

# Carrier Grade Disaggregated IP/MPLS Access & Aggregation Solutions

## Disaggregated Access & Aggregation

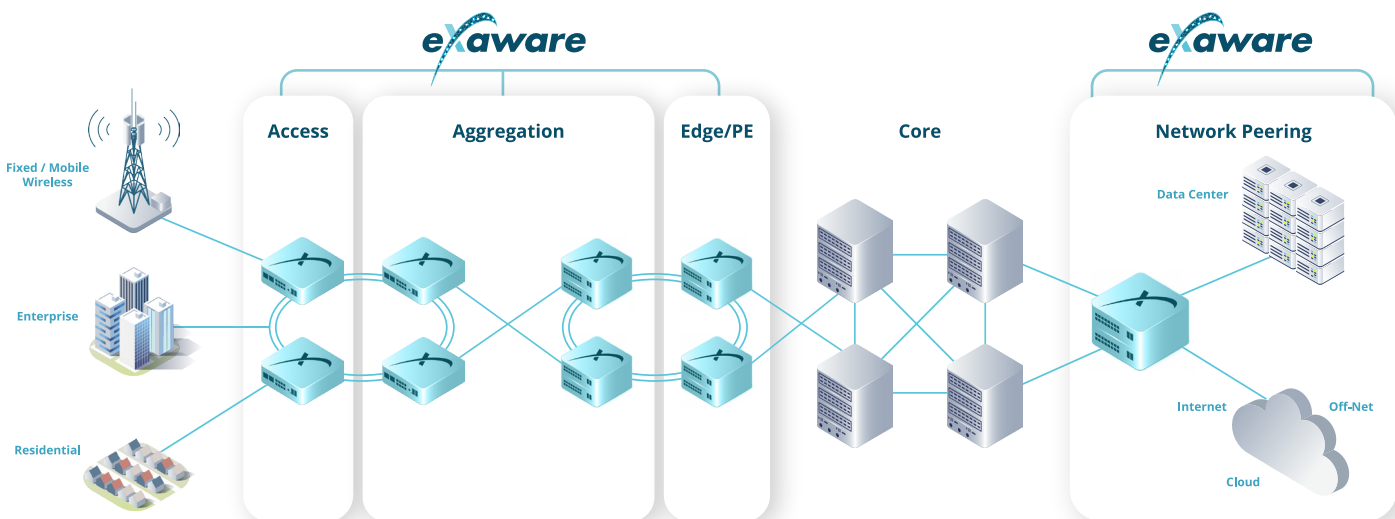
No access network comes without its challenges, and the most significant are maximizing quality of experience (QoE) and meeting service level agreements (SLA). This is crucial for any company that wants to sharpen its competitive edge, impress customers, and minimize churn.

Today's customers expect nothing less than feature-rich functionality and prioritized service continuity. Every access network is required to handle an eclectic mix of applications, from business to residential to mobile backhaul connectivity across a spectrum of access technologies. Access traffic is concentrated by the aggregation layer, and with each aggregation network element (NE) handling thousands upon thousands of users, NE level redundancy is not optional — it is essential.

Exaware's disaggregated IP/MPLS access and aggregation solutions use a modern software architecture that delivers the agility you need to scale with ease and effortlessly onboard value-added services as and when needed.

### Features

- Advanced hierarchical quality of service (QoS)
- Enhanced VPN services for network slicing
- Unified solution for residential, business, and mobile backhaul
- Robust and scalable
- Flexible and feature rich



# The Exaware Difference

Exaware's ExaNOS is an industry-leading network operating system (NOS) with a robust cloud-based architecture that confidently addresses today's challenges. By adopting an open networking approach, you gain a unified platform that keeps simplicity and agility at heart while supporting hyperscale capacity and feature-rich functionality.

Exaware boldly addresses the needs of enterprises for elevated access and aggregation through a spectrum of strong features and routing protocols that include Layer 2, BGP protocol extensions, and a range of VPN services (MPLS, L2VPN, and L3VPN), not to mention advanced QoS and sophisticated traffic prioritization.

