Using SRv6 and Programmable networks to reduce service costs at the Network Edge

April 4th, 2022
Bell Canada Ambitions

- **Build for the future** – evolve network to make it easier to deploy new network services
  Traffic Engineering | Service Chaining | Monitoring & Monetization

- **Network Simplification** – Distribute network infrastructure and move it closer to the edge
  Lower Cost | Vendor Independence | Better Customer Experience

- **Efficient scaling** – Leverage existing infra or new cloud capabilities
  SRv6 Proxy | Inline Network Services | Cloud Scaling
NoviFabric

Carrier Core Network

Internet

Smaller Central Office / Central Office in a Box

Edge Clouds

Regional / National Central Offices and Data Centers

NoviFlow Network Functions

Load Balancer
Packet Steering
Network Taps
Filtering
Telemetry Metadata
Service Chaining

NoviFabric

UPF
CG-NAT
Cloud Breakout
Firewall
DDoS

NoviFlow

Network Taps
Packet Steering
Filtering
Telemetry Metadata
Service Chaining

NoviFlow Network Functions

Bell
NoviFlow
Lanner
Seamless Service Insertion via SRv6

Can also be deployed in classic bump-in-the-wire mode
NoviEdge
NoviFlow software + Lanner HTCA 6600 Platform

Programmable
Carrier Edge needs programmable networks not based on legacy protocols

- Adaptable to support new features
- Software defined for automation

Better Visibility
Provide visibility into the performance of platform and VNFs

Tofino provides programmable telemetry in silicon
- In-band Network Telemetry (INT) for VNF performance
- Monitor the operational performance of the network

Scalable Architectures
Scalable network, compute and applications

Collapse multiple appliances on Tofino
- NoviFlow uses the network to scale across multiple virtual machines, blades or platforms
<table>
<thead>
<tr>
<th>Traditional Architecture</th>
<th>NoviEdge MEC Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>List Prices</strong></td>
<td><strong>“Sandwiched” configuration, single point of failure</strong></td>
</tr>
<tr>
<td><strong>UPS</strong></td>
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</tr>
<tr>
<td><strong>ToR Switch</strong></td>
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</tr>
<tr>
<td><strong>Patch Panel</strong></td>
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</tr>
<tr>
<td><strong>Load Balancer</strong></td>
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</tr>
<tr>
<td><strong>Server – 44 Cores</strong></td>
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<td><strong>UPS</strong></td>
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<td><strong>SDN Switch / Load Balancer</strong></td>
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</tbody>
</table>

* Did we mention cabling?

- **Total Cost**: ~$2.1 M USD*
- **Total Cost**: ~$236 K USD*

* *Less Cost*: 89%
* *Less Space*: 75%
* *Less Power*: 67%
NoviFabric – SRv6 Service Proxy

Reduce Service Complexity
• Acts as an orchestrator and enforcement point for a Service policy.
• Invokes, in order, the services listed in the service policy
• Support for a mix of different service types
• Each service can be HW or NFV
  • Integrated load balancing enabling service scalability
• Shipping: GA since 2021!
Reduce Network Complexity

- NoviFabric as a proxy for all services
- Addressable as SRv6 SID or uSID (C-SID-NEXT) across the network
  - No bump-in-the-wire placement
- Service chain (service policy) is represented as a unique SID (END.SC)
  - END.SC acts as a binding SID, isolating service chain execution from the rest of the network
SRv6 Supported Service Types

- **Type I – SR aware** -- Service is a SR node (has its own SID).
  - Packet with SRv6 header is transmitted to and returned by the service
  - It executes SR process on the SR header and its own service behavior on encapsulated packet
- **Type II – SR passthrough** -- Service is not an SR node
  - Packet with SRv6 header is transmitted and returned by the service
  - Outer SRv6 header is left unchanged by the service
  - Service executes its own service behavior on the encapsulated packet
- **Type III – SR unaware** -- Service is not an SR node
  - Information from SRv6 header is embedded in packet transmitted to the service
  - SRv6 header is reconstructed based on policy information
SRv6 Supported SID Formats

