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

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Bell
Daniel Bernier – Technical Director

NoviFlow
Jesper Eriksson – VP Product Management

Lanner
Sven Freudenfeld – CTO Telecom Applications Business Unit

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

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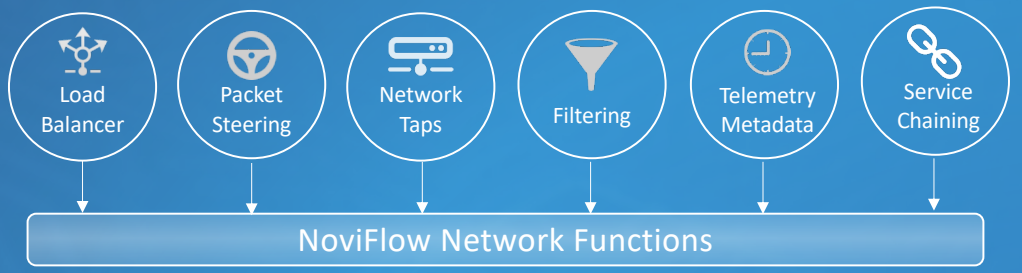
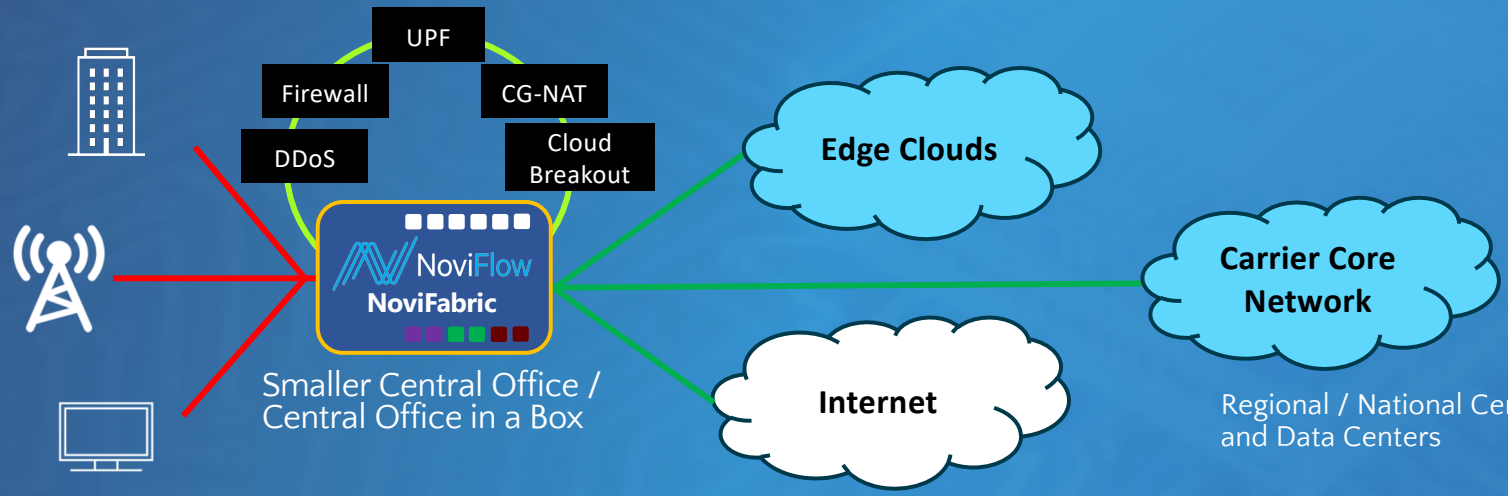
Vision, Architecture, Orchestration

