Cloudification of the Edge with Cloud-native Network Functions

Enabling Container Network Functions from the Cloud to the Edge

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Agenda

- Enterprise Edge-Cloud Landscape
- Cloudification of the Edge
- uCPE and MEC Use-Cases and Examples
- uCPE and SD-WAN
- Testing Cloud Technologies Applied to Edge Connectivity
  - Tests performed
  - Results
  - Turnium SD-WAN

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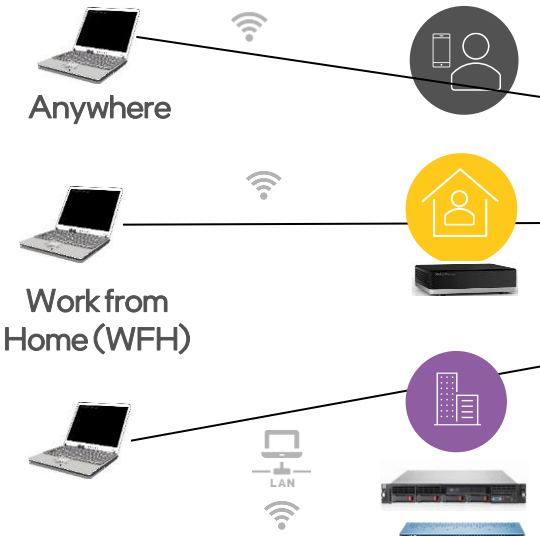
Enterprise Edge-Cloud Landscape

Enterprise Edge/On Prem.



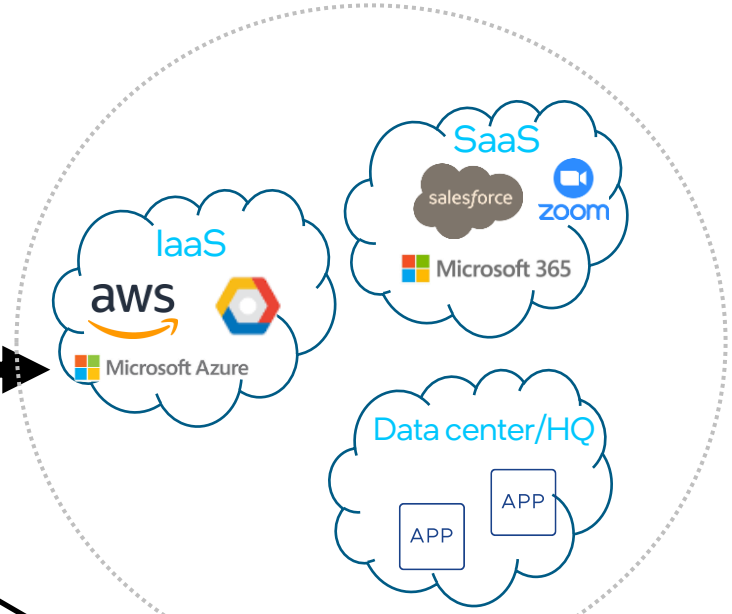
Enterprise Edge:
- Thin/Medium/Thick
- Network Security Appl.
- Routing/Switching

Cloud Edge/POP

DELL
Hewlett Packard Enterprise
SUPERMICRO
Lenovo
Lanner
Quanta Computer
Silicom Ltd. Connectivity Solutions
NEXCOM
CASWELL Complete Your Solution
ADVANTECH
rackspace technology
EQUINIX

DPDK DATA PLANE DEVELOPMENT KIT
Intel QuickAssist Technology
OpenSSL Cryptography and SSL/TLS Toolkit
HYPERSCAN.IO
OpenVINO
Intel® Smart Edge Open