**SID (uncompressed, full 128 bits)**
- Locator – Block (48 bits)
- Locator-Node (32 bits)
- Function (8 bits)
- Arguments (128 bits)

IPv6 subnet common to all SRv6 nodes in a managed network

**uSID (C-SID-NEXT)**
- Locator – Block (32 bits)
- Locator-Node (16 bits)
- Function (16 bits)
- Arguments (128 bits)

IPv6 subnet common to all SRv6 nodes in a managed network

<table>
<thead>
<tr>
<th>Version</th>
<th>Traffic Class</th>
<th>Flow Label</th>
<th>Payload Length</th>
<th>Next Header</th>
<th>Hop Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 bytes</td>
<td>8 bytes</td>
<td>8 bytes</td>
<td>8 bytes</td>
<td>8 bytes</td>
<td>8 bytes</td>
</tr>
</tbody>
</table>

IPv6 Header 40 bytes

**Advantages of uSID in Proxy Design**

- **Better ASIC efficiency** (requires less metadata)
- Support massive scale instructions with reduced header overhead
- Enables fully **stateless proxy** mechanism
- Interoperable with both Standard and uSID network implementations

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**Table:**

<table>
<thead>
<tr>
<th>Source IPv6 Address</th>
<th>16 bytes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Destination IPv6 Address</td>
<td>16 bytes</td>
</tr>
<tr>
<td>Next Header</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Hdr Ext Len</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Routing</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Segment Length</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Flags</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Tags</td>
<td>8 bytes</td>
</tr>
<tr>
<td>Segment List[0] (IPv6 address)</td>
<td>16 bytes</td>
</tr>
<tr>
<td>Segment List[n-1] (IPv6 address)</td>
<td>16 bytes</td>
</tr>
<tr>
<td>Optional Type Length Value (TLV) objects</td>
<td>Variable</td>
</tr>
<tr>
<td>Payload (Ethernet, IPv4 or IPv6)</td>
<td>Variable</td>
</tr>
</tbody>
</table>
The Telco Challenge – *Simple* Service Insertion

Real Deployable Network Service Composition is Hard!

- Network Plumbing Complexity (if it works, don’t break it)
  - Traffic Selection Criteria
  - Topological Dependencies
  - Transport Dependence
  - MacGyver“esque” networking tricks (ToS manipulation, PBR, route leaks, EVPN sprawl, etc.)

- Service Deployment Complexity
  - Guarantee of Service Ordering
    - Symmetric Traffic Flows
  - Service Scalability
    - Individual and combined services
    - Service Health Measuring
    - Across network regions
  - Multi-vendor Services
    - Dependency on service vendors
  - Multi-Access Services

- And “We Don’t Talk About … SD-WAN”
SRv6 Dynamic Service Insertion

- Service Insertion via SRTE
- Service Path insertion via
  - Route Coloring
  - PCE Control
  - SDN Control (gRPC)
  - Service Mesh 😊
- Service Proxy configured with END.SC functions
  - 1 SID per “service” NOT per function
  - A service = 1 Function
  - A Service = n Functions
- Service Proxy can support
  - PNFs, VNFS, CNFs
- Service Proxy performs PSP and forward towards next SR node
A Perfect Storm in the Making

3 Key Components Are Key to Success:

• **SRv6 Architecture and Network Programming**
  • Extensible Protocol Architecture to adapt to varying use cases
  • Massive Scale comes in various sizes → enabling integration to various targets
  • Elastic scaling of services over entire networks

• **Open, Programmable Dataplane (P4, etc.)**
  • Easily implement new behavior from concept to line rate hardware implementation
  • Quickly create, fix, recode HW pipeline to adapt to demand
  • Because great, innovative ideas don’t always come from ‘The Big Guys’

• **Great partner ecosystem (in our case NoviFlow)**
  • Deep knowledge of programmable network technology
  • Being bold and willing to adapt product for a customer use case ... even if outside of comfort zone
  • Proof is in the pudding ... changing code from default SID to uSID, at production quality, in a week !!!
We Invite you to
Visit NoviFlow in stand #305 and
Lanner Electronics in stand #304

Thank You!

www.noviflow.com