NoviFlow
Software: NOS and Network Services

Lanner
All-in-one White-box Hardware Platform

NoviFabric





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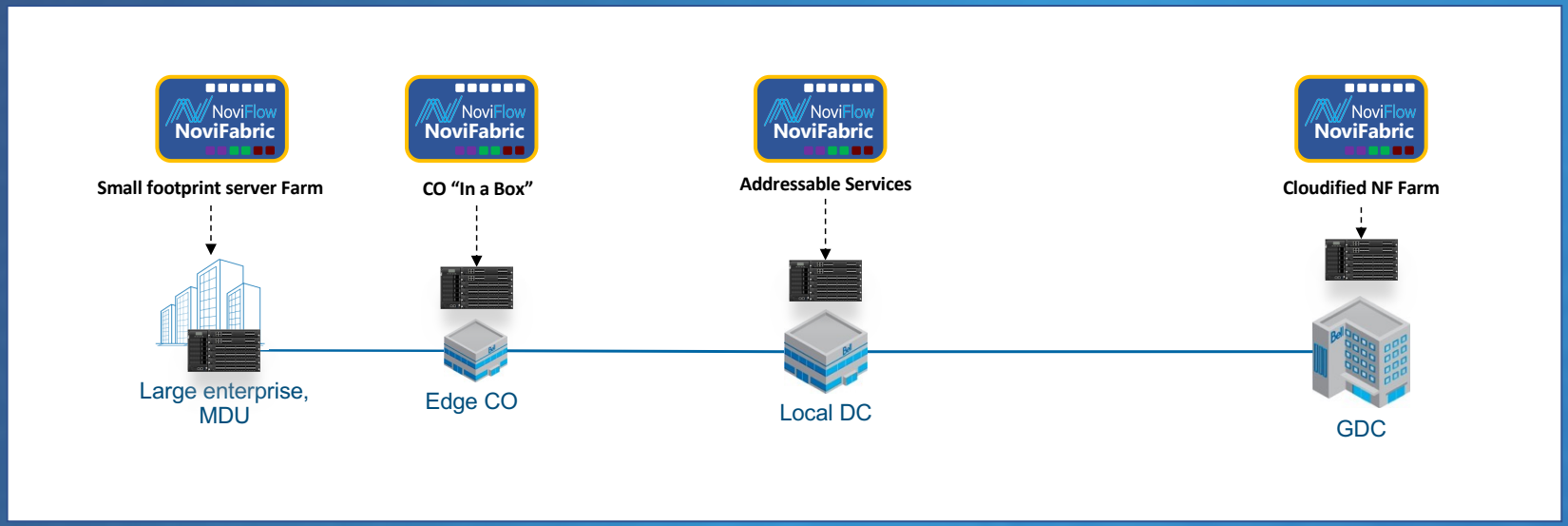
Seamless Service Insertion via SRv6



Can also be deployed in classic bump-in-the-wire mode

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NoviEdge

NoviFlow software + Lanner HTCA 6600 Platform

Programmable

Goes beyond legacy silicon and legacy protocols

Carrier Edge needs programmable networks not based on legacy protocols

- Adaptable to support new features
- Software defined for automation

Better Visibility

Tofino provides programmable telemetry in silicon

Provide visibility into the performance of platform and VNFs

- In-band Network Telemetry (INT) for VNF performance
- Monitor the operational performance of the network

Scalable Architectures

Collapse multiple appliances on Tofino

Scalable network, compute and applications

- NoviFlow uses the network to scale across multiple virtual machines, blades or platforms

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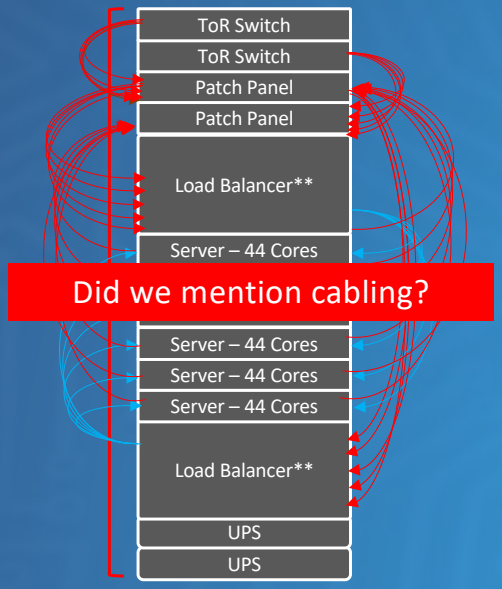
Cost Efficiency Comparison

