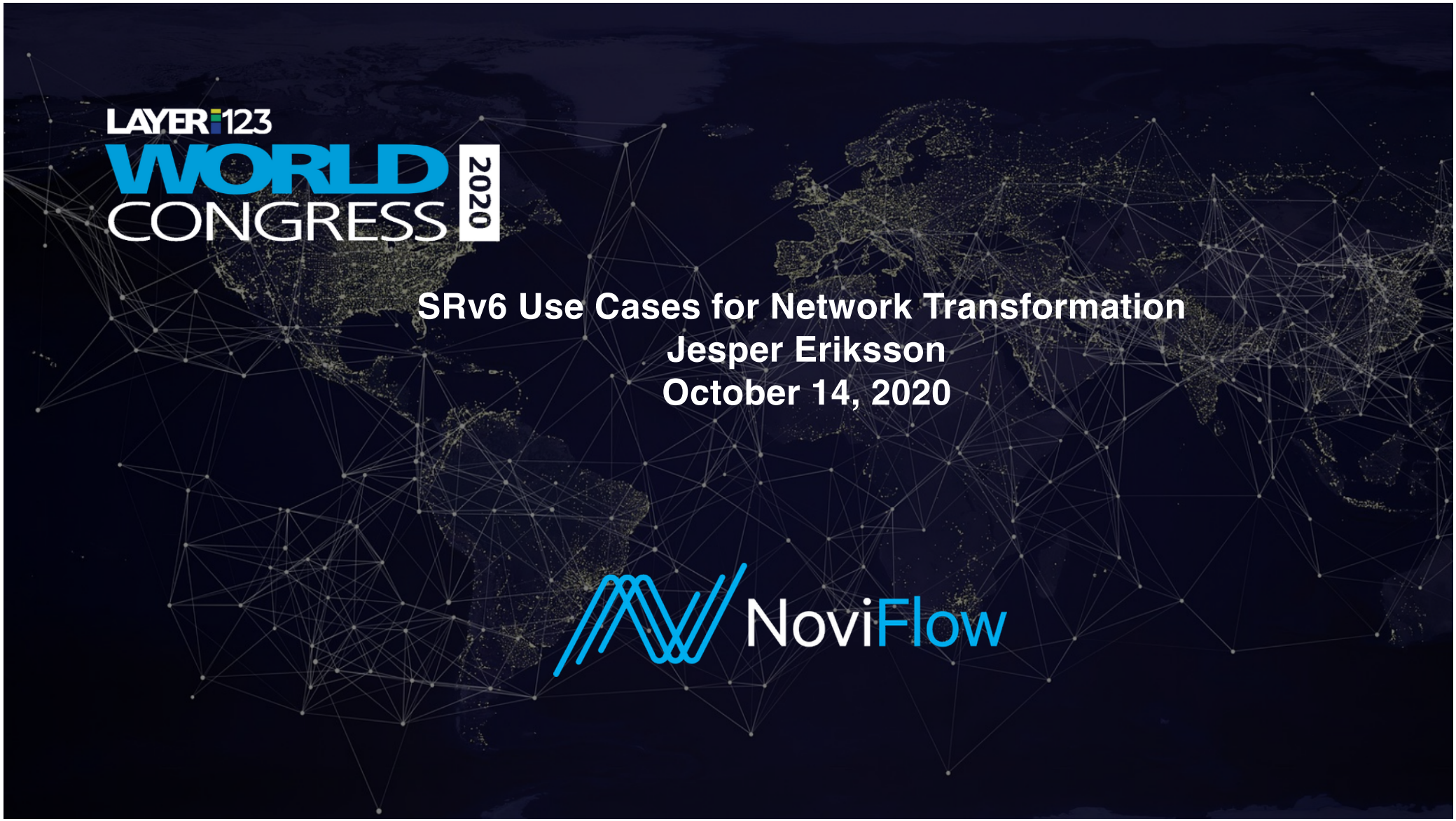

LAYER 123
WORLD CONGRESS
2020
SRv6 Use Cases for Network Transformation
Jesper Eriksson
October 14, 2020
NoviFlow

ABOUT NOVIFLOW

World's leading provider of SDN Network Operating Systems and solutions for programmable match-action data planes

