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IDC TECHNOLOGY SPOTLIGHT

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The economics and relevance of network disaggregation were proven in hyperscale datacenters, but the next wave of network disaggregation will occur at the datacenters of other cloud operators and large enterprises as well as in the telco clouds and edge infrastructure of communications service providers.

Network Disaggregation: Extending Beyond Hyperscale to Datacenter Operators and Telco Cloud/Edge

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Introduction

As network disaggregation draws increased interest from an expanding pool of customers among communications service providers and datacenter operators, it's important to understand its origins, salient benefits, and proliferating use cases.

Network disaggregation began among the hyperscale cloud giants, which have built datacenters at unprecedented scale — and for good reason. Their datacenters are effectively their businesses, the vast digital engines that generate and sustain immense business value.

As hyperscalers built datacenters at unprecedented scale to support their burgeoning digital empires, they constantly sought ever-greater agility, cost savings, and efficiencies in the datacenter architectures they designed and the datacenter infrastructure they deployed. They questioned conventional approaches and weren't afraid to challenge orthodoxies in their bid to remake datacenter infrastructure to suit the needs of their cloud businesses.

AT A GLANCE

WHAT'S IMPORTANT

Network disaggregation is expanding well beyond the realm of hyperscale, addressing a growing number of use cases and lucrative addressable markets. It is finding favor in modern datacenters, in datacenter interconnect scenarios, and at communications service providers, where it is being used by telcos and cable multiple system operators (MSOs) in internet exchange points (IXPs), passive optical networks, cloud gateways at the service provider edge, and 4G and 5G edge cell-site routing.

The datacenter network was not immune to such reassessment and modernization. In fact, the hyperscalers soon identified the datacenter network as an area that warranted extensive change. In this regard, network disaggregation emerged as a major priority. Network disaggregation, we should make clear, entails the abstracted decoupling of a networking device into its discrete component parts, with particular emphasis on decoupling the network device hardware (the brawn, so to speak) from the network operating system software (the brain that controls the device).

Prior to the embrace of network disaggregation at the hyperscalers, the general concept of disaggregation had already been well established in the realm of compute — it's why we have CPUs from one set of vendors, server hardware from others, and operating systems from still others. Until recently, however, traditional network devices tended to be vertically integrated and monolithic, featuring proprietary network silicon, proprietary network software, and proprietary interfaces.

Although network disaggregation was first implemented successfully by the hyperscalers, it is now making its way to other datacenter networks, including those of tier 2 and 3 IaaS and SaaS cloud operators and some large enterprises, as well as to telecom communications service providers, which have seized on the applicability and value of network disaggregation in their core and edge networks (e.g., central offices, cable headends, 5G base stations). In fact, these markets are readily emerging as the next wave of growth for network disaggregation, with an ecosystem of bare-metal network hardware suppliers (ODM and OEM alike) and a diverse spectrum of network operating-operating system software vendors coalescing to serve a full spectrum of requirements and use cases — from the datacenter, where it all began, to the edge and everywhere in between.

Indeed, the evolution of network disaggregation beyond hyperscalers is generating a growing number of use cases and lucrative addressable markets. Network disaggregation not only is increasingly viable in all modern datacenters but also is finding favor in datacenter interconnect scenarios where spine switches are being leveraged for routing use cases. Additionally, communications service providers, including a broadening circle of telecommunications providers and cable multiple system operators (MSOs) are taking an increased interest in network disaggregation for use in internet exchange points (IXPs), passive optical networks, cloud gateways at the service provider edge, and cell-site routing at the 4G and 5G edge.

Before we examine the benefits that network disaggregation delivers, let's briefly address the technological advances that have made it an increasingly attractive consideration for a growing base of customers and use cases. Foundational elements are the ever-greater capabilities and sophistication of merchant Ethernet network silicon, buttressed by standards-based and open network hardware, and — last but certainly not least — increasingly wide choice and flexibility in network operating systems, many of which are modern, open, programmable, and capable of integrating with a plethora of software-defined networking (SDN) controllers, network virtualization overlays (NVOs), and cloud orchestration systems.

Network disaggregation, therefore, is becoming a cornerstone of infrastructure automation and standardization, allowing customers not only to reduce capex costs but also to innovate at the speed of software, uninhibited by the constraints of network hardware life cycles and proprietary vendor road maps. What's more, in many cases, customers that adopt network disaggregation can now orchestrate, automate, and proactively manage their entire IT infrastructure (including network infrastructure) with the same toolsets and platforms, maintain choice and flexibility at every layer of the network stack, and achieve unprecedented operational efficiencies. This approach results in a range of operational and business benefits.