Traditional Architecture



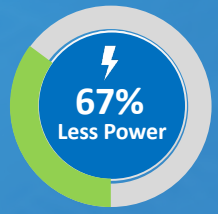
~$2.1 M USD*

Total Cost

* List Prices ** "Sandwiched" configuration, single point of failure

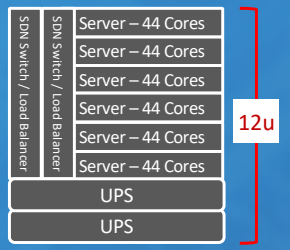
NoviEdge MEC Platform

Lanner/NoviFlow



~$236 K USD*

Total Cost



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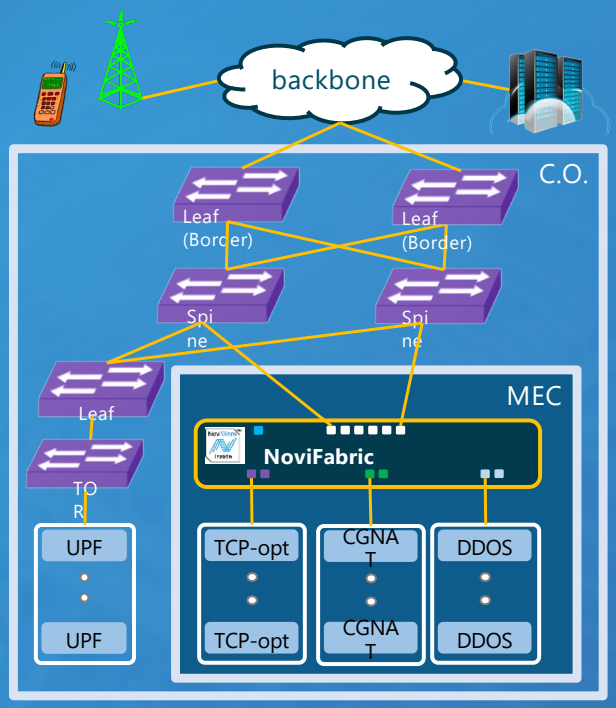
NoviFabric – SRv6 Service Proxy

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!



