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# Huawei NetEngine 8000 Series All-scenario Intelligent Routers


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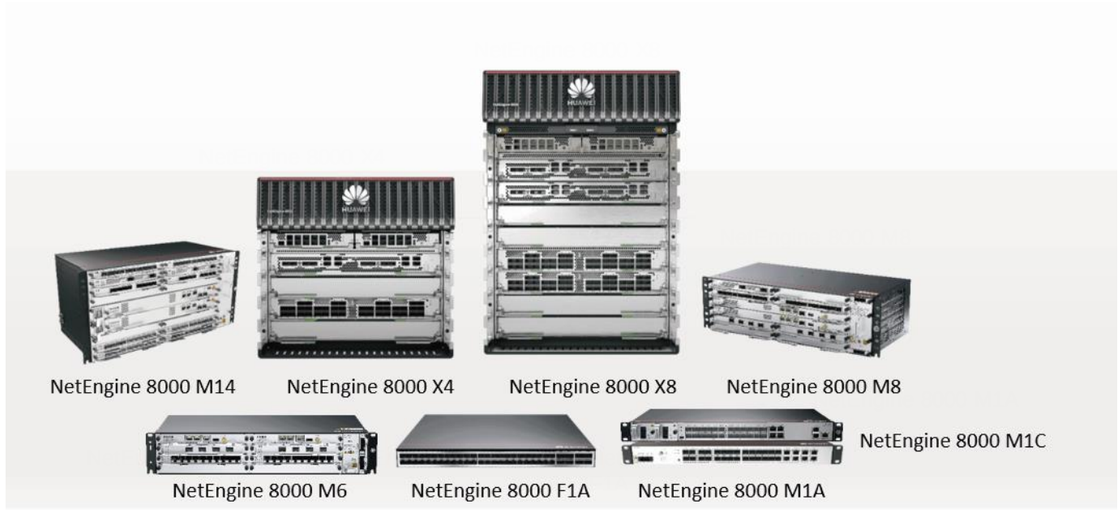
# PRODUCT DESCRIPTION

Huawei NetEngine 8000 series routers (hereinafter referred to as the NetEngine 8000) are Huawei's next-generation, high-end intelligent routers for all scenarios. They are predominantly suited to scenarios including access and aggregation, private line, inter-national gateway (IGW), data center-gateway (DC-GW), and data center interconnect (DCI) to help build intent-driven IP bearer networks that fea a simplified architec-ture, intelligent connections, and high availability.

The NetEngine 8000 series features an ultra-broadband network platform, SRv6-based intelligent connections, and full-lifecycle automation. It provides rich service types and high-reliability SLA quality, making it the best choice for enterprise customers in digital transformation.

## Product Appearance

The NetEngine 8000 consists of the X, M, and F series, including the NetEngine 8000 X8, NetEngine 8000 X4, NetEngine 8000 M14, NetEngine 8000 M8, NetEngine 8000 M6, NetEngine 8000 M1A, NetEngine 8000 M1C and NetEngine 8000 F1A, applicable to network of different scales.




## Highlights

### Industry-Leading Ultra-Broadband Platform

The ultra-broadband converged bearer platform supports up to 14.4T per slot, more than 1.5 times the industry average, meeting enterprises' requirements for full-scenario and large-capacity service access. This enables converged full-service bearing and smooth evolution to higher bandwidth. The high-density, large-capacity, and compact fixed-configuration routers supporting flexible cards help enterprises to save equipment room space and electricity, hence reducing operations and maintenance (O&M) costs.

### SRv6-Powered Intelligent Connections

IPv6 Segment Routing (SRv6) is a future-oriented, next-generation simplified protocol that inherently supports IPv6, facilitating the access of numerous terminals, while simplifying protocols and configurations. SRv6 and iMaster NCE enable network resource adjustment in accordance with changes on the cloud, one-hop access to the cloud, and service provisioning within minutes. SRv6 can identify applications and tenants to implement continuous innovations make it a leader in the SRv6 field. Huawei has participated in the development of more than 75% of SRv6 standards and led the large-scale commercial use of SRv6 in the finance and over-the-top (OTT) industries. Huawei will continue to lead future SRv6 evolution and innovation.

