Everywhere Networking

Disaggregation for Cloud-Grade Networking

Introduction

Cloud-Grade Networking builds on carrier-grade reach and reliability and enterprise-grade control and usability, bringing cloud-level agility and operational scale to networks everywhere. Cloud-Grade Networking essentially adds a new set of principles and capabilities to what the industry already knows, making networks less capital-intensive, more automated, and ultimately better suited for innovation, both on and within the network.

In many ways, Cloud-Grade Networking is an acknowledgement that the way networks are currently designed, built, and operated is changing. While these principles might have originated with the major cloud-scale properties, they are now transforming networks of all shapes and sizes, across all industry verticals.

What Is Everywhere Networking?

Simply put, Cloud-Grade Networks must be able to run anywhere—on any software, on any hardware, in any cloud. Juniper calls this requirement Everywhere Networking, which refers specifically to the disaggregation of the technology stack so that applications can run in any cloud, cloud workloads can run on any device, and software is not locked to hardware.

At the core of Everywhere Networking is the concept of disaggregation, which refers to the decomposition of networking technology such that it can be independently developed and distributed. While a single company might develop multiple elements in a disaggregated solution, those elements must be able to exist independently to be considered disaggregated.

Why Disaggregate?

The primary business values of disaggregation include:

- **Altered economics:** By decoupling what have traditionally been tightly coupled systems, companies can theoretically mix and match components to create fit-for-purpose architectures where “purpose” might mean cost-optimized, performance-optimized, or environment-optimized (for integration into existing tools, for example). Decoupling also provides a procurement advantage, as individual components can be priced and negotiated separately.
- **Choice and flexibility:** If components are loosely coupled through standard interfaces, then vertically integrated stacks break down, which allows different suppliers to insert value across key interfaces.

- **Inject intellectual property:** The premise behind disaggregation is that components will operate through well-defined interfaces. These interfaces can also provide a means by which companies can integrate their own intellectual property to provide differentiated and high-value services ranging from virtual network functions to analytics to off-box operational tools (as with cloud providers).

The Disaggregated Stack

How disaggregation is described depends on the granularity of the disaggregated components. For example, the separation of control and forwarding planes was arguably a disaggregation of previous routing architectures; however, it lacks the granularity of the modern definition, which includes a split between hardware and software, and management and orchestration layers. Similarly, it would be possible to disaggregate a switch into its constituent components, but a granular bill of materials for these components is not useful since most cannot be developed or procured separately.

Considering the need for right-sizing the level of granularity, disaggregation includes the layers shown in Figure 1.

Figure 1: Disaggregation layers

These layers map to the following descriptions:

- **Orchestration and management:** The orchestration and management plane maps most cleanly to controllers, policy management systems, and operations support systems/business support systems (OSS/BSS) that are in place today. Of course, the orchestration plane itself can be architecturally broken down into multiple components.
- **Software control plane:** The software control plane essentially maps to the core software that makes up the applications on a router or switch. It can include processes such as routing protocols, as well as the state (both configured and ephemeral) that drives basic device behavior.
- **Software data plane:** The software data plane is the forwarding code that determines how packets are handled. In physical devices, this is the Packet Forwarding Engine (PFE); in virtual devices, this is the packet pipeline code that runs on a general processor.
- **Hardware data plane:** The hardware data plane is the physical hardware (including the general processor or switching ASIC), as well as the device-side code.

Keys to Disaggregation

If the goal is disaggregation, there are implications to how individual layers are architected and delivered. In particular, disaggregation places two specific requirements on the underlying layers:

- **Integratable:** While disaggregated, the stack must have the ability to be integrated. In order for different components to work with each other across layers, there must be interfaces. In the most basic case, those interfaces don't have to be open or standard; they must simply exist. Proprietary interfaces could also work if the disaggregated stack is provided by a single vendor.
- **Interchangeable:** To meet the cost and optimization objectives, the individual components within a layer must be interchangeable. In the absence of interchangeable parts, the supplier dynamics remain unchanged. Interchangeability adds additional constraints to the interfaces between the layers. For different vendor solutions to be usable across different components, the interfaces must be open access or standards-based.

Some of the networking layers are already loosely coupled. For instance, orchestration has been working in heterogeneous environments for years, so the interfaces between management and control plane (i.e., NETCONF, YANG, REST, OpenConfig, OpenFlow, PCE, ALTO, etc.) have already been established.

For other layers, these interfaces are just emerging. P4, for example, could be a useful way of creating an open means of integrating software data planes with any choice of hardware data planes.

Conclusion: The Role of Integration

While the concept of Everywhere Networking is based on disaggregation, ultimately these decoupled components will need to be assembled into usable solutions. In some cases, this can be part of a best-of-breed model, where companies are responsible for procuring and assembling the individual components. In the vast majority of cases, however, users will look to either the vendors or a systems integrator to integrate the solution, and will need to plan their procurement and qualification processes accordingly. Cloud-Grade Networking, built on the Everywhere Networking foundation, offers companies both paths, delivering the flexibility to choose the solution that best serves their business.

About Juniper Networks

Juniper Networks challenges the status quo with products, solutions and services that transform the economics of networking. Our team co-innovates with customers and partners to deliver automated, scalable and secure networks with agility, performance and value. Additional information can be found at Juniper Networks or connect with Juniper on Twitter and Facebook.

JUNIPER NETWORKS

Corporate and Sales Headquarters
Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, CA 94089 USA
Phone: 888.JUNIPER (888.586.4737)
or +1.408.745.2000
Fax: +1.408.745.2100
www.juniper.net

APAC and EMEA Headquarters
Juniper Networks International B.V.
Boeing Avenue 240
1119 PZ Schiphol-Rijk
Amsterdam, The Netherlands
Phone: +31.0.207.125.700
Fax: +31.0.207.125.701

3200056-001-EN June 2017