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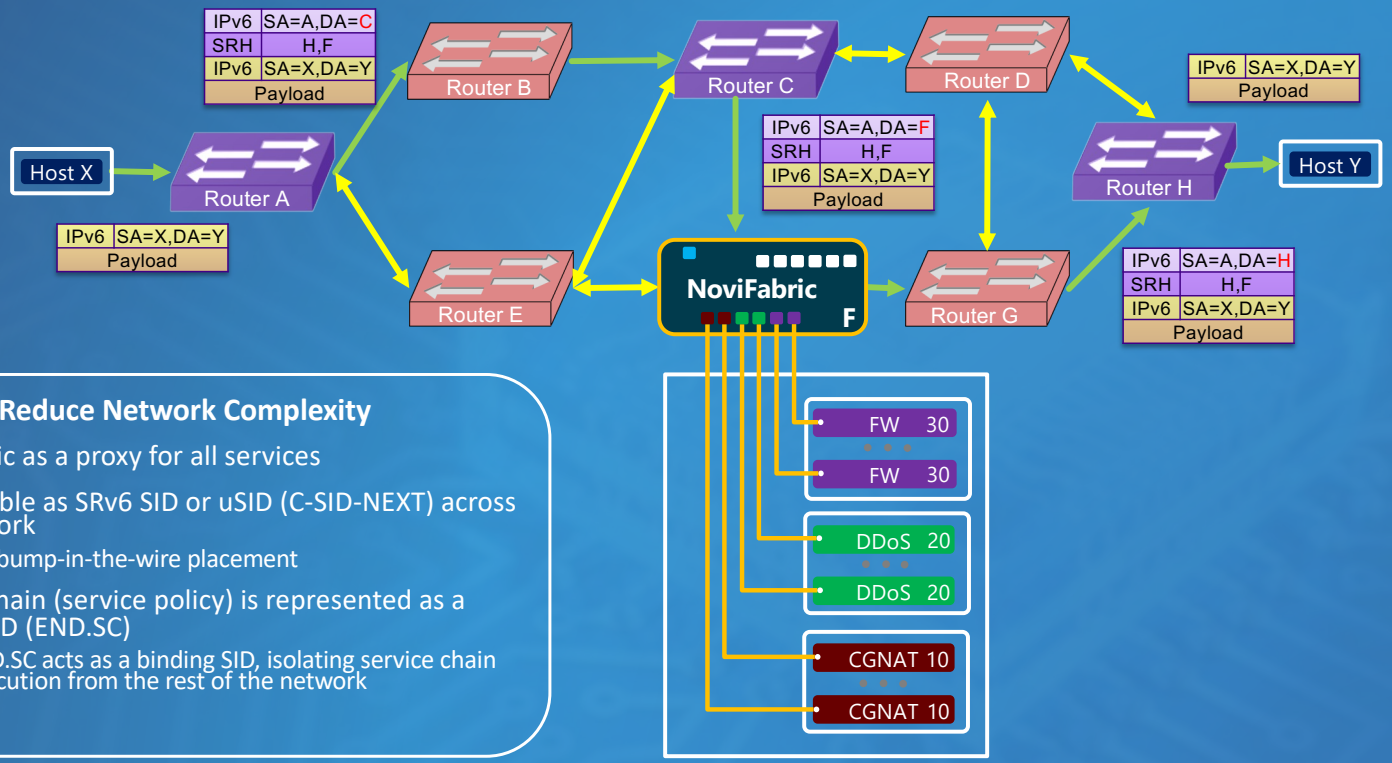
NoviFabric - SRv6 Service Proxy



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

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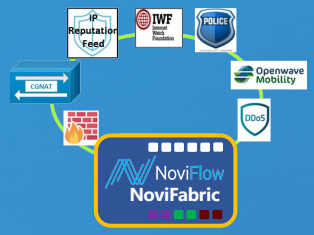
SRv6 Supported Service Types



- 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

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SRv6 Supported SID Formats

Version	Traffic Class	Flow Label	Payload Length	Next Header=**43**	Hop Limit	8 bytes	IPv6 Header 40 bytes
Source IPv6 Address						16 bytes	
Destination IPv6 Address						16 bytes	
Next Header	Hdr Ext Len	Routing Type=**4**	Segments Left	Last Entry	Flags	Tags	8 Bytes	SRH Header (Hdr Ext Len) bytes
Segment List[0] (IPv6 address)							16 bytes	
...							...	
Segment List[n-1] (IPv6 address)							16 bytes	
Optional Type Length Value (TLV) objects							Variable	
Payload (Ethernet, IPv4 or IPv6)							Variable	Payload (variable length)

SID (uncompressed, full 128 bits)

Locator (IPV6 routable)				
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 (IPV6 routable)				
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	C-SID-NEXT (32 bits)	C-SID-NEXT (32 bits)	C-SID-NEXT (32 bits)	