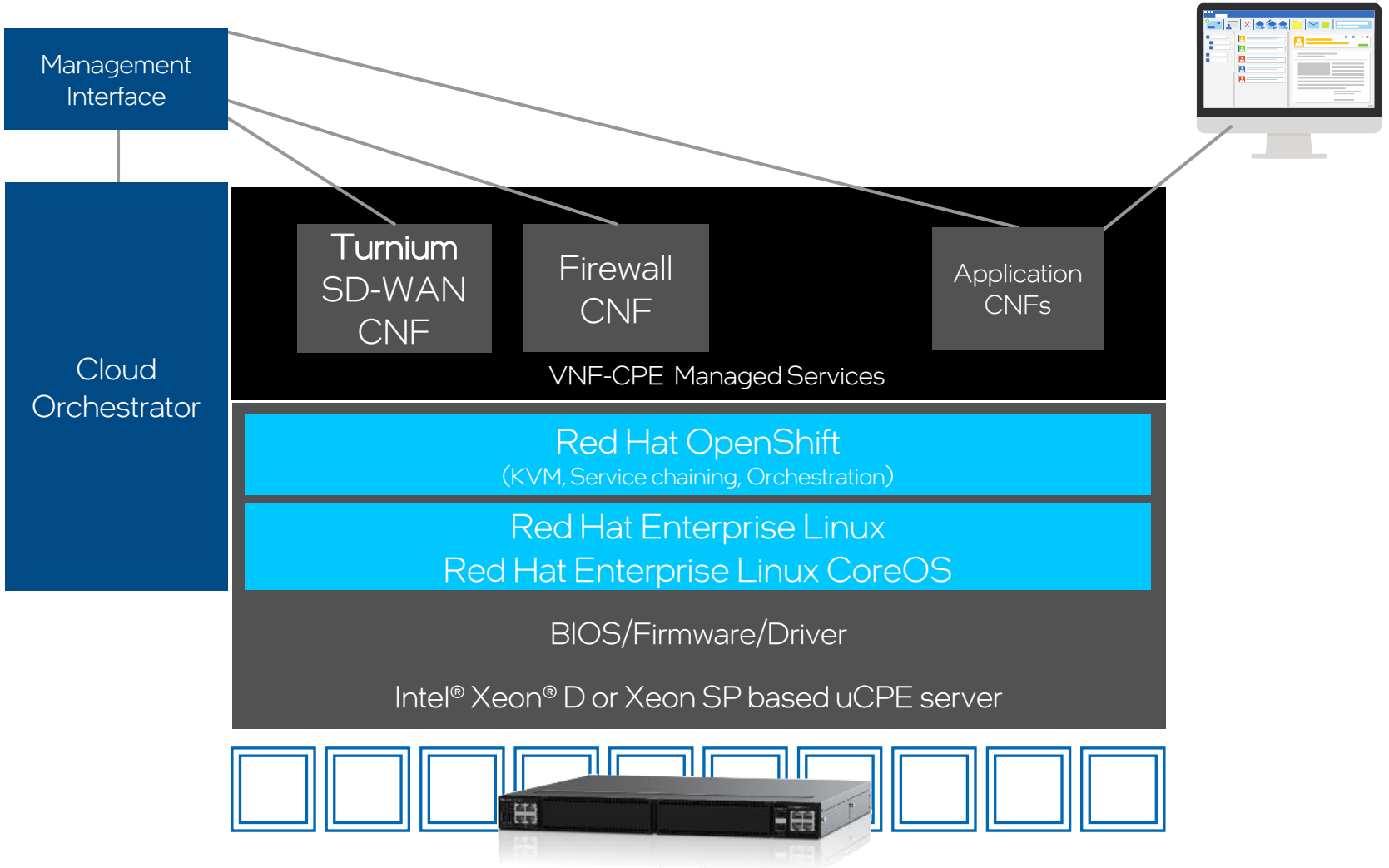
Public Cloud



64% of companies have either adopted SASE or are thinking of adopting SASE within the next year.
Mckinsey Global Post-COVID Workforce Survey, 2021

Cloudification of the Edge:

Cloud Native uCPE Stack with Red Hat OpenShift and Turnium SD-WAN CNF



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intel ATOM

intel XEON D

intel XEON PLATINUM

Cloud Native enables consistent functions and user experiences from the Cloud to the Edge

Capabilities for Edge2Cloud Networking

1 **Scalability**
in Edge/DC/Cloud

Thin/Thick Edge, DC, Cloud
Same infra, same software

2 **Consistency**

Same infra, same software &
workload movement flexibility
across the Edge, DC, Public Cloud

3 **Performance**

Room to Grow
Reliable High Performance

4 **Security/analytics offloads & SDKs**

Intel® QuickAssist Technology
DPDK
Hyperscan
OpenVINO
oneAPI
IPDK
VNNI
AES-NI

5 **Network Specific NICs/Accelerators**

NIC/PAC/FPGA/P4

Workload Optimization for the edge

Optimized R&D Investment with Intel® Software, Modular IP/Silicon

Intel® Xeon® Scalable Processor Family

Performant Architecture as Internet foundation, process, move and store data for Cloud, Network & Security System. Intel® RDT, Intel® DDIO, Intel® SGX, vAES.

Intel® Communications Chipset 89xx
Intel® C620 Series Chipset

Compute

Storage

Intel® Solid State Drive Intel® Optane™ DC Memory

PCI Express* brings extreme data throughput directly to Intel® processors, data security and in-memory security analytics

Intel® Solid-State Drive DC P3700 Series Family

Intel® Ethernet and Intel® FPGA Family

100/50/40/25/10GbE connectivity for Enterprise, Cloud and Communications

Intel 5xx/7xx/8xx Ethernet Adapter Family
Intel® Arria® 10 FPGA
Intel® Stratix® 10 FPGA
BAREFOOT