## Advanced Hierarchical QoS

Exaware elevates the traffic engineering process to enable communication service providers (CSP) to handle multi-priority services with efficiency and confidence. Our advanced QoS and extensive traffic management functionality are brought to life through ExaNOS, which includes advanced classification and marking.

ExaNOS is based on multiple packet fields, two-rate, three-color policing on ingress, shaping, and advanced queuing for unmatched end-to-end performance. By employing a weighted random early discard (WRED) mechanism, ExaNOS enables intelligent queue management and congestion avoidance, with a fourfold hierarchical QoS.

Benefits like these make Exaware the obvious choice for every CSP who needs to offer various service level agreements (SLAs) for varying customers and service types.

## Flexible and Feature-rich

Our dedicated team built ExaNOS from the ground up upon foundations of scalability and performance. Initially engineered for operation on chassis-based hardware, today ExaNOS features a distributed architecture designed to allow users to run separate processes with dedicated memory and CPU resources. This way, users can fully leverage underlying hardware — uninterrupted.

With the support of MP-BGP for L3VPN and L2VPN services

ExaNOS enables superior access layer disaggregation in both functionality and scale, which further supports numerous advanced services, including:

- Layer 2 VPN (L2VPN) and VPLS services
- Layer 3 VPN (L3VPN) and IPv4, 6PE, and 6VPE
- Advanced hierarchical QoS
- Guaranteed SLAs for any service or online application from unified communications to multimedia streaming, online gaming, working from home, telehealth, and beyond
- Residential aggregation and business connectivity support
- Segment routing and EVPN roadmap for future-proofed networks

It is important to note that aggregation is a critical network application, concentrating incoming access traffic. Disaggregation empowers ExaNOS users to deliver sound access network solutions in terms of agility, flexibility, and third-party application openness.

From future services to monitoring applications, ExaNOS changes the way you operate. The ExaNOS software router supports advanced control plane architecture, delivers resilient solutions, and supports all the SLAs your end users expect and demand. Redundancy at the NE level is critical.

What started out as a high-performance proprietary routing solution is a leading cloud-based NOS in the networking industry. ExaNOS was installed in production networks of Tier 1 service providers, giving you a field-proven, carrier-grade network operating system.

## White Box Solution Architecture

CSPs are on a perpetual hunt for ways to break the chains of vendor lock-in, and that's where disaggregation between software and hardware comes into play. As a leading platform engineered to run on any Broadcom DNX-based white box, ExaNOS empowers service providers to select their preferred hardware vendor, aligning their unique needs with the correct off-the-shelf solution.

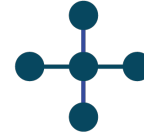
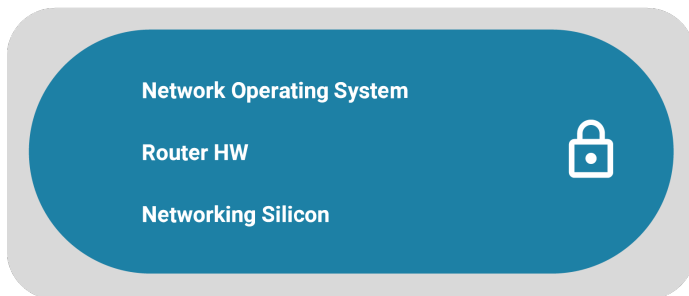


# Vertical Versus Disaggregated Routers

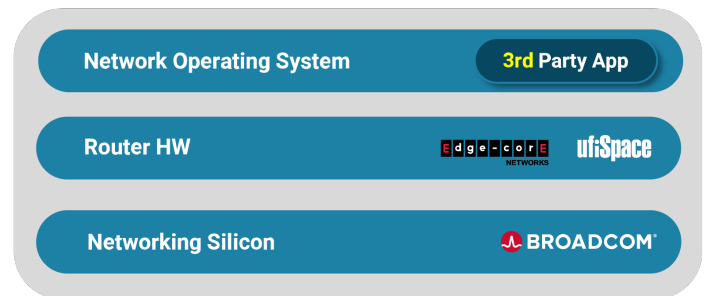
## VERTICAL VS. DISAGGREGATED ROUTER



Vertically Integrated Monolithic Router



Disaggregated Router



## Openness & Ecosystem

ExaDOS is ushering in a new era of openness in the field of network disaggregation, thanks to its revolutionary, one-of-a-kind software architecture. We pave the way for third-party applications to co-exist alongside ExaDOS in flawless harmony, within the same white box router. We are proud to be bringing our vision to maximize commercialized white box utilization to life.






