NoviMapper™

Policy-based Service Chaining and Load Balancing at Multi-Terabit Speeds
Scale, Manage and Monetize 5G, Cybersecurity and other Network Services

NOVIMAPPER BENEFITS FOR NETWORK SERVICES

1. **Elastically and Economically Scale and right size network services to any size,** while making them more available and reliable
2. **Empower cyber defenders** by reducing the attack surface and instantly scaling virtualized security services
3. **A**llows any network service to be deployed in service chains with multiple policies with fine-grained real-time network visibility, and line speed mitigation
4. **Future-proof programmable** design makes it easy to upgrade solutions over time
5. **Save money:** cut hardware costs by up to 90%

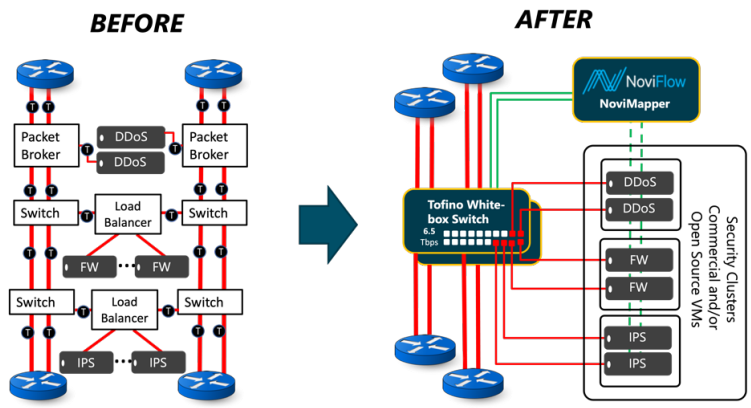

Figure 1: Simplifying Networks With NoviMapper

The NoviMapper Network Services Load Balancer offers major performance and dynamic scalability improvements for network services, reduces overall cybersecurity costs, and enables real-time automation, control and monetization of network services. *NoviMapper* off-loads load balancing, service chaining, data monitoring, inspection and handling functions to programmable network switches which are far more efficient at packet processing than general purpose servers, often enabling huge savings by greatly simplifying network architectures and reducing or even eliminating the need to duplicate or overprovision network resources. *NoviMapper* includes the *vOPS* Visual Operations interface that greatly simplifies the configuration and management of tool clusters, eases the setup of load balancing and enables vendor independent measurement of traffic latency through network assets.

Benefits of *NoviMapper*:

- Pre-processes traffic inline (filters-out trusted or known bad traffic) to reduce by 50% or more traffic sent to server farms, thus reducing both hardware and software costs
- Affinity Load Balancing eliminates expensive physical load balancers, further reducing both CAPEX and OPEX
- Order of magnitude better throughput (up to 6.5 Tbps in a single Tofino-based white box switch) than can be delivered by conventional load balancers
- Protects "State" in fail-over - ideal for stateful DPI Servers and virtualized network functions
- Mitigation Interface enables real-time security automation and integration with defense tools
- Support for integration with commercial IP Reputation feeds and Cybersecurity DPI server mitigation
- Significantly reduces network complexity and operating costs via scale-out NoviSwitch hardware deployed anywhere in the network with unlimited linear scalability
- High Availability (HA) Active-Active sync algorithm with "Non-Destructive" failover on HA events

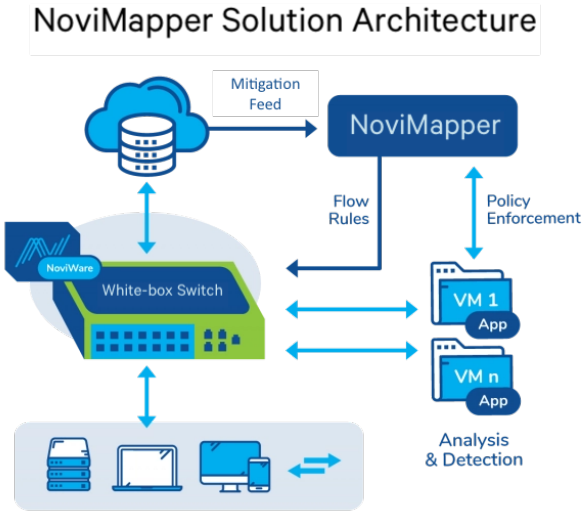

Figure 2: NoviMapper Solution Architecture

NoviMapper supports the deployment of key Cybersecurity functions directly within the network fabric. It does so by implementing a pre-configured high- performance SDN match-action pipeline, as well as providing the pre-configured controller with RESTful APIs that securely expose these functions to applications, orchestration servers and network security nodes, such that these entities need only by able to interact with *NoviMapper* via these simple abstracted APIs. No deeper knowledge of SDN, P4 or P4-Runtime is required.