Network

Software

DPDK
DATA PLANE DEVELOPMENT KIT

f-stack.io

HYPERSCAN.IO

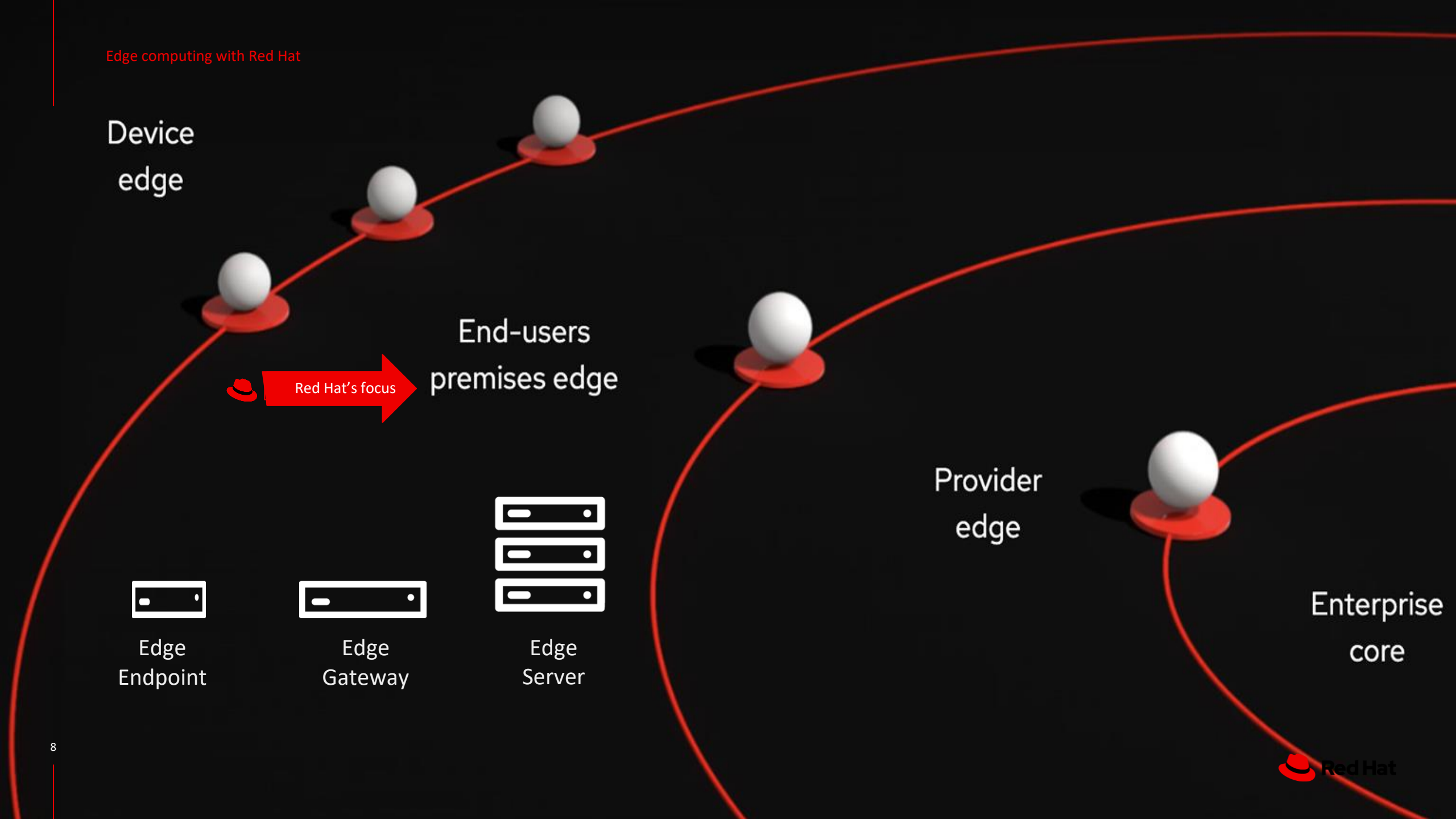
Leading open-source ingredients creates the foundation for NFV / SDN, server virtualization, cloud native optimization

Acceleration

Intel® QuickAssist Technology

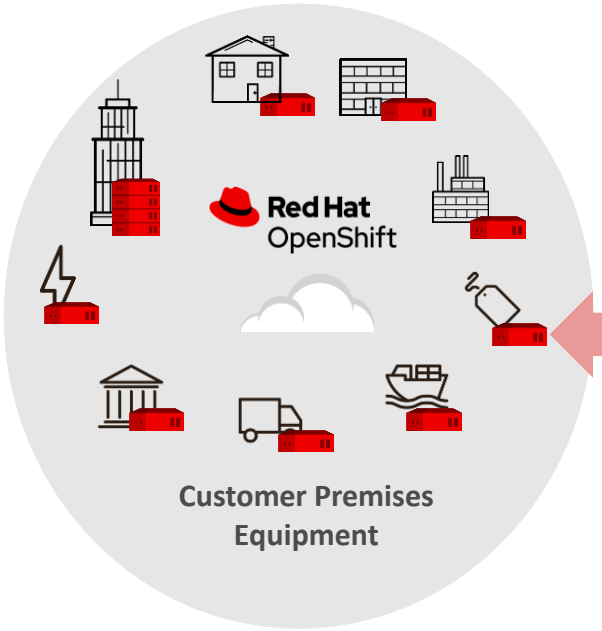
Offloads packet processing technology thereby reserving processor cycles for application and control processing

Intel® QuickAssist Adapter 8970-SCCP


Device
edge
End-users
premises edge
Red Hat's focus
Provider
edge
Enterprise
core
Edge
Endpoint
Edge
Gateway
Edge
Server

uCPE & MEC Use Cases - Red Hat OpenShift brings Hybrid Cloud Infrastructure to the Edge

End-User Edge
Business / Enterprise Customers



Customer Premises Equipment

Example of Services

- xDSL/FTTx/4G/5G Bonding & Failover
- SD-WAN
- Firewall
- Video Analytics
- Assisted Maintenance
- CDN
- Other Industry IoT, AI/ML, AR/VR applications
- And more …

Private & Public Cloud

End User Edge

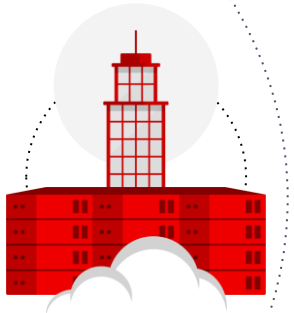
Seamlessly support provisioning and management of ISVs solutions at the Edge for **on-net** and **off-net** use cases

Multi-Cluster

Enables automation of Clusters and Edge Devices / Services for Deployment and Configuration

Drive Usage

Allows for multiple ISVs solutions to be available via a **Marketplace and BSS / Selfcare Digital Channels**



Red Hat Ansible Automation Platform

Red Hat Advanced Cluster Management for Kubernetes

Red Hat OpenShift

Red Hat enables CSPs and Enterprises to extend the Hybrid Cloud Infrastructure to the End-User premises edge, creating new managed services capabilities for Enterprise Grade products and services. Applications can be deployed & lifecycle managed across the Hybrid Cloud environment to optimize the use of resources by running workloads where most efficient.