## Full-Lifecycle Automation

iMaster NCE, the "intelligent brain", enables real-time visualization of the whole network and full-lifecycle automation. iMaster NCE and In-situ Flow Information Telemetry (iFIT) allow real-time visualization of service quality and fault locating within minutes. Huawei proprietary Routing Optimization Algorithm based on Matrix (ROAM) algorithm enables intelligent traffic steering and optimization, improving network utilization by over 20%. AI algorithms for alarm compression reduce the number of alarms by 99% and improve OæM efficiency by 90%, helping enterprises move towards autonomous driving wide area networks (WANs).

## Strong Service Support Capabilities

The NetEngine 8000 supports diverse features and provides powerful service processing capabilities to meet the service requirements of metro networks, vertical networks, DCI networks, and campus or DC gateways. See below for some of these capabilities.

- Powerful routing capabilities: The NetEngine 8000 supports super large routing tables and diverse routing protocols including Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Intermediate System to Intermediate System (IS-IS), Border Gateway Protocol Version 4 (BGPv4), and broadcast, unknown-unicast and multicast traffic (BUM) routing. In addition, the NetEngine 8000 supports both simple and ciphertext authentication and fast convergence to ensure network stability and security in complicated routing environments.
- Strong service bearing capabilities: IP, Multiprotocol Label Switching (MPLS), and SRv6 can be deployed on the NetEngine 8000 as required. The NetEngine 8000 supports Layer 2 virtual private network (L2VPN), L3VPN, multicast VPN (MVPN), and Ethernet VPN (EVPN) services, traffic engineering (TE), flexible 802.1Q in 802.1Q (QinQ), and Generic Routing Encapsulation (GRE). The NetEngine 8000 supports traditional access, emerging services, and multi-service bearing.
- Powerful expandable multicast capabilities: The NetEngine 8000 supports various IPv4/IPv6 multicast protocols, such as Protocol Independent Multicast - Sparse Mode (PIM-SM), PIM - Source Specific Multicast (PIM-SSM), Multicast Listener Discovery Version 1 (MLDv1), MLDv2, Internet Group Membership Protocol Version 3 (IGMPv3), IGMP snooping, and MLD snooping. The NetEngine 8000 can flexibly carry video services, such as Internet Protocol Television (IPTV), and satisfy multicast service requirements on networks of various scales.
- Powerful IMIX traffic forwarding performance with multiple services enabled (IPSec, NAT, QoS, ACLs, etc), and CPU operating conditions bellow 75% usage.

## Comprehensive Network Slicing Functions

The NetEngine 8000 provides comprehensive network slicing functions to meet the differentiated SLA requirements of different services and enterprises. Quality of Service (QoS) ensures service isolation and pipe statistical multiplexing. Flexible Ethernet (FlexE) sub-interfaces implement service protection based on queue isolation. Timeslot-based FlexE slicing provides SLA assurance for super services through physical isolation.

High-quality QoS capabilities, advanced queue scheduling algorithms and congestion control algorithms, as well as a five-level hierarchical QoS (HQoS) scheduling mechanism, meet the service requirements of diverse users on the access side in a differentiated manner. The NetEngine 8000 supports MPLS HQoS on the network side. QoS can be deployed on the network side to provide QoS for MPLS VPN, virtual leased line (VLL), and pseudo-wire emulation edge to edge (PWE3) services. The NetEngine 8000 performs precise multi-level scheduling of data flows, meeting the quality requirements of different users and services of different classes.

## Future-Oriented IPv6 Solution

The NetEngine 8000 supports IPv6 static routes and various IPv6 routing protocols, including OSPFv3, IS-ISv6, and Border Gateway Protocol for IPv6 (BGP4+). In addition, it provides a large-capacity IPv6 forwarding information base (FIB) and supports IPv6 terminal access, IPv6 Access Control Lists (ACLs), IPv6 policy-based routing, and SRv6. These features lay the foundation for a smooth transition from IPv4 to IPv6. The NetEngine 8000 also supports IPv4/IPv6 dual stack and IPv4-to-IPv6 transition technologies for both communication between IPv4 and IPv6 networks and between separate IPv6 networks to enhance network scalability.

## High-Precision 1588v2 Clock Solution

IEEE 1588v2 refers to the IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measure ment and Control Systems. The 1588v2 standard defines a Precision Time Protocol (PTP), which can achieve time and frequency synchronization with an accuracy of sub-microseconds.

