

# Distributed Services Platform for the Enterprise

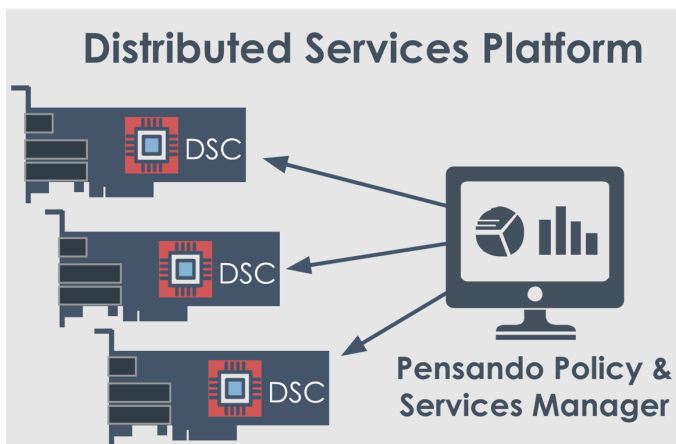
## NETWORKING, SECURITY AND STORAGE SERVICES AT CLOUD SCALE

The massive expansion in the number and diversity of applications, as well as an explosion in the amount of data being generated and transported through enterprise data centers, has pushed the architectural limits of modern IT infrastructure. Traditional “scale-up” approaches—where networking services are deployed as networking and security appliances, or rely on limited, static functionality in traditional top-of-rack switches—are no longer able to keep up, suffering from either performance, agility or scale limitations, as policy tables bloat and the number of active flows reaches into the millions. The limitations and expense of this centralized resource model have led data center architects to limit the core network infrastructure functions to simply transporting IP traffic with as little latency and jitter as possible.

Just as compute and storage systems are adopting a “scale out” approach, the networking and security elements of the data center must also adopt a *Scale-out Services Architecture* and these functions need to find a new home in this model. The ideal place to instantiate these services is the *server edge* (the border between the server and the network), where services such as encryption, tunneling and VPN termination can be delivered in a scalable manner. Since each server edge is tightly associated with a single server, its services only need to be aware of the policies related to that server and its users. This approach naturally scales as more services capabilities are made available when new servers are deployed.

The Pensando **Distributed Services Platform** delivers a powerful suite of software-defined services at the compute edge. Easily installed in standard servers, Pensando's technology provides high-performance scalable networking, security and storage functions, eliminating an assortment of discrete appliances throughout the data center and dramatically simplifying IT operations while providing unmatched telemetry, I/O visibility and troubleshooting insights.

## PENSANDO DISTRIBUTED SERVICES PLATFORM



*Built on an optimized domain-specific distributed processing unit (DPU) with a P4-programmable processor and positioned at the server edge, Pensando Distributed Services Cards (DSCs) put software-defined services adjacent to the workloads, where application-aware network processing and visibility are most effective.*

The Pensando Policy and Services Manager (**PSM**) controls all aspects of the system, including lifecycle management and health monitoring for all of the DSCs. Resources can be automatically provisioned and new software-defined services deployed from a single pane of glass. The PSM handles seamless distribution of network configuration, encryption keys, etc. to active distributed services nodes to consistently manage network performance while also ensuring compliance. Comprehensive telemetry features enable full data center visibility, rapid troubleshooting of problems and enable proactive steps to avoid problems before they occur.

## MULTI-ENVIRONMENT SUPPORT

In virtualized compute environments such as VMware ESXi, the Pensando solution enhances the base virtualization functionality with pervasive visibility, improved performance and security.

In Bare Metal and Container environments, the

Distributed Services Platform also includes firewall and micro-segmentation capabilities with full transparency to the host OS and applications.