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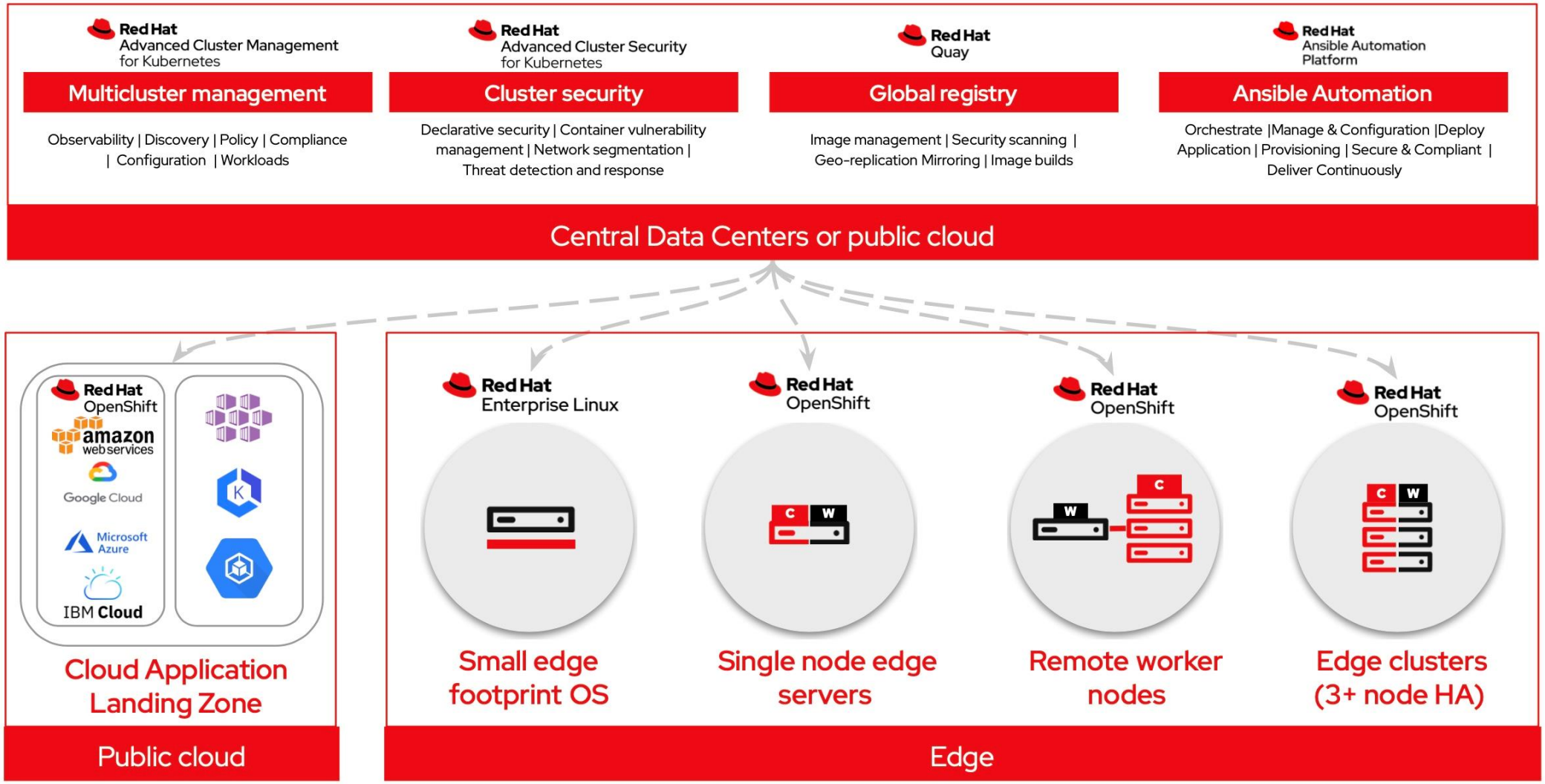
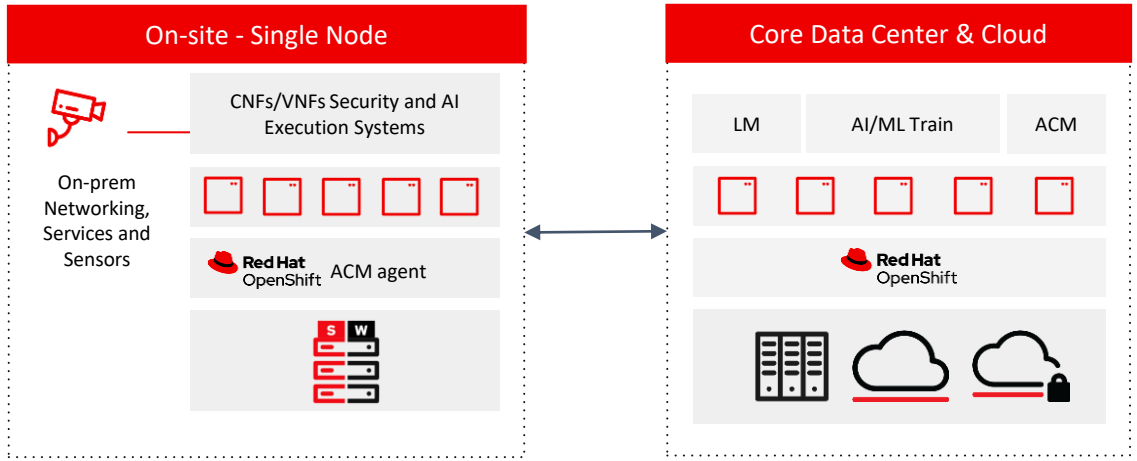
Hybrid multi-cluster and edge strategy



uCPE & MEC Use Case Example
Real-Time Visual Analytics



ACM: Red Hat Advanced Cluster Management for Kubernetes

LM: Products and Services Lifecycle Management

On-Prem - Real-Time AI processing of video streams

- reduced network traffic
- independent from internet connectivity
- video content secure on-site

Core Data center / Cloud - AI/ML training models
reduced HW requirements for on-prem deployment

- centralized training for multiple sites with sufficient compute power

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Why Cloudify the Edge?