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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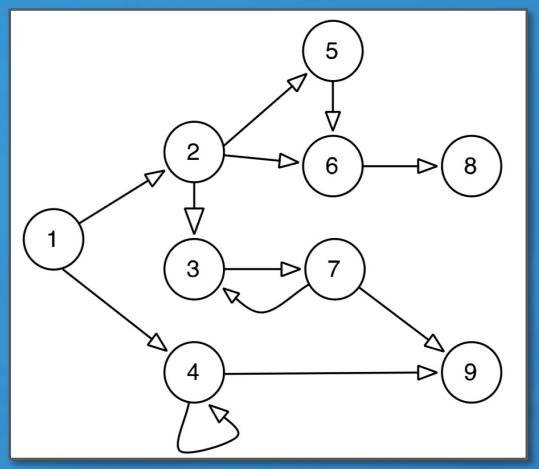
The Telco Challenge – *Simple* Service Insertion

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 Meatering
    - Across network regions
  - Multi-vendor Services
    - Dependency on service vendors
  - Multi-Access Services
- And "We Don't Talk About … SD-WAN"



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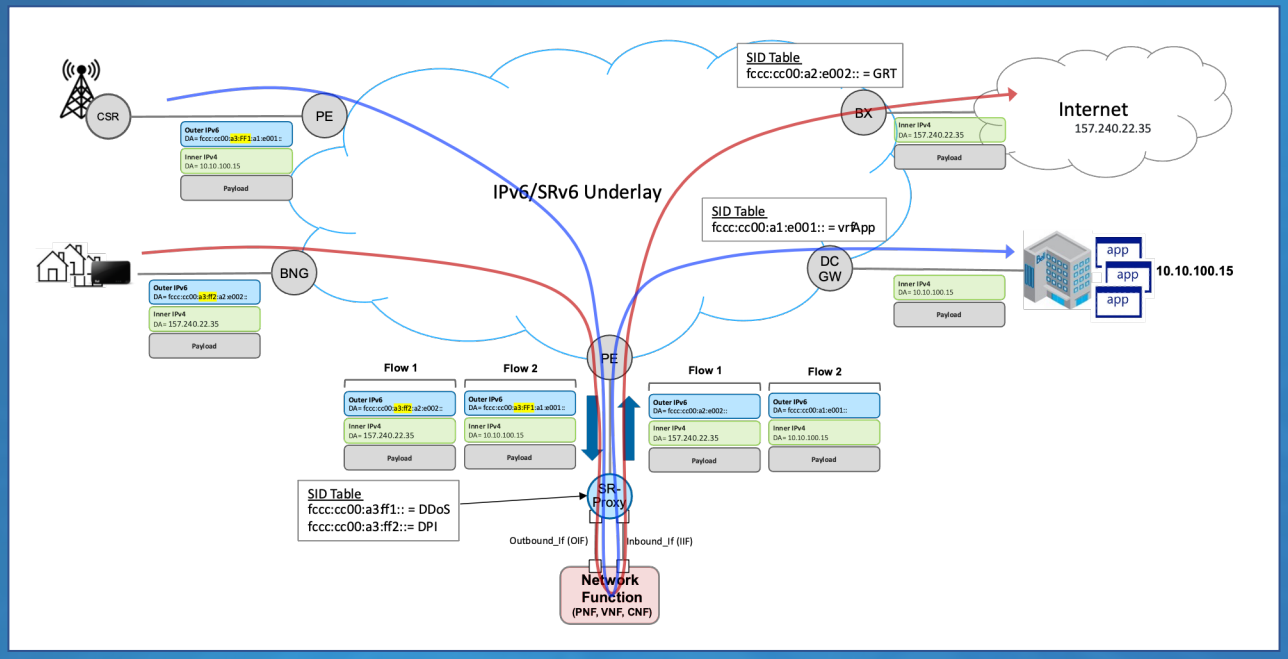
SRv6 Dynamic Service Insertion

- 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

  or
  - A Service = *n* Functions
- Service Proxy can support
  - PNFs, VNFs, CNFs
- Service Proxy performs PSP and forward towards next SR node



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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 !!!

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Thank You!

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