FOUNDED
2012

Business Model
Software Licensing
Systems Sales

FOCUS
SDN
Cybersecurity
DCi

PRODUCTS
NOS
Whitebox switches
Controller Applications

ARCHITECTURES
NPU
Tofino

Production deployments worldwide by global network operators, Hyperscalers, large enterprises and government agencies

RED HERRING GLOBAL 100 WINNER 2017

RED HERRING GLOBAL WINNER 100 2018

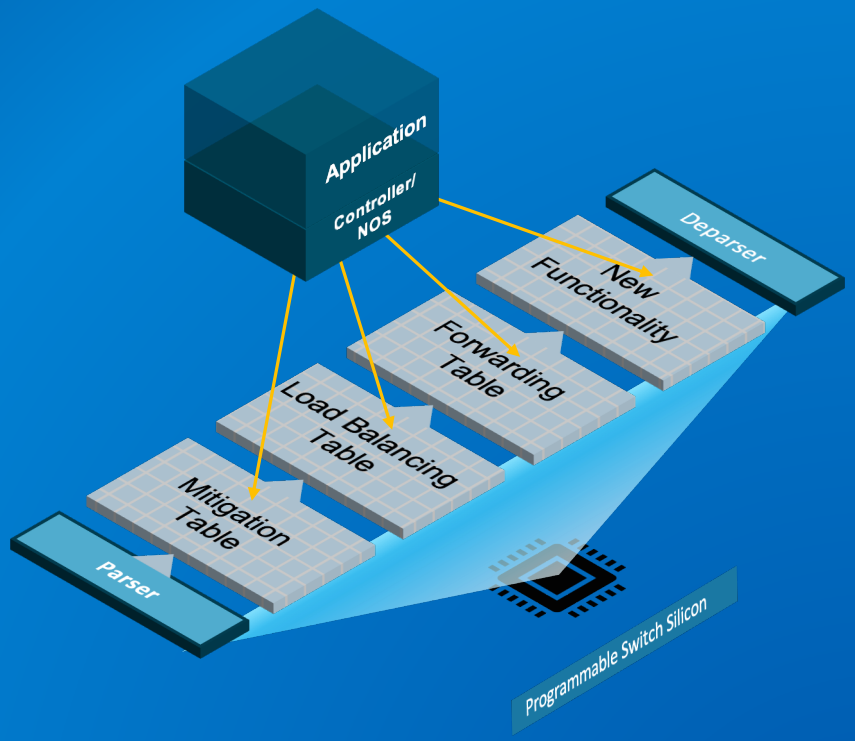
MEF AWARDS 2017 Third Network Technology Solutions of the Year Multi-Vendor

Technology Fast 50 2015 CANADA Deloitte.

NoviFlow

NoviFlow's DNA

- Making networks programmable
- Exposing programmable match-action pipelines to applications
- Leveraging programmable match-action pipelines for own application
- A fully programmable stack that implement the match-action pipeline
  - NoviFlow SDN applications such as CyberMapper
  - NoviFlow SDN P4Runtime controller
  - NoviFlow SDN NOS
  - NoviFlow P4 applications for Barefoot Tofino programmable switch silicon
  - White box switches and COTS servers
- This enables us to innovate at every level of the technology stack, and in our own time frames (not dependent on 3rd party)
- This NextGen technology stack makes NoviFlow a nimbler, more innovative, and more cost-effective provider for your current and future requirements



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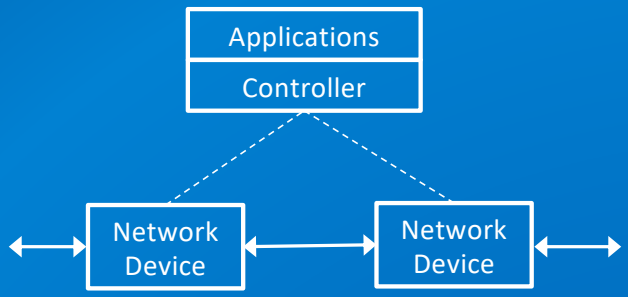
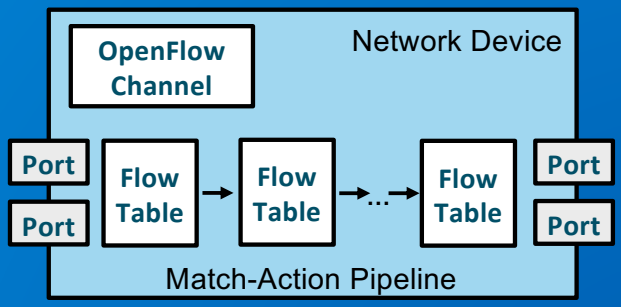
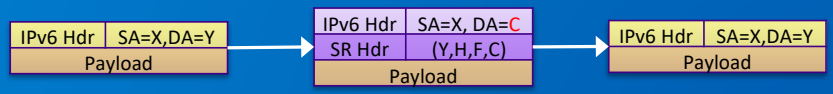
Programmable Networks