Benefits

The decoupling of the network operating system from the underlying network hardware (switches and routers) confers numerous benefits, all of which derive from the choice and flexibility that are inherent to network disaggregation. These benefits include the following:

- Savings on capex and through operational efficiencies arise from industry-standard, white-box hardware from a growing pool of suppliers, embedding a full-featured operating system tailored to the applications and use cases that customers wish to address.
- No compromise on either hardware performance, due to the advances of Ethernet merchant silicon, or on software functionality, due to the sophisticated feature sets of available network operating system.

- Customers can choose network operating systems suited to their purpose, for almost every use case, without the need to accept extraneous features or functionality and the additional costs their inclusion entails.
- Liberation from the vendor lock-in that is characteristic of monolithic, vertically integrated networking devices.
- Innovation at the speed of software, leveraging new features and functionality as needed and made available, while also being able to leverage the latest network hardware for higher bandwidths, greater port densities, larger buffers, or any other hardware-based requirement.
- Reduced software and software-maintenance costs, with the value of the software now decoupled and suited for purpose to the environments in which it is deployed.

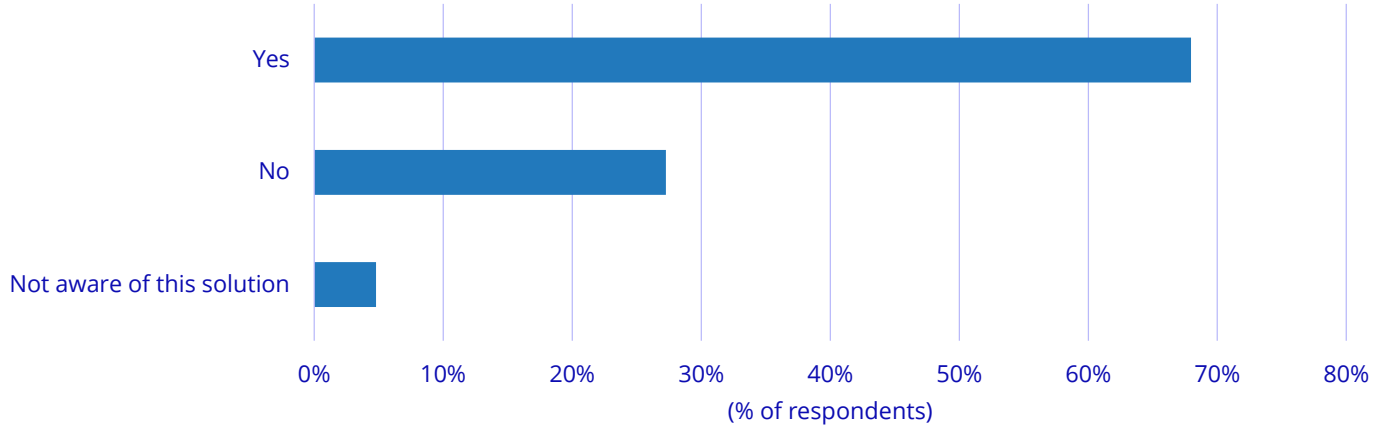
Key Trends

Disaggregation, which occurred first among the hyperscale cloud behemoths, is about establishing the right network abstractions to allow for software-defined agility, flexibility, simplicity, operational efficiencies, and scalability in networking. It's also about adapting a comprehensive model of abstractions, already prevalent in software development and virtualized computing, to a network paradigm for the cloud era.

As a result, as cloud operating models and practices have proliferated, interest in network disaggregation has grown steadily. In IDC's 2015 worldwide *SDN Survey*, about 44% of respondents indicated that they had considered adoption of network disaggregation. Toward the end of 2017, in a subsequent iteration of the survey, that number increased to nearly 70% (see Figure 1).

FIGURE 1: ***Interest in Network Disaggregation Takes Off***

Q *As part of your network architecture, have you considered running a third-party network operating system on a disaggregated switch from an OEM or ODM vendor?*



n = 253

Base = respondents using or planning to use SDN in organization's datacenter

Source: IDC's SDN Survey (Datacenter and Enterprise Campus), October 2017

While consideration does not necessarily equate to adoption, the level of interest is high and growing, and many inhibitors or obstacles to network disaggregation — the breadth and depth of the offerings from the ecosystem and supply chain, the features and functionality of the disaggregated network operating systems, and support issues — have been mitigated or addressed to the satisfaction of an increased percentage of potential customers.