Service Provider Benefits

- Enables compute to be pushed closer to its origin or use:
  - Avoiding the bandwidth expense of backhauling large quantities of data
  - Eliminating transfer latency, enabling real-time and near-real-time usage
- Improves cybersecurity
  - By reducing the attack surface associated with transmitting large volumes of raw data
- Containerized SD-WAN
  - Extends a consistent, cloud-native technology environment right to the LAN edge
  - Enables dynamic use of edge resources – push different applications depending on need
  - New revenue streams from new managed services
  - Reduced capex costs for edge devices by deploying white-box options
  - Enables remote deployment onto edge devices, making it easier to bring sites on-net

End-Customer Benefits

- Better end-user experience
  - Applications can be deployed, updated more quickly
  - Customer businesses can optimize use of edge devices, loading multiple applications or dynamically changing them
- Securely process information on-premise
  - Keep information local for processing and transmit only required data to the cloud
- Faster deployments, site activations, higher survivability
  - Automate deploying secure, encrypted network connectivity to bring sites onto the network more quickly
  - Off-the-shelf connectivity reduces timelines and makes onsite turn-up plug-and-play
  - Get required bandwidth, secure communications, and site survivability at branches, remote sites, small sites within required ROI parameters
  - Use simpler, lower-cost edge devices, with simpler (or no) maintenance and licensing costs

Testing Cloud Technologies Applied to Edge Connectivity

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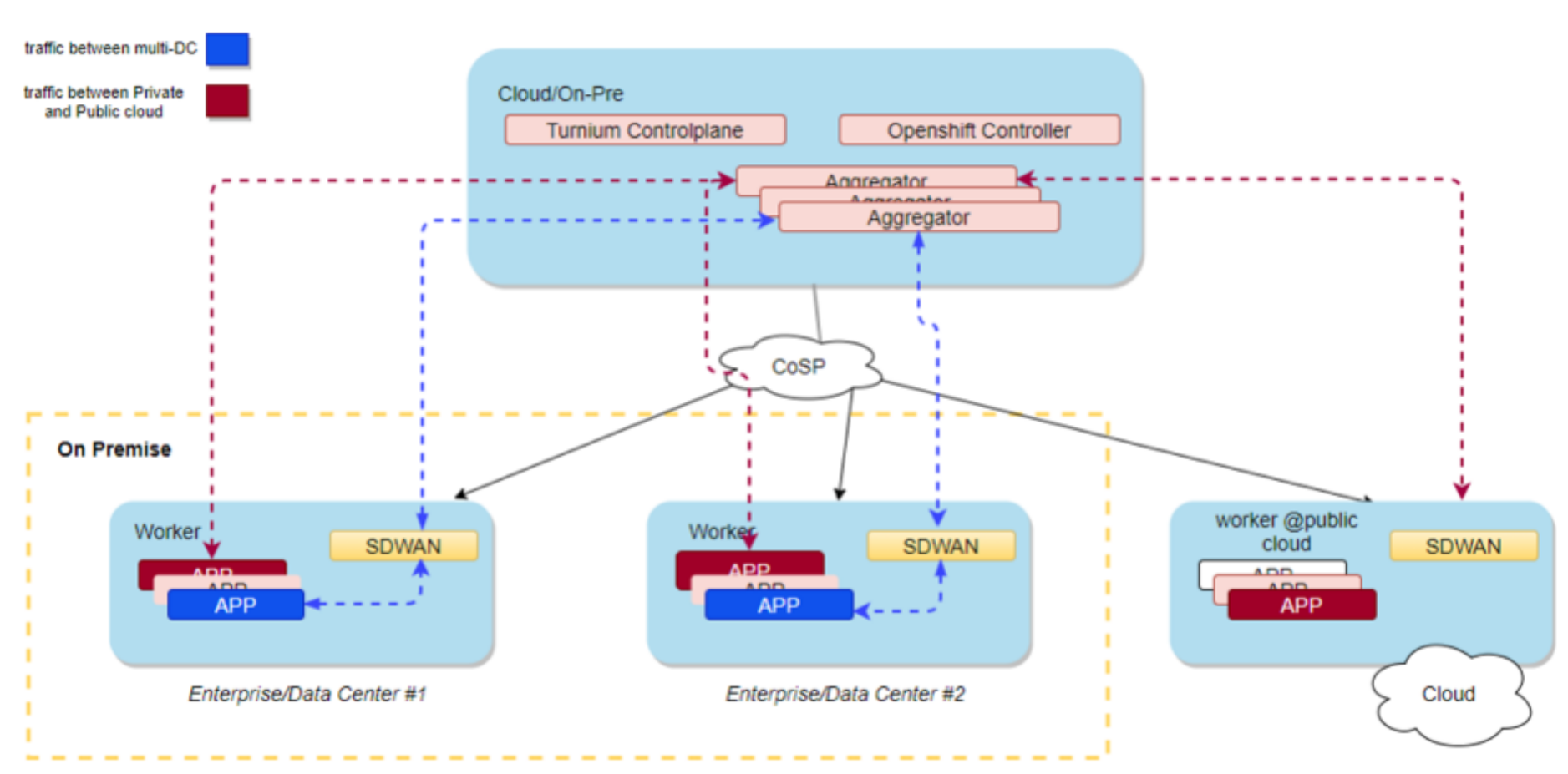
- Tested cloud technologies applied to our SD-WAN to:
  - Verify that the combined solution is comparable to proprietary, on-premise hardware-based options
  - Illustrate other key benefits of containers that make cloud-native deployments much more flexible and optimize resource use
- The tests were designed to determine the relative performance of cloud technologies compared to bare metal
  - Verified the performance of the combined solution in both cloud and on-premise deployments
- Multi-vendor solution involving Intel, Red Hat, and Turnium