The 1588v2 standard enables time and frequency synchronization to meet the requirements of the G.813 template. Moreover, an accuracy of 100 ns meets the requirements of wireless and Long Term Evolution (LTE) networks, and the time jitter between multiple nodes (under 30 nodes) is less than 1 µs, allowing for large-scale networking. The external clock sources can be assigned different priorities. The NetEngine 8000 automatically selects an external clock source as its reference clock source based on parameters such as the priorities of external clock sources and the number of hops between itself and the external clock sources. If the best external clock source fails, the device automatically selects the second-best external clock source as its reference clock source. Service switching can be completed within 200 ns, ensuring high clock reliability. In the meantime, iMaster NCE provides GUI-based clock management.

## All-Round Reliability Solution

The NetEngine 8000 provides reliability protection at different levels, including the device level, network level, and service level. The NetEngine 8000 can provide a network-wide reliability solution that comprehensively meets the reliability requirements of diverse services. These reliability features lay the foundation for reliable enterprise service interconnection with a system availability of 99.999%.

- Device-level reliability: The NetEngine 8000 provides redundancy backup for key components. Key components also support hot swap and hot backup. Furthermore, the NetEngine 8000 leverages Non-Stop Routing (NSR) and Non-Stop Forwarding (NSF) technologies to ensure uninterrupted service transmission.
- Network-level reliability: The NetEngine 8000 uses multiple technologies to ensure network-wide reliability and provide end-to-end protection switching within 50 ms for uninterrupted services. These technologies include: IP fast reroute (FRR), Label Distribution Protocol (LDP) FRR, VPN FRR, TE FRR, hot standby, and fast convergence of Interior Gateway Protocol (IGP), BGP, and multicast routes. Other technologies used by NetEngine 8000 to ensure reliability include Virtual Router Redundancy Protocol (VRRP), trunk load balancing and backup, bidirectional forwarding detection (BFD), Ethernet operation, administration and maintenance (OAM), routing protocol/port/VLAN damping, Topology-Independent Loop-free Alternate FRR (TI-LFA), and egress protection through mirror segment IDs (SIDs).

- Service-level reliability: The NetEngine 8000 uses technologies such as VPN FRR, E-VRRP, VLL FRR, Ethernet OAM, pseudo wire (PW) redundancy, and enhanced trunk (E-Trunk) to provide service-level redundancy for L2VPNs and L3VPNs, ensuring stable, reliable, and uninterrupted services.
- Dual-device hot backup: The NetEngine 8000 provides 1+1 or 1:1 hot backup for multicast services.

## Comprehensive OAM Technologies

The NetEngine 8000 provides point-to-point Ethernet fault management in compliance with IEEE 802.3ah and supports connectivity fault management (CFM) OAM for end-to-end fault detection and locating. The NetEngine 8000 provides Ethernet performance management in compliance with ITU-T Y.1731. By inserting a timestamp into 802.1ag loopback (LB) messages, the NetEngine 8000 can measure performance indicators, such as latency, jitter and packet loss rate. performance measurement can be configured as a scheduled task, and performance statistics reports are output through collaboration with iMaster NCE.

iFIT can collect SLA information in real time, upload this information to iMaster NCE for intelligent analysis, control, and management, and deliver service policies. If a fault occurs, iFIT enables fault locating within minutes, implementing a SLA-based closed-loop. In the meantime, data is sent to the AI cloud platform for training and self-learning to match more service types and fault models. This makes the "network brain" smarter and enables WANs to move toward becoming autonomous driving networks.

## Energy-Conserving Design

The NetEngine 8000 boasts an environmentally friendly design with energy saving features.

- The NetEngine 8000 is equipped with an industry-leading powerful heat dissipation system. The system is powered by multiple cutting edge technologies, including an aerospace grade mixed-flow fan, carbon nanotube thermal pad, vapor chamber liquid cooling radiator, and board-specific floating heat dissipation. The optimal head dissipation design greatly improve heat dissipation efficiency while reducing the power consumption of the entire system.
- Equipped with Huawei-developed Solar R chips, the NetEngine 8000 leverages leading nanotechnologies in combination with chip-level dynamic frequency adjustment and intelligent fan speed adjustment technologies to significantly reduce power consumption. In the way, the NetEngine, 8000 is optimized for energy conservation.