These developments set the stage for the extension of network disaggregation into large addressable markets such as the broad-based market for Ethernet switching in the datacenter, which IDC projects will expand at a CAGR of 5.9% through 2023, when it will be worth $16.6 billion. Non-hyperscale cloud datacenters (including public and private cloud) will achieve a CAGR of about 8.3%, going from expenditures of nearly $6.6 billion in 2018 to about $9.8 billion in 2023. These modernized, cloud datacenters are an addressable market for network disaggregation.

With regard to routing use cases and associated markets, IDC forecasts that the carrier edge routing market will grow from $8.4 billion in 2018 to $9.8 billion in 2023, expanding at a CAGR of 3.1%.

As noted previously, 5G will also pave the way for edge infrastructure opportunities where network disaggregation will be compelling. IDC forecasts that the total 5G network infrastructure market (radio access network [RAN], core, network functions virtualization infrastructure [NFVI], routing, and optical) will grow from approximately $528 million in 2018 to $26 billion in 2022 at a CAGR of 164.9%. IDC believes spending on 5G-related routing and optical backhaul will rise at CAGRs of 146.1% and 129.6%, respectively, from 2018 to 2022. Demand for backhaul routers and an improved optical underlay will be critical to enable 5G service evolution.

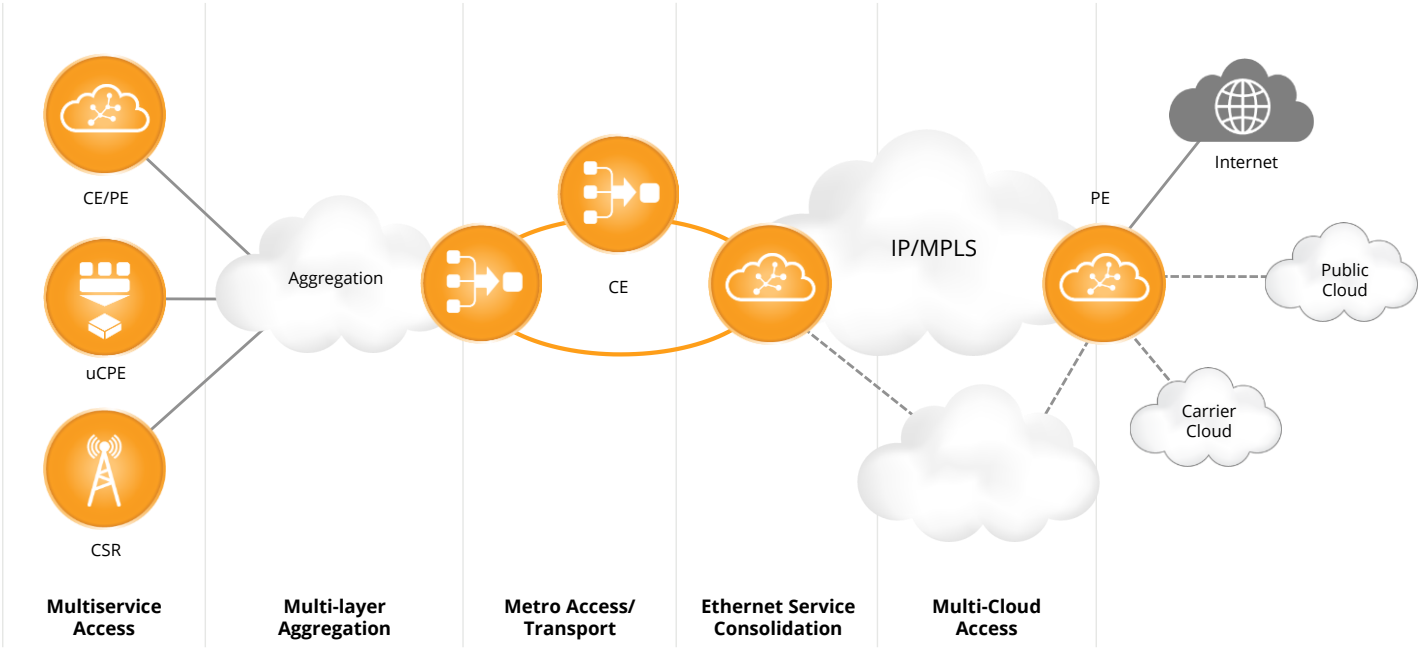
Considering IP Infusion

IP Infusion has been providing network operating system solutions for 20 years. Leveraging that expertise and software heritage, IP Infusion built OcNOS, a full-featured, carrier-grade network operating system for network disaggregation. Focused on datacenter and carrier use cases, OcNOS has been deployed in production carrier networks and supports multiple white-box switches from Dell, Edge-Core, Delta, UfiSpace, and Celestica. OcNOS addresses several use cases including datacenter leaf / spine switches, datacenter interconnect (DCI), and a range of service-provider use cases, including cell-site routing (4G and 5G), passive optical networks, Provider Edge (PE) routers, and edge aggregation for cost-effective scaling as well.

In November 2019, AT&T announced IP Infusion as the exclusive value-added reseller and integrator of DANOS-Vyatta edition, the first disaggregated networking operating system software, based on technology proven in AT&T's production networks. DANOS-Vyatta edition is based on DANOS, a Linux Foundation open source project that introduced the first carrier-grade, open source network operating system framework.

Customers leveraging DANOS-Vyatta edition get the benefits of an underlying open-source offering that has been fully hardened in AT&T's network. DANOS -Vyatta edition provides a hardware abstraction that enables it to easily run on multiple white-box platforms. The initial use case supported by DANOS-Vyatta edition enables cell-site routers for LTE and 5G mobile networks. IP Infusion will be working with AT&T to expand DANOS-Vyatta Edition to additional service-provider applications. IP Infusion has also rolled out its vCPE/uCPE platform, Open SD-Edge, which enables secure and virtualized managed services (see Figure 2).