Real-world deployment example



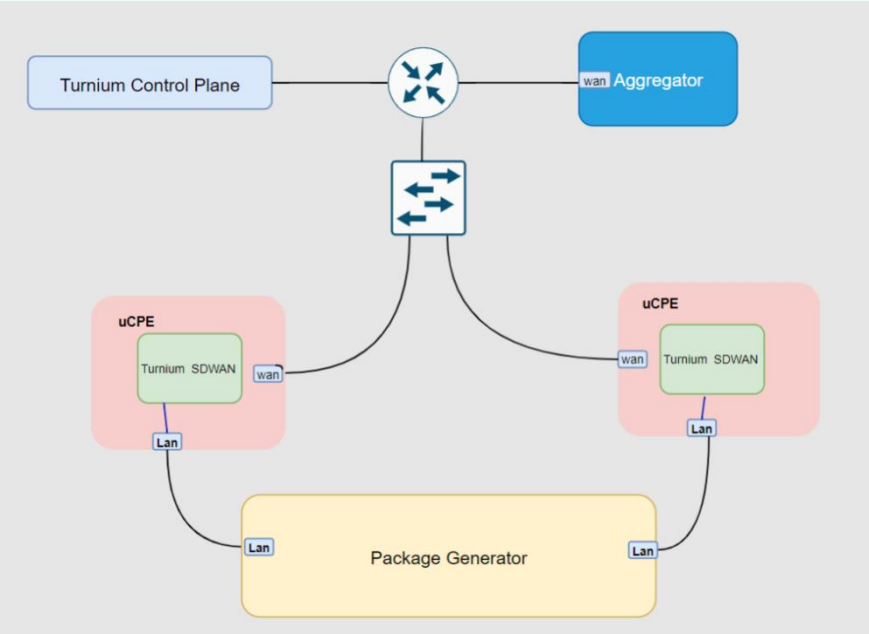
The test stack

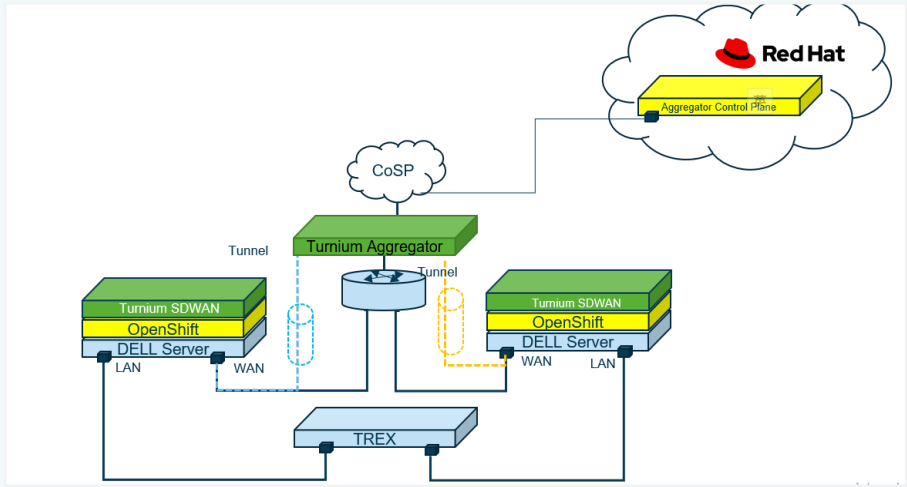
- Server Platform Dell EMC Networking VEP1485
- CPU Intel® Atom® C3958 CPU @ 2.0GHz @16 cores 32 threads
- Memory Total 64G DDR4 (32Gx2)
- NICs 2 x Dell Networking, Transceiver, SFP+, 10GbE
- Item Description
- Server Platform Dell EMC Networking VEP4600
- CPU Intel® Xeon® D-2187NT CPU @ 1.90GHz @16 cores 32 threads
- Memory Total 64G DDR4 (32Gx2)
- NICs 2 x Dell Networking, Transceiver, SFP+, 10GbE

• Operating System: Red Hat® Enterprise Linux® 8.2 (Ootpa) Linux 4.18.0-305.19.1.el8_4.x86_64>
• Container Platform: Red Hat OpenShift Container Platform <4.8>
• SD-WAN Solution (Agent): Turnium <V6.5.55>
• SD-WAN Solution (Aggregator): Turnium <V6.6.33>
• Packet Generator: Trex fueled by DPDK <Trex V2.9.1>