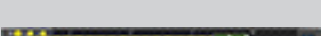

There are two primary modes of operation, namely:

- Virtual Machine (VM) – The application runs in native mode over the operating system, adapted to the white box environment.
- Container Mode – Supports any and all applications that need to run over the operating system. No adaptation needed.

Consider for a moment DDoS mitigation, embedded in the router itself. The goal here is to block aggressive attacks in real-time, directly at the peering point. ExaDOS delivers an advanced PON access solution via the pluggable OLT module, designed to effortlessly collaborate with L2VPNs, L3VPNs, VPWS, and VPLS services.

We enable our users to leverage the power of telemetry, unlocking deep-seated network insights to surface and rectify anomalies before they impact your end customers.

# Exaware Platforms for Access & Aggregation

Exaware Model	Broadcom Chip Set	System Capacity	1G/10G	10G/25G	100G	400G	Access	Aggregation
EXA5201-100G 	AX	100Gbps	20	4	3		✓	
EXA5200-100G 	AX	100Gbps	16	8	2		✓	
EXA5201-300G 	AX	300Gbps	20	4	3		✓	✓
EXA5200-300G 	AX	300Gbps	16	8	2		✓	✓
EXA5300-400G 	MX	400Gbps	48		6			✓
EXA5400-800G 	Q2A	800Gbps		24	2	2	✓	✓
EXA5300-800G 	MX	800Gbps			6			✓
EXA5600-2400G 	Q2C	2.4Tbps		4	22	4		✓
EXA5500-2400G 	Q2C	2.4Tbps		64	8			✓
EXA5600-2400G 	Q2C	2.4Tbps		64	10			✓
<i>*Each system includes a certified white box hardware chassis integrated with ExaNOS, Exaware's carrier grade IP routing operating system.</i>								

**Roadmap Updates:** Contact us for any questions on availability and suitability for your applications, as well as the latest updates to our roadmap.

## Simplicity

The Exaware solution for access and aggregation enables automation and lifecycle management via various open APIs (including NETCONF/YANG).

ExaDOS includes our Compass unified policy language (CUPL), a sophisticated policy language, and common programmability for control plane and data plane policies. The latter includes routing protocols, ACL, and QoS. At the heart of it all lies our vision to deliver a simple yet powerful interface for advanced configurations.