## HIGHLIGHTS

### BENEFITS

- Improve security posture through distributed network protection and east-west security
- Maximize server CPU availability by offloading networking and security functions at wire speed
- Eliminate complexity and latency associated with "tromboning" through multiple appliances
- Simplify configuration and network management for large scale deployments
- Achieve deep visibility into network behavior with 'Always-On' telemetry
- Solution works seamlessly with virtualized, bare metal and containerized workloads
- OS version agnostic

### FEATURES

- Integrated security, networking and storage functions in a single device
- Incorporates both data plane and control plane, eliminating host agents
- Isolated domain of security enforcement
- NVMe storage virtualization with NVMe-oF
- Scale: 100s of thousands of Flows, >1M routes
- Centralized management system securely manages configuration and offers full network visibility

## SOFTWARE-DEFINED INFRASTRUCTURE SERVICES (SDIS™)

Server-based network services extend the intelligence and resilience of network devices to the server, greatly simplifying the network operational model. A flattened architecture with infrastructure services such as security, encryption, QoS, load balancing and telemetry deployed at every server has lower latency and is easier to centrally reconfigure and manage than legacy approaches using multi-vendor appliances for services functions.

The network and services layer are decoupled, so network decisions can be made independently of the security architecture – policies remain the same regardless of the underlying transport mechanism.

## UNIFIED MANAGEMENT

Managing security at Cloud-scale requires a new way of thinking about both management and security. Pensando's Policy and Services Manager leverages an intent-based model of delivering network and security policy to DSC nodes for services implementation at the edge. With an intent-based model, IT administrators are assured that all security and network policies are consistent throughout a multi-tenant domain supporting thousands of nodes. Distributed services nodes incorporate gRPC and RESTful management APIs for managing and monitoring of all platform capabilities.

Designed for high-availability and fault-tolerance, the PSM system is distributed and redundant. All communications between it and the distributed services cards are encrypted and authenticated.

The Pensando Distributed Services Platform can integrate smoothly with existing Central Management infrastructure, by either communicating with the PSM via its "northbound" APIs, or by connecting directly to the DSCs via gRPC / REST APIs.

## USE CASES

- Deep network and security visibility & telemetry
- Routing, Segment Routing, MPLS, BGP
- SDN and Virtual Networking with underlay/overlay encapsulations (VXLAN, etc.)
- East-West encryption within the data center
- Storage virtualization including NVMe-oF

## SERVICES PACKAGES PORTFOLIO

Tailored services packages ensure that the specific needs of your data center are met. Additional capabilities and updates can be deployed in the field through the PSM using secure over-the-network (OTN) software updates.

The baseline DSC product delivers comprehensive network I/O functionality with leading edge network offloads, and is combined with an available software subscription package.

**Advanced Observability:** Flow-based packet telemetry, stateful connection tracking, latency metrics, drop statistics, threshold alerting, ERSPAN (bi-directional), NetFlow/IPFIX capture

**Advanced Networking:** Overlay networking (e.g.

VXLAN), Software-Defined Networking (SDN), NAT

troubleshooting and problem reporting.

**Advanced Security:** East-West encryption (IPsec), TLS/DTLS encryption, TLS Proxy, Stateful L4 firewall for bare metal and containerized environments with ALGs and URL filtering, Micro-Segmentation, and packet-based attack protection

**Enhanced Storage** – NVMe virtualization, NVMe-oF with TCP transport, data-at-rest encryption, data compression, deduplication acceleration

**ENHANCED DATA CENTER SECURITY**

Customers are increasingly reporting that upwards of 80% of all data center traffic is East West. The security landscape is evolving, with pervasive threats emerging from inside the data center that render perimeter based solutions ineffective. Enterprises are recognizing the value of distributed host-based services, and Pensando’s solution delivers unique value by isolating network, security and storage services from the server CPU:

<b>Significantly enhanced security</b>	Strict host isolation enforced by HardGap™ technology protects the DSC from compromise in the presence of attacks on the server
<b>No need for host-based agents</b>	No disturbance to existing server configuration or applications
<b>Single point of enforcement</b>	All server traffic traverses the DSC node, where policy and encryption may be consistently applied
<b>Free up host CPU resources</b>	Compute-intensive security functions offloaded to domain-specific hardware