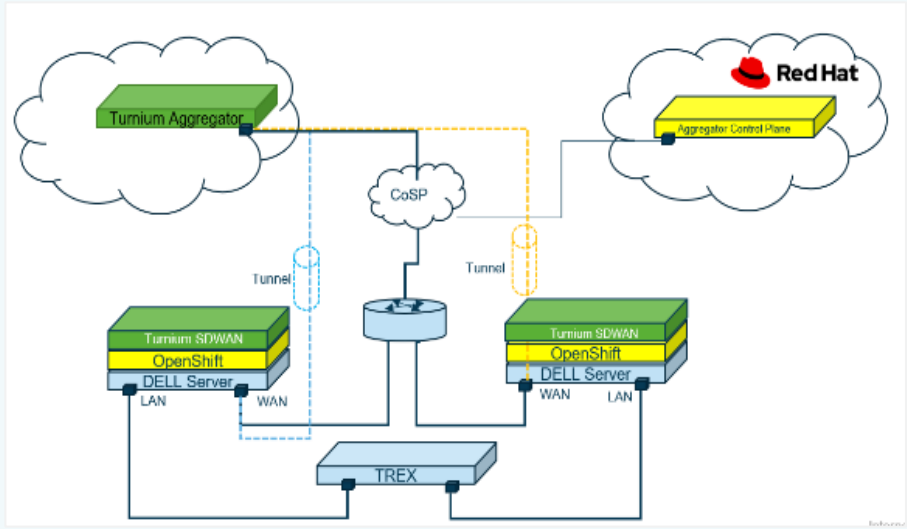
Bare metal deployment
OpenShift deployment

The test topologies





Local/LAN Turnium core node



Cloud-based Turnium core node

Test performance results

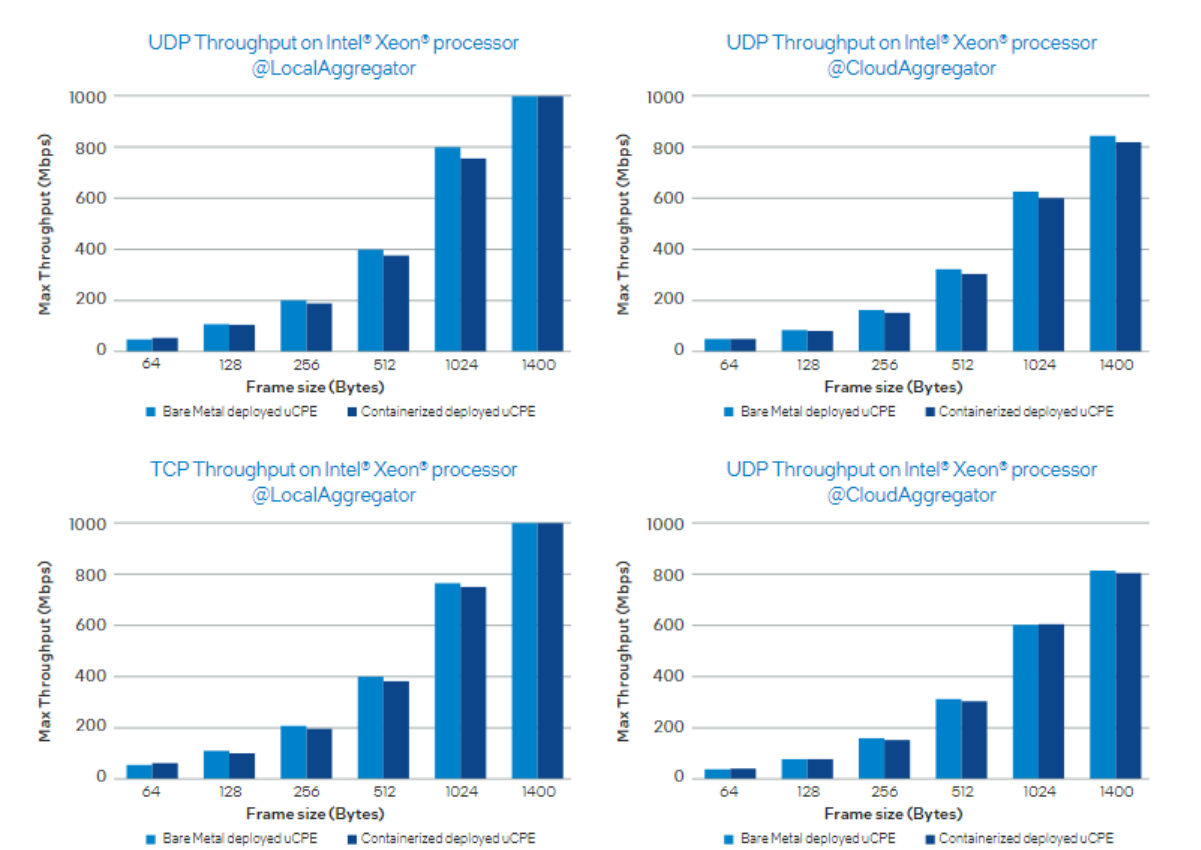
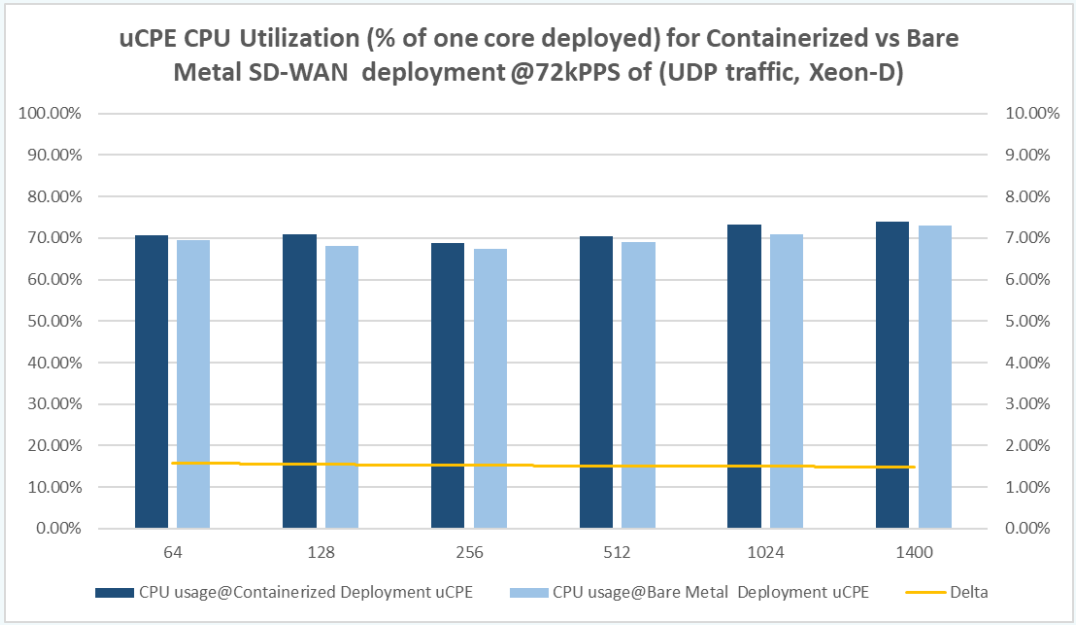


