

NoviWare™ 400.5 for Barefoot Tofino Chipset

HIGH PERFORMANCE PROGRAMMABLE SWITCH OS SOFTWARE

NoviFlow's NoviWare 400.5 is the SDN industry's most complete and highest performance implementation of the OpenFlow 1.3/1.4/1.5 standard running on the 6.5 Tbps Barefoot Tofino network processor. This high-performance forwarding plane is ideally suited for use in switches, WAN IP/MPLS routers, network appliances and other network devices requiring both massive throughput and fully programmable match-action pipeline packet processing. (See *NoviWare 400.5 for NP datasheet* for support of Mellanox NP-4 and NP-5 network processors.)



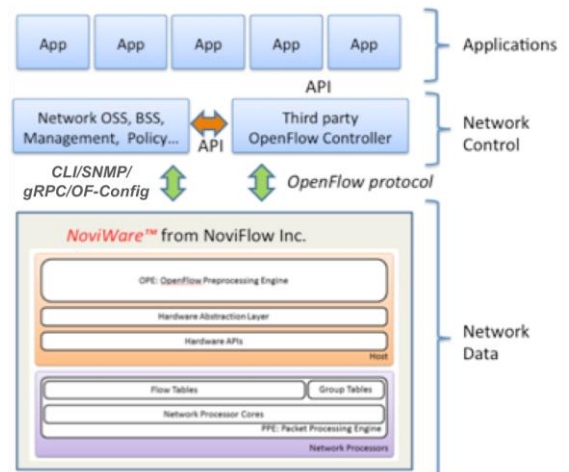
NoviWare was designed from the ground up to be a reliable, scalable platform for match-action pipelines implementing OpenFlow and combines a fully programmable L2-L7 packet forwarding data plane with high throughput performance. NoviWare is deployed around the world in NoviFlow's *NoviSwitch* products and is also offered via software license to OEM and white box ODM switching platform suppliers.

NoviFlow Inc™ aims to change the traditional approach to networking by making switching and routing smarter. The company was founded to deliver upon the promise of SDN by delivering solutions that can handle complex flow processing and be field upgradable via software updates, making it possible for data centers and WANs to keep up with today's exponentially growing networking demand. By offering NoviWare for Tofino, NoviFlow is enabling leading OEMs and ODMs to deploy, accelerate and scale tried and tested OpenFlow 1.3/1.4/1.5 solutions on the Barefoot Tofino chipset in months, not years. NoviWare for Tofino also provides both SDN application users and our OEM partners a graceful evolution path into powerful P4 technology as these solutions are developed and released commercially.

NOVIWARE 400.5 FOR TOFINO CHIPSET KEY FEATURES:

Implements the industry's most extensive set of OpenFlow 1.3/1.4/1.5 match fields, instructions and actions for the Barefoot Tofino chipset:

- Supports Barefoot Tofino based networking hardware with throughput of up to 6.5 Tbps
- Fully programmable OpenFlow 1.3/1.4/1.5 pipeline with up to 9 flow tables supporting wildcard or exact match flow table entries. Maximum table size varies depending on the size of the flow entries
- The maximum flow table size varies depending on the size of all of the flow tables, the group table, the meters to be defined in the system, the associated match-fields and the actions, all of which share a common memory space:
 - Up to 100,000 32b wild card match flow entries in a single table with a simple output to port action
 - Up to 300,000 48b exact match flow entries in a single table with a simple output to port action
 - Up to 100,000 meters can be defined in meters table
 - Up to 100,000 entries can be defined the group table
 - Up to 100,000 buckets can be defined, with max of 15 buckets per group
- The number of match fields, actions, group-actions, and hash-match fields is limited by available memory only
- Intel x86 host processor software optimized for maximum flow-mods/second performance
- Hardware abstraction layer to facilitate porting to other Tofino-based whitebox platforms – please see www.noviflow.com/noviware for a current list of Tofino whitebox suppliers and supported models
- Extensive O&M features optimized for large scale deployments including Plug-and-Play features such as gRPC remote automated provisioning and Switch IP address default set via DHCP