- **Orchestration: NETCONF/gNMI/YANG/OpenConfig**
  - Programming the configuration and state data in the network device
  - The network device's configuration and state data is abstracted through a standardized YANG data model and this data may be pushed or read from the device through the NETCONF/gNMI protocols
  - Benefits: Automate provisioning of legacy network devices
- **Match-Action Pipeline: OpenFlow/P4/P4Runtime**
  - Programming the match-action pipeline in the network device
  - A set of match-action flow tables are programmatically defined through OpenFlow or P4. At runtime, a controller pushes flow entries into these flow tables. The match-action pipeline and flow entries define how a packet is processed by the network device
  - Benefits: Allows the network device to evolve its functionality over time through software updates and it separates the PCE from the protocol stacks
- **Packet: Segment Routing over IPv6 (SRv6)/SR-MPLS**
  - Programming the packets as they enter the network (traditional or SDN)
  - Insert into the packet a set of instructions for how the packet will be processed by the network
  - Benefits: Traffic engineering, service chaining of addressable service resources







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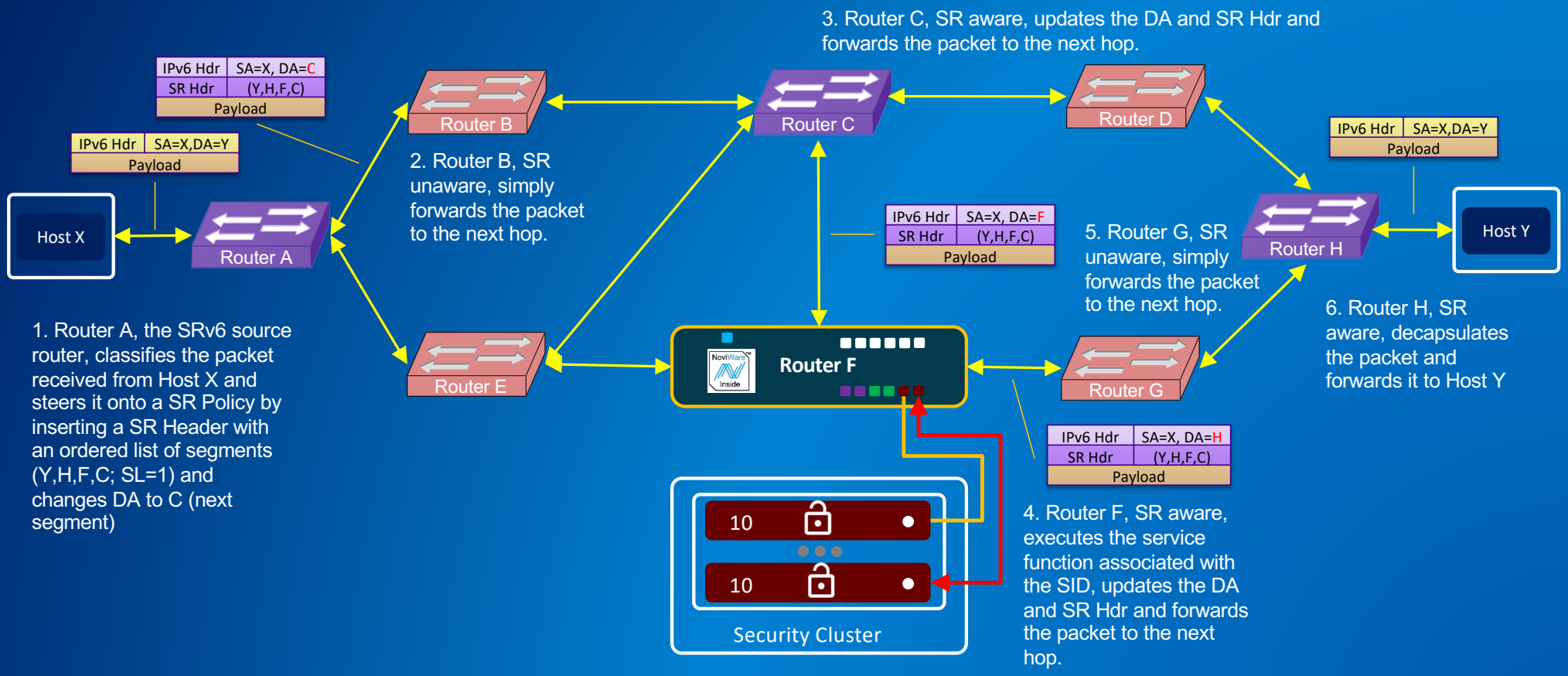
Segment Routing