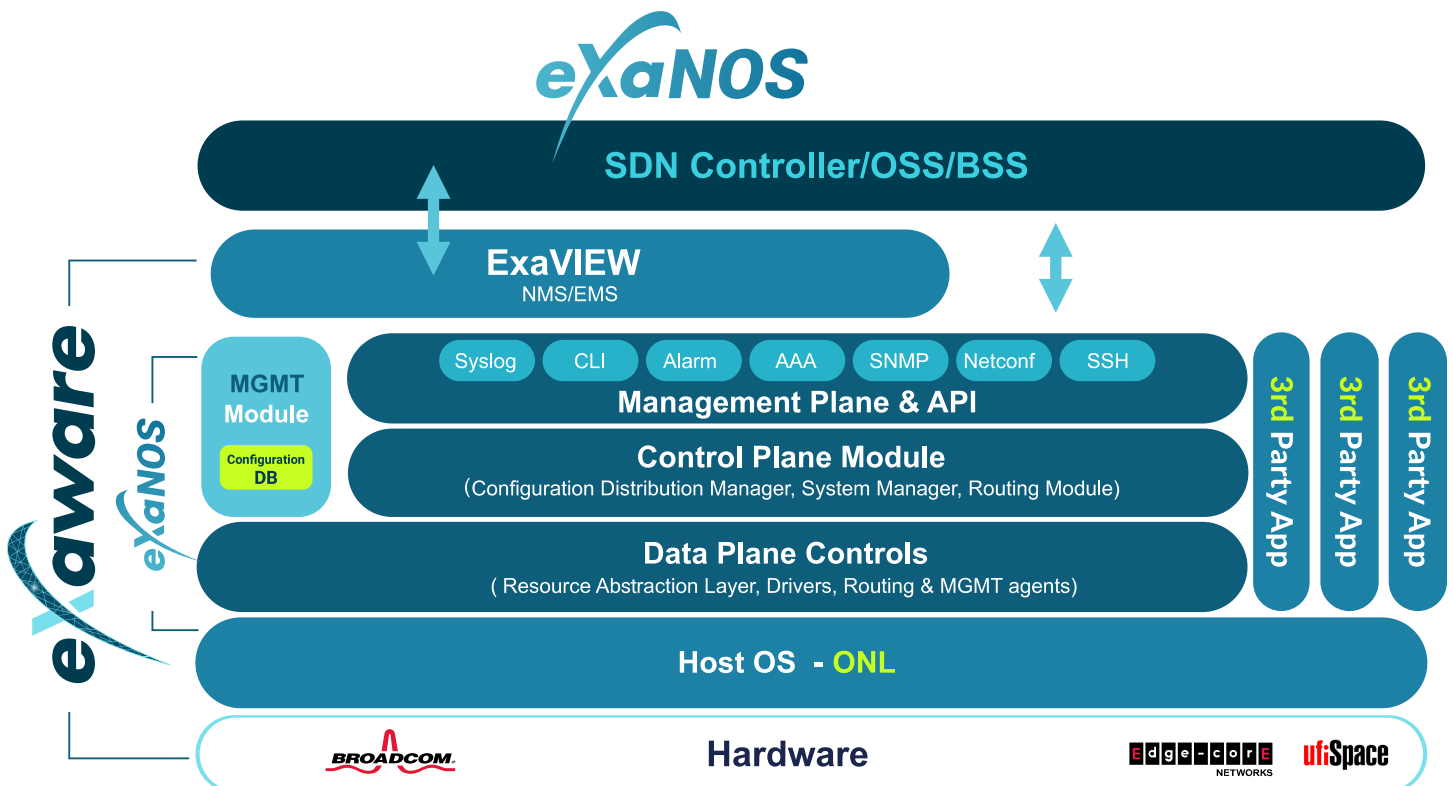
Exaware's management plane is based on NETCONF/YANG, which is fully synchronized with the hierarchical CLI interface. Our state-of-the-art two-phase commit process – for both CLI and NETCONF – aligns with primary carrier grade vendors. These two unique phases guarantee that multiple changes will only be set should sufficient resources

exist in order for the changes to take effect at once without impacting existing services. With NETCONF/YANG support, the Exaware solution enables programmable access to network devices directly to your preferred SDN controller, through structured data API.

## Field Experience

NOS vendors are not hard to come by, but NOS vendors with genuine operational experience are few and far between. As one of the only NOS vendors of our kind, we bring years of international operational experience to our clients.

We've served some of the world's major Tier 1 service providers. This experience, coupled with our proven networking proficiency, means you can always count on Exaware to deliver any application with scale and reliability.



# In Summary



## Cloud architecture

- Modern software environment
- Cloud-based architecture for flexibility and boundless scaling



## Unified software platform

- MPLS VPNs, L2VPNs, L3VPNs, VPWS and VPLS services
- Flexibly customize access networks in line with your preferences
- Third-party NMS/SDN controller



## Carrier grade routing solution

- A decade of development with ExaNOS
- Successfully deployed among several Tier 1 service providers
- Critical redundancy
- Two-phase commit



## Reduced TCO

- Choose from plan-ahead (chassis) to pay-as-you-grow
- Generate new revenue streams with third-party applications
- Break the chains of vendor lock-in