Figure 3. Maximum throughput measured for local and cloud-based aggregator SD-WAN solution.[1]



Testing showed negligible differences in performance yet measurable differences in flexibility and management

Test results demonstrated the viability of cloudifying the edge

- Ease and flexibility of deployment
  - Centralized orchestration, management, automation
- Accelerated time to market
  - Connect new sites more rapidly
  - Deploy new services
- Scalability
  - Grow deployments
  - Deliver on and automate varied and changing needs across the customer base
- Wide ecosystem
  - Availability of Intel-based white-box uCPE reduces deployment costs, maintenance, licensing
- Enables uCPE deployments
  - Run additional workloads alongside Turnium SD-WAN

As networks get more complex, Turnium simplifies

- Turnium simplifies delivering and managing connectivity to the edge
  - Available as Container, Virtual Instance, Bare metal/ISO
  - Software platform run by channel partners as an OEM, white-label solution
- Abstracts complexity, simplifies configuration, separates the control plane from the underlying transport
  - Enables partners to provide IP addressing and extend their network reach, regardless of carrier providing the underlying circuit
  - Delivers visibility to network conditions (jitter, latency, packet loss) critical for the performance of hosted, cloud-based applications
  - Turns network deployment and changes into a clerical task, not needing Professional Services every time
  - Deliver built-in sub-second failover across multiple circuits from multiple carriers (including wireless and LEO)

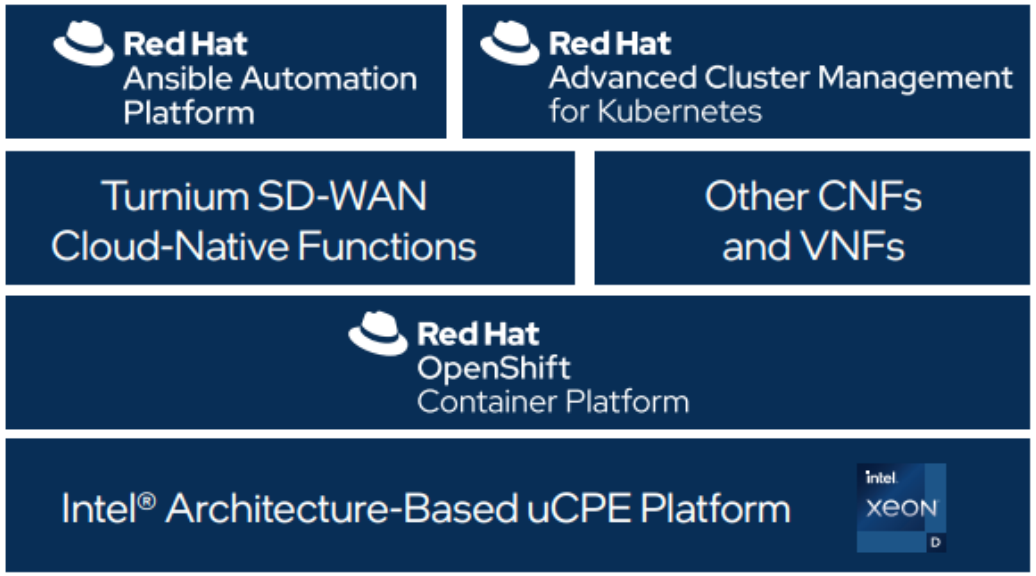
As business gets more competitive, Turnium differentiates

- Our disaggregated approach enables:
  - Service Provider profitability
  - Leverage existing technologies and skills to build differentiated offers
  - Deliver services to SMB and SME markets that give them what they need (great connectivity) at the prices they require
- We enable Service Providers to:
  - Build their own service stacks with their existing technologies and skill sets
  - Implement in container environments for mass customization
  - Develop unique bundles and solutions for their markets and segments
  - Differentiate and avoid price competition resulting from selling the same commoditized brand-name solutions as others in-market

Summary

Cloudification of the Edge

- Deploying edge solutions with containers makes sense
- Tests showed that cloud technologies can deliver comparable performance to existing solutions
- While delivering the benefits of cloud to the edge
  - Simplicity, flexibility, agility
- Containerized SD-WAN realizes same benefits and fits into a cloud-native stack
  - Automated deployment, Any access technology aggregation
  - Software-defined and managed
- Cloudifying the edge opens opportunities for service providers and enterprises to do more at the edge, especially at scale



Questions and Answers?

Thank you

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- Andrea Turno, Business Development Manager, EMEA/TME, Red Hat

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Resources

- https://networkbuilders.intel.com/solutionslibrary/end-to-end-platform-to-extend-the-network-edge-and-deliver-multi-access-edge-compute

- https://turnium.com/reimagine-the-enterprise-edge-cloud-native-technology/