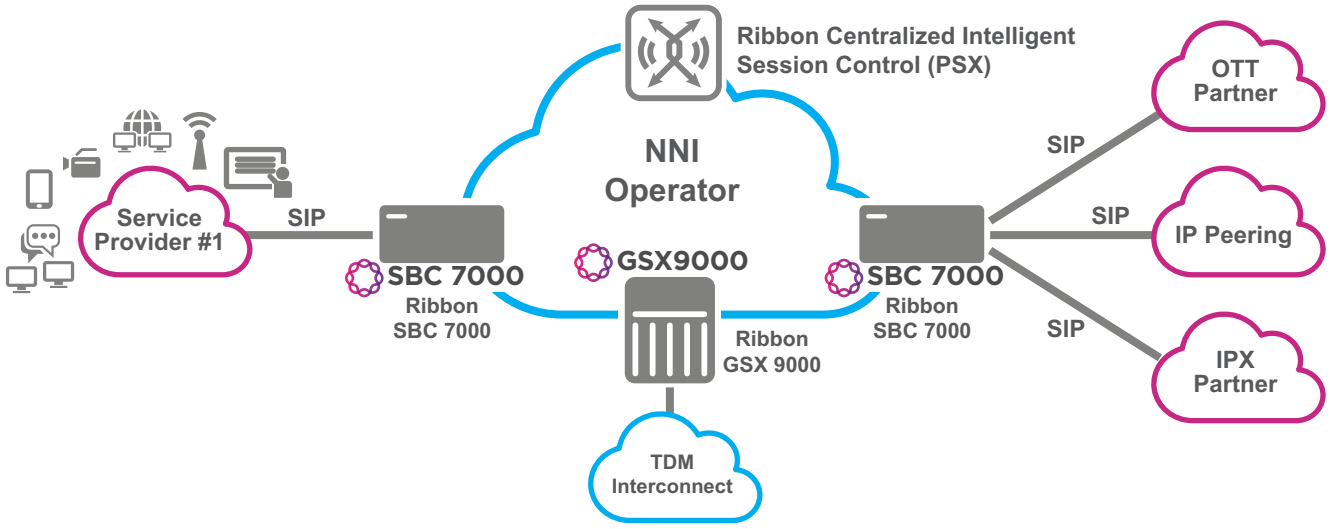

Figure 1 – Ribbon' NNI Solution

Critical to any NNI / peering environment, the Ribbon solution delivers the following functions:

- Complete network protection from theft of service and attack, including Distributed Denial of Service (DDoS) and overload controls.
- Feature-rich interworking across voice and video, and collaboration without compromising performance or scale
- Enforces Quality of Service (QoS) policies with intelligent session control, and provides easy migration to an LCR and quality-based routing solution
- Can be deployed on purpose-built appliances or in private/public Clouds as a virtual solution
- Provides scalable transcoding of media and, codec interworking, Dual-tone Multi-frequency (DTMF) and fax interworking

- Easily integrates into existing business support systems (BSS)/operations support systems (OSS) to enable migration from existing TDM assets to IP
- Ensures Call Detail Record (CDR) generation and storage for billing
- Robust interworking tools for multiple signaling protocols (SIP, H.323 & over 80 international signaling variants), as well as both IPv4 and IPv6 devices
- Enables IPv4 and IPv6 networks to work together seamlessly with no other upgrades required
- High availability design to ensure no loss of calls
- Largest portfolio of SBCs to meet your exact requirements
- Global support team ready to answer your call

Summary

Everyday service providers leverage Ribbon SBCs and intelligent session control solutions to improve the scalability, flexibility, and security of their NNI networks.

Ribbon delivers a complete solution with the security, policy control, and signaling and media interworking needed to ensure an NNI operator's success. Only with Ribbon will NNI operators be able to drive revenue growth in new markets by offering new interconnect services. They will have robust and reliable security at scale for every network peering point. And as network operators look at new architectures, only Ribbon will give them the proper flexibility in their deployment, by offering either dedicated hardware or a virtualized, cloud environment for additional CAPEX and OPEX savings.

You can be confident to put your NNI network in the hands of the vendor that manages well over 5 billion real-time communications sessions per day.

About Ribbon

Ribbon Communications (Nasdaq: RBBN) delivers communications software, IP and optical networking solutions to service providers, enterprises and critical infrastructure sectors globally. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge software-centric solutions, cloud-native offers, leading-edge security and analytics tools, along with IP and optical networking solutions for 5G. We maintain a keen focus on our commitments to Environmental, Social and Governance (ESG) matters, offering an annual Sustainability Report to our stakeholders. To learn more about Ribbon visit rbbn.com.

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