## Technical Specifications

| Parameter | NetEngine 8000 X8 | NetEngine 8000 X4 | NetEngine 8000 M14 | NetEngine 8000 M8 |
|---|---|---|---|---|
| Switching Capacity | 83.78 Tbps | 41.89 Tbps | 4 Tbps | 2.4 Tbps/960G |
| Forwarding Performance | 14,496 Mpps | 7,248 Mpps | 906 Mpps | 453 Mpps |
| throughput with encryption. | 120Gbps (512 Byte) per card | 120Gbps (512 Byte) per card | 30Gbps (512 Byte) per card | 30Gbps (512 Byte) per card |
| Max. Capacity of a Board | 4 Tbps | 4 Tbps | 200 Gbps | 200 Gbps |
| Capacity Density (G/U) | 2025 | 1633 | 400 | 400 |
| IPU | 2, 1:1 | 2, 1:1 | 2, 1:1 | 2, 1:1 |
| SFU | 8, 7+1 | 8, 7+1 | 2, 1:1 (integrated) | 2, 1:1 (integrated) |
| Processing Board/ Subcard | 8 | 4 | 14 | 8 |
| Power Supply Module | Max 10, N+1 | Max 6, N+1 | 2, 1+1 (DC) 4, 2+2 (AC) | 2, 1+1 |
| Fan Module | 12, 11+1 | 6, 5+1 | 4, 3+1 | 2, 1+1 |
| Dimensions (H x W x D) | 442 mm x 861.4 mm x 702.3 mm (15.8U) | 442 mm x 861.4 mm x 435.6 mm (9.8U) | 442 mm x 220 mm x 222 mm (5U) | 442 mm x 220 mm x 132.6 mm (3U) |
| Typical Power Consumption | 11,017 W | 5,913 W | 1,270 W | 485 W |
| Weight (in Full Configuration) | 296.6 kg | 186.2 kg | 27.4 kg | 16.5 kg |
| IPv4 BGP route capacity | 80M | 80M | 25M | 10M |
| IPv6 BGP route capacity | 40M | 40M | 10M | 5M |
| Number of IPv4 FIB entries | 4M | 4M | 4M | 4M |
| Number of IPv6 FIB entries | 2M | 2M | 2M | 2M |