- Variant of source routing:
  - The headend (ingress) router inserts an ordered list of segments onto the packet that will steer the packet along a specific path in the network
  - The segments represent instructions that are executed on subsequent SR aware routers in the network.
    - Not only “forwarding to next hop” instruction
    - But also more complex instructions (encap, decap,…)
- Segment routing works on top of either a MPLS network or on an IPv6 network:
  - MPLS network: Segments are encoded as MPLS labels.
  - IPv6 network: An IPv6 extension header called a Segment Routing Header (SRH) is used and the segments are encoded as a list of IPv6 addresses.
- Notes:
  - Segment routing is an **additional** capability of an MPLS/IPv6 forwarding node.
  - To implement SR, not all MPLS/IPv6 routers in the network must be segment routing capable

Possible Routing Approaches:

- **Flooding:** Each router will forward the packet to every interface except the ingress port. Very simple. No need to know anything about the topology of the network. Very inefficient. Can loop forever.
- **Forwarding table:** Each router has a forwarding table for selecting the best next hop in order to reach the destination. The forwarding table may be populated manually (static routing) or dynamically (using peer-to-peer protocols)
- **SDN:** The forwarding rules in the router are calculated by a centralized SDN controller with a God’s view of the network and pushed to the router using some protocol (PCEP, OpenFlow, P4Runtime).
- **Source routing:** Sending host knows topology and defines which routers the packet will go through to reach the receiver. Heavy load on end point. Variant presented here…

SRv6 Example



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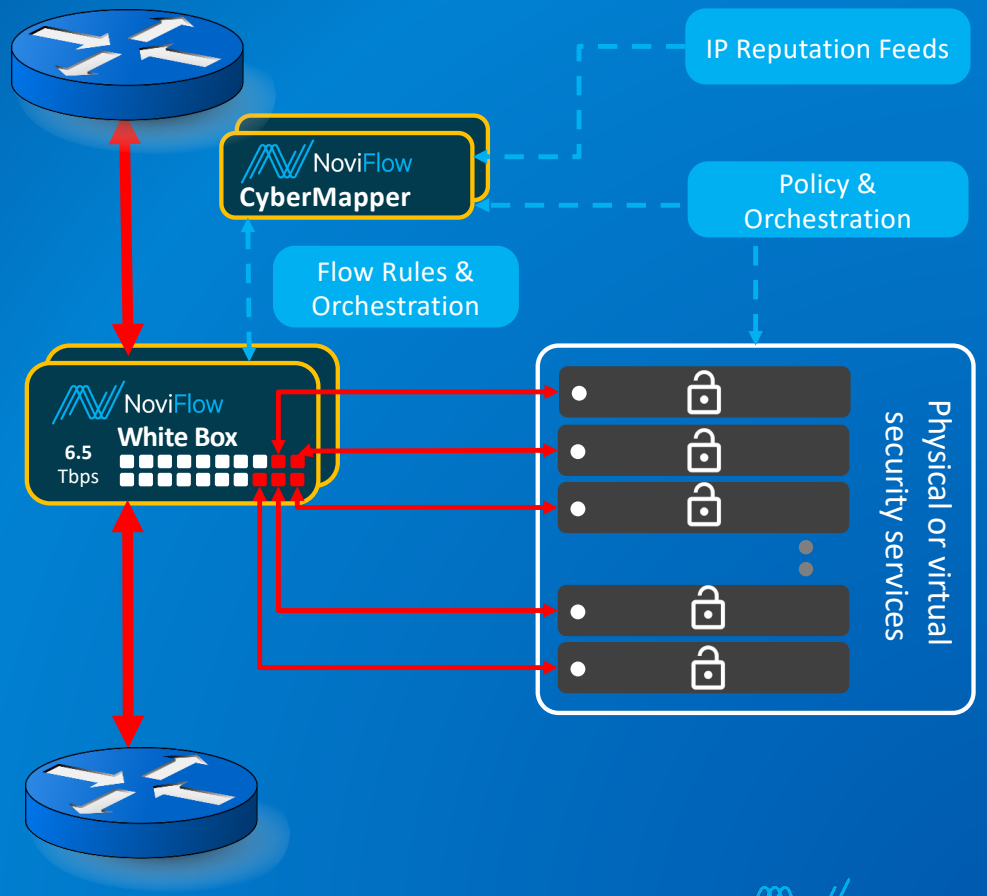
CyberMapper – Scaling Network Security Services