NOVIWARE FOR TOFINO 400.5 FEATURES SUMMARY*

- Multiple Controllers and Controller role-change
- OpenFlow version negotiation (1.3, 1.4 and 1.5)
- OpenFlow 1.3/1.4/1.5 required and optional match fields: IN_PORT, IN_PHY_PORT, METADATA, ETH_DST, ETH_SRC, ETH_TYPE, VLAN_VID, VLAN_PCP, IP_DSCP, IP_ECN, IP_PROTO, IPv4_SRC, IPv4_DST, TCP_SRC, TCP_DST, UDP_SRC, UDP_DST, SCTP_SRC, SCTP_DST, ICMPv4_TYPE, ICMPv4_CODE, ARP_OP, ARP_TPA, IPv6_SRC, IPv6_DST, ICMPv6_TYPE, ICMPv6_CODE, IPv6_ND_TARGET, MPLS_LABEL, PBB_UC
- All OpenFlow 1.3/1.4/1.5 instructions: Meter, Apply-Actions, Write-Actions, Write-Metadata, Goto-Table
- OpenFlow 1.3/1.4/1.5 actions: Output {physical port, logical port, ALL, LOCAL, CONTROLLER, TABLE, IN_PORT, FLOOD}, Set-Queue, Drop, Group, Push VLAN, Pop VLAN, Push MPLS, Pop MPLS, Set Field {ETH_DST, ETH_SRC, VLAN_VID, IP_DSCP, IP_ECN, IPv4_SRC, IPv4_DST, TCP_SRC, TCP_DST, UDP_SRC, UDP_DST, IPv6_SRC, IPv6_DST, MPLS_LABEL}, Set MPLS TTL, Decrement MPLS TTL, Set IP TTL, Decrement IP TTL
- TAGS: Push/Pop MPLS, multiple MPLS, VLAN (802.1Q) and multiple VLAN (802.1ad "QinQ") tags to/from packets
- Flexible flow entry based on selected match fields
- Multiple tables support (OpenFlow pipeline processing). Any match field or combination of match fields, any instruction and any action may be used in any table
- Group Table supporting all OpenFlow 1.3/1.4/1.5 required and optional Group types (ALL, SELECT, INDIRECT, FAST FAILOVER) for complex forwarding such as multicasting
- Up to 4 queues per port (port slicing) with priorities
- Meters (Drop, DSCP Remark) compliant with RFC2697 srTCM and RFC2698/ MEF 5 trTCM
- Bundles, Role Status Events, Group and Meter change notifications
- Link Aggregation Group (LAG) with dynamic provisioning of ports
- Per port Rx dropped counter on table-miss with action drop
- Time sync in a NTP
- Additional stats counters and logs:
 - Number of packets received, dropped and transmitted per flow
 - Per port counters
 - Logs: errors, table entries
 - Matching entries per protocol
 - Multipart message support
 - Queues support
 - Per-flow meters
- O&M Features:
 - TACACS+ for AAA services
 - RADIUS for CLI access control and accounting
 - Access Control Lists (allowed IP addresses) for switch management ports
 - VLAN on OpenFlow and CLI ports
 - CLI command log file with accessing IP address for configuration change traceability
 - CLI command log file export to external server
 - Command to initiate the sending of a dummy Packet-out on a specific port
 - Load new/rollback to previous switch software revision
 - Set port configuration, tables, user names, passwords, traces on/off for monitoring of OpenFlow messages to/from the controller
 - Show configuration for switch, controller, transceiver, OFChannel, tables, users
 - Show switch stats, logs, software revision, OFChannel status
 - Manual and automatic (remote server based) switch configuration
 - Switch configuration file export/import to remote server in binary and text formats
 - OF-Config 1.1.1/1.2
 - TLS CA certificates
 - Commands for adding and deleting flow entries
 - Redundant physical OFChannel ports
 - SNMP v2/v3 protocol
 - Support gNMI, gNOI and the OpenFlow model for OpenConfig over gNMI
 - Key-based user authentication

*Please consult www.noviflow.com/noviware for a list of Barefoot Tofino white box models supported by NoviWare. NoviWare features described above, may be only partially supported on some supported devices, or may not be available on all supported devices. Contact NoviFlow at contact@noviflow.com for enquiries.

FOR MORE INFORMATION


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