**ALWAYS-ON TELEMETRY AND DEEP VISIBILITY**

The Pensando DSC brings sophisticated Telemetry at the edge, providing real time observability and insights for network and storage, without affecting application performance. It can correlate packets and perform message level inferences. Always-on telemetry enables proactive end to end

Native tools in the Pensando PSM enable infrastructure to automatically report potential issues such as unusual behavior from a compromised workload based on firewall statistics (policy drops, known attack vectors, probing multiple ports), bandwidth usage patterns, connection duration (short-lived vs. long-lived), number of connections established, rate of incoming/outgoing connections, number of inbound vs. outbound connections, data content (incongruent data patterns within applications), and other criteria.

With its hardware-accelerated telemetry engines, the DSC supports proactive testing and probing without compromising latency or impacting server CPU resources.

These powerful visibility tools give IT administrators the ability to:

- Vastly improve Time-To-Repair across the entire infrastructure
- Automate problem detection AND remediation
- Proactively monitor and manage systemic health

**COMPREHENSIVE AUDIT and COMPLIANCE**

Explicit “zero trust” policy enforcement and optional data encryption capability complies with best-practices requirements in regulated industries.

Firewall, Syslog and Audit logs can be exported to industry-standard SIEM software like Splunk, Elastic, and are compatible with 3rd party analysis plugins such as Bro/Zeek. The PSM supports 6-month retention on all audit logs with flexible archiving options.

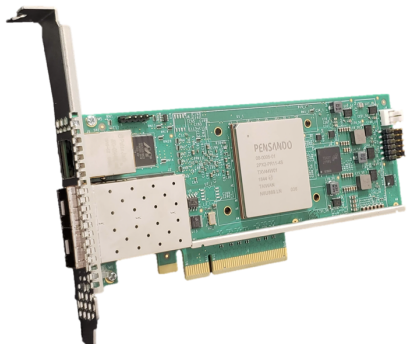
**INDUSTRY-LEADING PLATFORM**

Pensando’s custom-designed Capri™ P4 Programmable Processor powers the DSC, enabling wire-speed performance and enhanced security through isolated policy enforcement. The data plane and control plane are fully software-defined and supported with hardware accelerators. Up to 8 GBytes of on-chip High Bandwidth Memory (HBM) provides low latency and enormous flow-table capacity for the largest of enterprise deployments.

## DEPLOYMENT OPTIONS

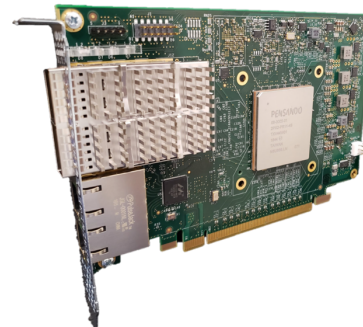
### Pensando Distributed Services Card (DSC)

#### Pensando DSC-25



- Installs in server, delivers Ethernet I/O and software-defined networking, security & storage services
  - DSC-25: 2-port 10/25G Services Card
    - PCIe Gen3 8-lane
    - 2x SFP-28 connectors
    - 1x RJ45 100M/1G management port
  - 50Gb/s networking and services throughput
- Power: 20W typical

#### Pensando DSC-100



- High-performance card; delivers high-speed connectivity to the applications as well as sophisticated networking, security & storage services
  - DSC-100: 2-port 100G Services Card
    - PCIe Gen3/4 16-lane
    - 2x QSFP28 connectors supporting DAC and fiber
    - 2x RJ45 100M/1G management ports
  - 100Gb/s networking and services throughput
- Power: 27-36W typical

### Pensando Policy and Services Manager (PSM)

- Microservices-based, fault-tolerant management infrastructure, supporting large-scale data centers
- Policy and network services configuration centrally managed from the PSM GUI or via REST API
- Collect events, logs and metrics from DSCs
  - Powerful troubleshooting tools