- **Northbound Interfaces:**
  - Visual OPS (GUI) for OAMP
  - REST API for services provisioning
  - Interface to NMS
- **Services:**
  - **Threat Intelligence Gateway**
    - Sits ahead of the carrier's firewall to offload denylisted traffic, e.g. IWF's denylist
  - **Packet broker**
    - Filtering
    - Mirroring
    - Port-pairing
  - **Load balancing**
    - Sticky stateless load balancing
    - Proportional load balancing
    - Dynamically grow/shrink load balanced pool
  - **Networking**
    - In-Band Network Telemetry (INT)
    - SRv6 Routing and Service Chaining
    - SRv6 security services proxy



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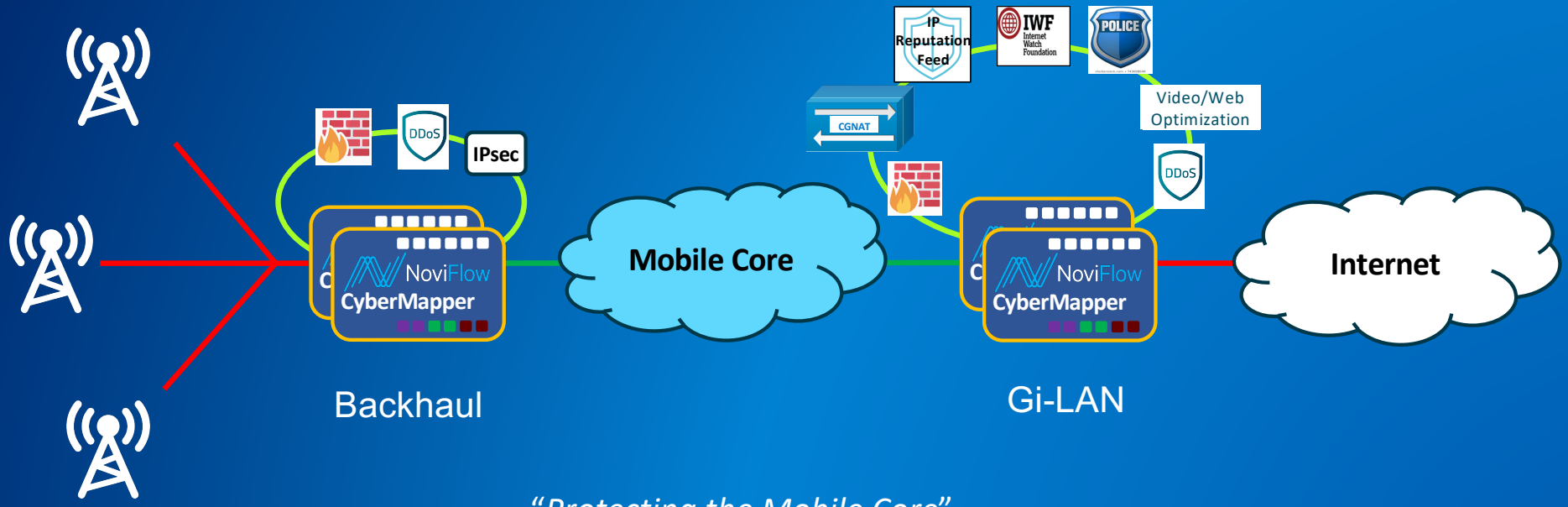
CyberMapper Mobile Backhaul Security and GiLAN Service Chaining



"Protecting the Mobile Core"

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Thank You!
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