NoviMapper leverages the power and flexibility of the programmable SDN match-action pipelines to implement fine grain mapping of cyber mitigation events including reputation filtering and load balancing into a DPI security cluster, delivering multi-Terabit Security Load Balancing in a single switch using open standard interfaces such as gRPC and P4-runtime, at up to 6.4 Tbps of bandwidth when deployed with switches utilizing the Intel/Barefoot Networks Tofino chip.

NoviMapper Security Load Balancer enables *NoviWare™* compatible switches (such as select white-box switches) to deliver load balancing, packet filtering, threat mitigation and telemetry production directly in the network fabric in a simple, scalable pizza-box form factor, and at a fraction of the price of conventional load balancing solutions. *NoviMapper*'s functions include:

NoviMapper Reputation Filtering: *NoviMapper* identifies known-safe (whitelist) or known-hostile (blacklist) traffic before it enters the network, dropping hostile traffic and filtering out traffic that doesn't need further security scrutiny reducing the load on expensive DPI servers by 50% or more! *NoviMapper* integrates real-time inputs from trusted industry IP Reputation Feeds as well as mitigation events generated by DPI threat engines by implementing them as new OpenFlow rules instantly distributed to all switches managed by *NoviMapper*.

Cybersecurity Intelligence – mirroring streams and providing information (such as time-stamping, latency monitoring, and telemetry) from the forwarding plane to be made available to cybersecurity analysis and inspection systems. Via vOPS Visual Operations Monitoring operators can create a new *NoviMapper* setup from their browser in just a few minutes, install and configure load balancing and HA (High Availability), track the impact on traffic latency of their security tools, and provide the telemetry needed to ensure that tool farms are meeting performance specifications and to document compliance to service level agreements (SLAs).

NoviMapper Affinity Load Balancing: Unlike traditional load balancers, *NoviMapper* uses the large rule set capabilities of SDN to implement an "Affinity" high-availability (HA) load balancing algorithm with non-destructive failover, far superior to any simple hashing or LAG based Load Balancing. This function provides Non-Destructive Load Balancing services to the Security Content Filtering DPI Cluster specifically designed to protect the stateful nature of Security DPI servers. This reduces costs by eliminating the need for expensive Load Balancing appliances fronting the DPI Cluster, and enables upgrades, additions, and repair of Security DPI Servers without impeding security analysis of remaining DPI Servers.

Cybersecurity Mitigation, Scaling and Optimization – enabling the behaviour of the forwarding plane (load balancing, packet brokering, filtering and flow redirection) to be changed based on changes in the network data flows and resulting from the conclusions and deductions drawn from examination of these flows and changes in flows, and to support right-sizing of security resources in real-time.

The *NoviMapper* vOPS Visual Operations interfaces visually with clients to gather *NoviMapper* operational requirements such as the Load Balancing connections to the Tool Cluster and the number of bump-in-the-wire connections. vOPS then generated the API calls to *NoviMapper* that implement the Load Balancing, Mitigation, port configuration, etc. needed to implement the requirements. At the end of the setup process vOPS presents a visual view of the switch state.

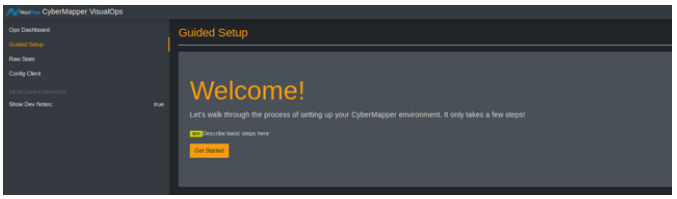

Figure 1: vOPS Guided Setup

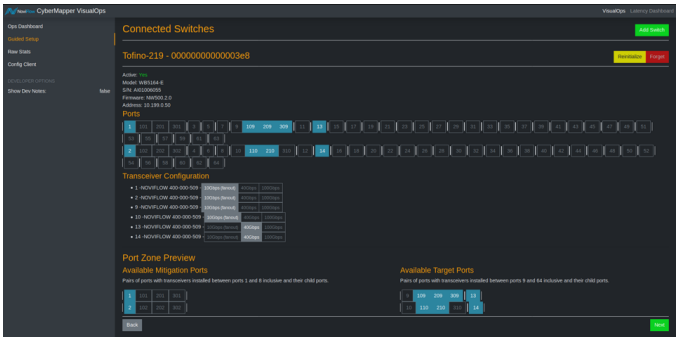

Figure 2: Connected Switch Detection

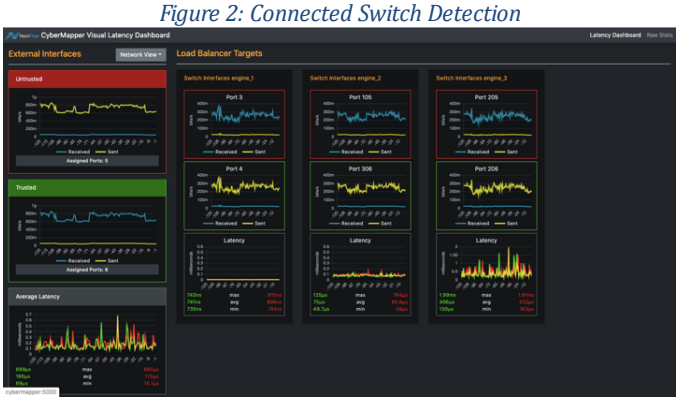

Figure 3: vOPS Latency Monitoring Dashboard

Other *NoviMapper* Network Services Load Balancer Features:

- Provides the ability to tie multiple applications into one or more service chains
- Each chain is defined by a separate service policy
- Secure REST API for load balancing distribution
- Tools to monitor logs packaged in a Docker container
- Log files with file rotation
- Supports mitigation rules with multicasts and named ports
- Retrieval of ports and load balancing flows statistics through secure REST APIs with the ability to set the retrieval interval
- Supports dynamic log activation/deactivation
- Support for the Tofino based WB-5000 Series switches
- Support for matching on IN_PORT and IN_PHY_PORT in table 2
- Load balancing table supports up to 16384 entries
- Ability to configure a switch to be connected to two controllers (primary and backup)
- Switch_stats configuration can be saved to database
- Active-Active sync
- Use tenant VLAN to keep track of the origin of traffic
- Allows matching on IP fields after MPLS tag
- Weighted load balancing
- Inband active heartbeats
- Mitigation matching based on port class (ingress or egress)
- Matching on source and destination IP address, source and destination port and protocol (5-tuple)
- Sync link status: brings a port down when the paired port is down
- Support for IPv6 with WB-5000 Series switches
- Automatic switch configuration using gRPC interface
- L4_matchfields configuration via REST API
- Uses docker-compose for distribution
- Target scaling up/down
- All configuration data defined through the REST interfaces with validation
- Database authentication
- GUI for visual management

***NoviMapper* Optional Features:** optional (separately licensed) extensions to NoviFlow's *NoviMapper*.

NoviFlow's Dynamic In-Line Packet Broker Services for NoviMapper deliver optimized flow monitoring and acquisition functions without requiring the use of optical taps to duplicate packets on the main network and transmit them to a monitoring and analytics network. This virtualizes the entire process of traffic monitoring with a tap/filter, and eliminates the cost and time required to install physical tap hardware, enabling traffic to be monitored dynamically at need.

CGNMapper option for NoviMapper provides a powerful and economical solution for scaling Carrier Grade NAT tool farms to the ever-increasing throughput demanded by today's internet traffic. It incorporates a packet processing pipeline architecture optimized specifically to enable multi-Terabit scaling of CG-NAT traffic utilizing commercial CGNAT tool farms.

NoviMapper Solution Requirements:

- NoviMapper s/w running on a standard server (4-core X86 with mimum 16GB RAM, or better)
- One or more NoviWare capable switches (Intel/Barefoot Networks Tofino-based white-box devices running NoviWare. See www.noviflow.com for list of certified white-box devices.)
- One NoviMapper Right-to-Use license for each switch being managed by NoviMapper.

NOVIMAPPER BASE SOFTWARE	
800-002-001	NoviMapper Base Software license for X86 server (Recommend 4-core, 16 GB RAM or better)
800-002-003	NoviMapper RTU Software license for Barefoot Tofino-16-based switches
800-002-004	NoviMapper RTU Software license for Barefoot Tofino-32-based switches
800-002-005	NoviMapper RTU Software license for Barefoot Tofino-64-based switches

DYNAMIC INLINE PACKET BROKER OPTION	
800-002-008	Dynamic PacketBroker Services Optional Features Bundle add on NoviMapper perpetual license for Barefoot Tofino 32D base switches (per switch)
800-002-009	Dynamic PacketBroker Services Optional Features Bundle add on NoviMapper perpetual license for Barefoot Tofino 32Q base switches (per switch)
800-002-010	Dynamic PacketBroker Services Optional Features Bundle add on NoviMapper perpetual license for Barefoot Tofino 64 base switches (per switch)
DYNAMIC INLINE PACKET BROKER OPTION	
800-002-018	CGNMapper Optional Features Bundle add on NoviMapper perpetual license for Barefoot Tofino 32D base switches (per switch)
800-002-019	CGNMapper Optional Features Bundle add on NoviMapper perpetual license for Barefoot Tofino 32Q base switches (per switch)
800-002-020	CGNMapper Optional Features Bundle add on NoviMapper perpetual license for Barefoot Tofino 64 base switches (per switch)

For more information, please visit www.noviflow.com™ or e-mail us at contact@noviflow.com