

NoviWare™ 500.2 for Barefoot Tofino Chipset

HIGH PERFORMANCE PROGRAMMABLE SWITCH OS SOFTWARE



NoviFlow's NoviWare 500.2 is the SDN industry's most complete and highest performance and first commercially deployed SDN NOS running on the 6.5 Tbps Barefoot Tofino network processor. This high-performance forwarding plane supports the OpenFlow 1.3/1.4/1.5 standard as well as P4-Runtime, and 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 500.2 for NP datasheet* for support of Mellanox NP-4 and NP-5 network processors.)

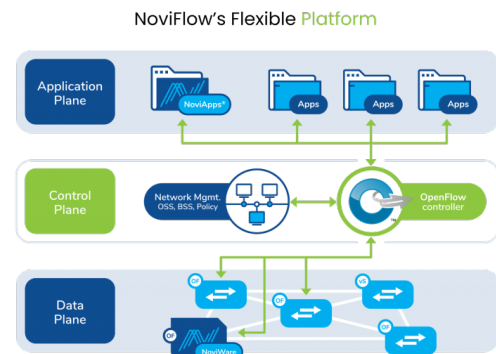
NoviWare was designed from the ground up to be a reliable, scalable platform for match-action pipelines implementing OpenFlow and P4-Runtime, and combines a fully programmable L2-L7 packet forwarding data plane with high throughput performance. NoviWare is deployed around the world in NoviFlow's **NoviSwitch** 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 SDN 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 500.2 FOR TOFINO CHIPSET KEY FEATURES:

Implements the industry's most extensive set of SDN features for the Barefoot Tofino chipset:

- Supports Barefoot Tofino based networking hardware with throughput of up to 6.5 Tbps
- OPENFLOW: 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 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, and up to 100,000 buckets can be defined, with max of 15 buckets per group
- P4Runtime version v1.0.0 <https://github.com/p4lang/p4runtime/releases/tag/v1.0.0>
 - Use Barefoot SDE bf-sde-8.9.1 to compile and debug P4 programs before pushing to switch via P4Runtime
- Supports Virtual Machine installation on top of NoviWare
- Simplifies installation of NoviWare through ONIE
- Resetting and showing statistics via gRPC
- 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 Plug-and-Play deployments such as gRPC remote automated provisioning and switch IP address default set via DHCP



NOVIWARE FOR TOFINO 500.2 OPENFLOW 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_UCA
- 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, L2GRE, 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 up to 254 LAG ports
- Per port Rx dropped counter on table-miss with action drop
- Packet timestamping with stats
- Time sync in a NTP or PTP
- PTP Transparent Clock
- Linux port bonding-OF port redundancy
- Supports Virtual Machine installation on top of NoviWare
- Simplifies installation of NoviWare through ONIE
- Resetting and showing statistics via gRPC
- Support for In-band Network Telemetry (INT)
- Support for 4x25G Fanout on 100G ports
- Experimenters for HASH_Field_SYM, Ppoe, L2TP

- I4_dport and I4_sport as hashfields
- Support of Postcards with command to define the INT/Postcard Monitor
- 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 with AAA timeout
- 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, OF port status logging – messages log
- 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 Possibility to use the option 'monitoring' with 'show status port' and 'show status platform' through gRPC
- Switch configuration file export/import to remote server in binary and text formats
- 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
- NETCONF support
- Introduction of SmartCTL
- TLS for Remotelog Server
- gRPC Support for CA Chain

*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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