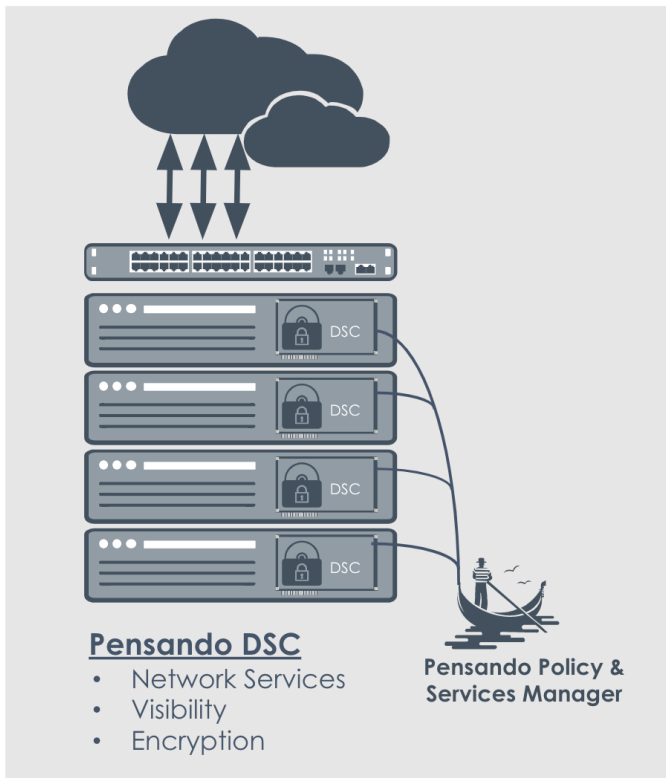


- Intent-based object model
- Integrates with VMware management platforms
- Deployed as a VM or native Kubernetes microservices
- Clustered instances with High Availability (quorum) features
- Federation of multiple PSM domains for large-scale deployments\*

\* Available CY 2021

DEPLOYMENT CONFIGURATION

**Pensando** DSCs are installed into standard servers to provide advanced services as well as high speed network I/O ports. The PSM manages DSC devices in-band or out-of-band.



*Distributed Services Cards deployed in servers*

PERFORMANCE

The DSC delivers 100G wire-speed services to the server, including chained services such as encryption and flow-based network telemetry.

Performance Metric	Pensando DSC-100
L4 Stateful LPM flow forwarding	100Gb/s
Encryption throughput	100Gb/s (AES-GCM-256, @ 256B pkts)
NVMe-oF/TCP IOPS	3M, 100Gb/s @ 4KB transactions
Packet rate	35 Mpps
Avg. Latency	3µs
Avg. Jitter	40ns

SCALE

**The Distributed Services Card** can be software defined into multiple configurations to support immense scale for the largest data centers, one of which is detailed below:

Scale Metric	Pensando DSC-100
Route Tables (LPM)	1M IPv4 and 1M IPv6; 2M total
Simultaneous Flows	100,000 per node
Overlay Mappings	128k Local Mappings
	1M Remote Mappings
	1M SIP to TEP Mappings
NAT Mapping Tables	512k
Policers	4K

ABOUT PENSANDO SYSTEMS

Founded in 2017, Pensando Systems is pioneering distributed computing designed for the New Edge, powering software-defined cloud, compute, networking, storage and security services to transform existing architectures into the secure, ultra-fast environments demanded by next generation applications. The Pensando platform, a first of its kind, was developed in collaboration with the world's largest cloud, enterprise, storage, and telecommunications leaders and is supported by partnerships with Hewlett Packard Enterprise, NetApp, Oracle, IBM, Equinix, and multiple Fortune 500 customers. Pensando is led by Silicon Valley's legendary "MPLS" team – Mario Mazzola, Prem Jain, Luca Cafiero, Soni Jiandani and Randy Pond – who have an unmatched track record of disruptive innovation having already built eight \$Bn/Year businesses across storage, switching, routing, wireless, voice/video/data, and software-defined networking. The company is backed by investors that include Lightspeed Venture Partners, Goldman Sachs and JC2 Ventures.

For more information, please visit [pensando.io](https://pensando.io).