FIGURE 2: ***IP Infusion's OcNOS Use Cases***



Source: IP Infusion, 2020

Challenges

Many carriers are receptive to network disaggregation, but adoption has often been slow to materialize into commercial deployments. A range of inhibiting factors are at play that vendors such as IP Infusion are addressing, including cultural inertia, perceived risks in dealing with multiple suppliers (hardware and software), support concerns, and resource and skill gaps of the carriers themselves. Similar factors exist in large enterprises and other non-cloud datacenter operators.

That said, the agility, flexibility, and cost savings that can accrue from network disaggregation represent compelling benefits, and the continual technological advances in Ethernet merchant silicon and disaggregated network software are likely to further reduce inhibitors, making network disaggregation and IP Infusion's DANOS-Vyatta edition and OcNOS solutions increasingly viable in the use cases, application scenarios, and market segments cited in this document.

Conclusion

The second wave of network disaggregation is upon us. First established in the demanding datacenters of the hyperscale cloud giants, network disaggregation is now gaining traction in the broader marketplace, including a wide range of cloud datacenter operators and communications service providers, which are tapping network disaggregation for its agility, flexibility, extensibility, and cost savings across a gamut of environments, including the telco cloud and the edge, the latter of which is poised to play a much larger role in the context of 5G.

The second wave of network disaggregation is upon us—expanding into a broad market of CSPs and MSPs.

Like the hyperscalers that blazed the trail before them, these organizations are leveraging network disaggregation to innovate at the speed of software — with network operating systems that are full featured and capable of addressing a full spectrum of use cases — while taking advantage of the latest and greatest network hardware. With its OcNOS and VirNOS offerings, built on a common code base and rich company heritage in support of industry-standard routing protocols, IP Infusion is well placed to capitalize on the commercial and technological advances of network disaggregation.

About the Analyst

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Brad Casemore is IDC's Research Vice President, Datacenter Networks. He covers networking products and related technologies and platforms deployed in the datacenter, including Ethernet switches and software-defined networking (SDN).

MESSAGE FROM THE SPONSOR

Modular and feature rich – with support for industry-standard Layer 2, Layer 3, and MPLS protocols, as well as for management, security, and QoS features and protocols – OcNOS addresses multiple use cases, including datacenter switching, datacenter interconnect (DCI) and optical metropolitan-area networks, and a range of service-provider applications, including Internet Exchange Points (IXPs), passive optical networks, cell-site routing (4G and 5G edge), and cloud gateways at the service-provider edge.

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