## Feature Specifications

| | |
|---|---|
| Hardware Architecture | Non-blocking architecture<br>400GE/100GE/50E/40GE/25GE/10GE/GE/FE/E1/Channelized STM-1c/OC-3c/STM-1c/OC-12c/STM-4c |
| Layer 2 Ethernet Protocols | G.8032, STP/RSTP, MSTP, BPDU, and LACP Transparent transmission of Layer 2 protocols |
| Ethernet Services | VLAN, VPWS and VPLS<br>MAC address limit function<br>bridge domain<br>EVC Layer 2 sub-interface<br>VxLAN, EVPN for VxLAN<br>Eth-Trunk |
| Routing Protocols | Routing protocols such as RIP, RIPng, OSPFv2, OSPFv3, IS-IS, IS-ISv6, BGP, BGPv6,MP-BGP, IPv4 multicast, IPv6 multicast, static routes, and multicast static routes, IPv4/IPv6 Dual Stack, routing policy, route filtering IPv4/IPv6 policy-based routing, load-balancing (ECMP and UCMP), OSPF-LDP, IS-IS LDP-IGP synchronization, and BGP route reflector (RR) |
| Multicast | IGMPv1/v2/v3, PIM-SM/PIM-SSM, MSDP, MVPN, NG-MVPN, BIER/BIERv6, IGMP snooping, MBGP, anycast RP and Reverse Path Forwarding (RPF) multicast routing policy |
| MPLS | MPLS LDP,<br>RSVP-TE, P2MP TE/mLDP, and MPLS/BGP VPN, in compliance with RFC 2547<br>BGP route reflector<br>MPLS-TP<br>ECMP and UCMP<br>Flexible Ethernet (FlexEth) |
| VPN | BGP and LDP MPLS L2VPN, L2VPN techniques, such as VPLS and VLL/VPWSL3VPN, dual-stack VPN, Multicast VPN, EVPN VPLS/VPWS/L3VPN and PBB EVPN<br>Inter-AS VPN (Option A, B, or C). |
| IPv6 | Various IPv4-to-IPv6 transition technologies: manual tunnel, automatic tunnel, 6to4 tunnel, GRE tunnel, and ISATAP tunnel<br>IPv4 over IPv6 tunnel and IPv6 Provider Edge (6PE)<br>IPv6 neighbor discovery, PMTU discovery, TCP6, ping IPv6, tracert IPv6, socket IPv6, static IPv6 DNS, IPv6 DNS server, TFTP IPv6 client, and IPv6 policy-based routing<br>Internet Control Message Protocol Version 6 (ICMPv6), Management Information Base (MIB), User Datagram Protocol Version 6 (UDP6) MIB, TCP6 MIB, and IPv6 MIB |
| SR&SRv6 | SR-BE, SR-TE and SR Policy, SR TI-LFA/Anti-micro-loop<br>SRv6 BE, SRv6 TE Policy and EVPN VPWS&EVPN VPLS&EVPN L3VPN over SRv6 TE policy, SRv6 Policy traffic statistics, SRv6 TI-LFA FRR, EVPN over SRv6 BE |
| Security | MD5 and keychain authentication<br>IPv4/IPv6 URPF<br>URPF with strict and loose mode<br>ARP attack defense<br>BGP IPv4 Flow Specification and BGP IPv6 Flow Specification, BMP(BGP Monitoring Protocol)<br>Traffic suppression include multicast, broadcast, and unknown unicast traffic<br>MACsec |
| Reliability | SR-MPLS TI-LFA/Anti-micro-loop<br>Hardware BFD minimum 3.3ms detection interval<br>BFD for VRRP, OSPF, IS-IS, BGP, LDP, TE, SR, VRRPv6, OSPFv3, ISISv6, BGP4+,PW<br>IP FRR (OSPF, ISIS, BGP), LDP FRR, TE FRR, and VPN FRR<br>Remote-LFA/TI-LFA/Anti-micro-loop<br>VRRP<br>Command rollback and commit trial<br>SRv6 TI-LFA&SRv6 TE FRR&BFD for SRv6 TE Policy for fast fault convergence<br>NSR for VRRP, OSPF, IS-IS, BGP, LDP, TE, SR, VRRPv6, OSPFv3, ISISv6, BGP4+ |
| OAM | iFIT, IP FPM NQA BFD, TWAMP, MPLS OAM, MPLS TP OAM VRRP, Ethernet OAM (802.3ah, 802.1ag/Y.1731), Ethernet LPT, Bit error-triggered switching, LLDP, BFD for eth-trunk |
| QoS | Hierarchical QoS, SQ, PQ, WFQ and LPQ, QPPB, DifferServ and redirection, WRED<br>Traffic classification based on 802.1p, IP Precedence, DSCP, and MPLS EXP<br>Traffic marking/re-marking 802.1p, IP Precedence, DSCP, and MPLS EXP |
| Clock | NTP<br>Synchronous Ethernet (SyncE)<br>1588v2 and G.8275.1 profile |
| O&M | Telenet, SSH/SSHv2,Netcogf, SNMPv1, SNMPv2 & SNMPv3. |
| Regulatory compliance | EMC<br>ANSI C63.4, AS/NZS CISPR 32<br>CISPR 24,CISPR 32<br>EN 55024, EN 55032<br>ETSI EN 300 386, ETSI ES 201 468<br>FCC CFR47 Part 15 Subpart B<br>ICES-003 Issue 6, ICES-GEN Issue 1<br>IEC 61000-3-2, IEC 61000-3-3, IEC 61000-4-11, IEC 61000-4-2, IEC 61000-4-29, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-6-2, IEC 61000-6-4<br>VCCI-CISPR 32<br>Environment<br>IEC 60068-2-30, IEC 60068-2-78, IEC 60068-2-14, IEC 60068-2-1, IEC 60068-2-2<br>Safety<br>IEC/EN/UL/CSA 60950-1, IEC/EN 62368-1<br>Environmental protection<br>2011/65/EU & (EU)2015/863 (EU RoHS)<br>Regulation (EC) No.1907/2006 (REACH)<br>2012/19/EU (WEEE)<br>2006/66/EC & 2013/56/EU on batteries and accumulators |