NANOEDGE
Remote Edge Hyperconverged Platform

Overview
Organizations seek to serve applications to users in their remote and branch office locations with a minimum of local infrastructure. However, the distributed and remote nature of this infrastructure makes it hard to manage, difficult to protect and costly to maintain for a variety of reasons:

• **Lack of local IT staff** at remote sites results in increased service-level challenges for remote IT requests such as provisioning and configuration of servers, maintenance updates and troubleshooting.

• **Inconsistent host configurations** at remote sites complicate troubleshooting across multiple remote sites. Further, the remote nature of servers makes it more challenging to perform software upgrades and maintenance.

• **Limited IT budgets** makes it prohibitive to invest in specialized business continuity solutions or redundant hardware for remote sites, and affordable options (like tape backup) are error-prone, labor intensive to maintain, and susceptible to theft or loss.

• **Limited space** at remote sites poses challenges to accommodate new servers. In addition, the existing physical hosts at these sites are not efficiently utilized.

HCI: The Next Infrastructure Revolution
Businesses are embracing hyperconverged infrastructure (HCI) technologies to reduce the time, effort, and cost to deploy applications, and to easily and securely scale up resources as users and applications are added, enabling them to deliver on their business initiatives and explore new business opportunities.

HCI is a scale-out, software-defined infrastructure that converges core data services on flash-accelerated, industry-standard servers, delivering flexible and powerful building blocks under unified management. All key data center functions run in a tightly integrated software layer—delivering services that previously required purpose-built hardware.

**nanoEDGE**
nanoEDGE is a very small form factor SDDC appliance, a converged hardware and software stack that runs the full VMware vSphere®, VMware vSAN™ and VMware NSX® in a low cost, small physical volume appliance, that provides "just enough" compute to run 25 to 50 virtual machines in a remote/EDGE location.

nanoEDGE is 2.5 Servers in a small case, 2 servers provide vSAN and NSX and the third (0.5) server provides the vSAN Witness Appliance, 2.5 servers allow the overall cost to be reduced as the solution can utilize 10GbE back to back connectivity for vSAN and vMotion traffic.

The appliance can provide enough compute to run the full SDDC alongside a number of use cases, including:

• ROBO
• Retail Edge, Far Edge
• SD-WAN
• VDI - VMware Horizon View
In the architecture described in this solution architecture, nanoEDGE is combined together with Supermicro E300-9D to enable reliable and high-performance delivery of applications from the data center to branch offices with a minimum of infrastructure in the remote locations.

### Solution Architecture

The following figure shows the deployment architecture of the nanoEDGE across two sites: headquarter data center and a nanoEDGE branch office.

As of vSAN 6.1, a new type of two-node solution has been supported, typically referred to as Remote Office/Branch Office (ROBO) environments. This solution architecture allows small office implementations to benefit from shared storage, while also minimizing cost. Prior to this, and without this specific architecture, three-node clusters remain the minimum supported configuration for vSAN enabled environments.

The two-node vSAN architecture builds on the concept of Fault Domains, first introduced in vSAN 6.0. Each of the two VMware ESXi™ hosts, located on the customer ROBO premises, represent a single Fault Domain. In vSAN architecture, the objects that make up a virtual machine are typically stored in a redundant mirror across two Fault Domains, assuming the Number of Failures to Tolerate is equal to 1. As a result of this, in a scenario where one of the hosts goes offline, the virtual machines can continue to run, or be restarted, on the alternate node. To achieve this, a Witness is required to act as a tie-breaker, to achieve a quorum, and enable the surviving nodes in the cluster to restart the affected virtual machines.

However, unlike a traditional vSAN enabled cluster, where the witness objects are local to the configured cluster hosts, in a two-node architecture, the witness objects are located externally at a second site or a different host on a dedicated virtual appliance specifically configured to store metadata, and to provide the required quorum services for a host failure. In the case of nanoEDGE, this Witness Appliance is located in the third host for this validation. However, this witness can be hosted on a HQ data center.

- In this deployment, the HQ Data Center hosting all management components like, Active Directory, DNS, VMware vCenter, VMware vRealize Operations manager
- Two node nanoEDGE cluster is connected back to back with 10Gbe for vSAN and vMotion traffic.
- The headquarters data center and nanoEDGE cluster are connected with a L3 Routed Network.
- vSAN witness appliance is hosted on a separate node and connected with a L3 routed network.
Workload VMs are hosted on a 2 node nanoEDGE cluster.

**Network Design**

Determine the number of networks or VLANs that are required depending on the type of traffic that includes the vSphere operational traffic, and traffic that supports the organization’s services and applications. Following is a detailed snapshot of how the virtual network is configured for nanoEDGE, including:

- Management
- vMotion
- vSAN

**Validation of Design:**
nanoEDGE for ROBO use case allows us to understand the number of compute virtual machines the customer could expect to run at their remote/Edge locations. We have completed tests using the 2.5 server configuration, 2 servers are configured as vSAN servers, the third (.5) server hosts the vSAN witness appliance, this allows us to use 10Gb ethernet connection between the 2 vSAN servers and reduce costs on the third servers by removing storage and physical memory.
Test case Provision workload VMs to find a sweet spot VM count of 100 percent workload for two ESXi hosts in the 2 node vSAN cluster.

Test Summary

During this validation, we found 60 VMs running with 100 percent CPU and memory utilization on this two node vSAN cluster. Figures below are captured graphs for CPU, memory, Network and vSAN resource utilization for VM, Host and 2 node Cluster.

Workload VM CPU and Memory Utilization: (CPU, Memory)

nanoEDGE Host Utilization: (CPU, Memory)

nanoEDGE 2-Node Cluster Utilization: (CPU, Memory)

REFERENCE WORKLOAD VM SIZE:

<table>
<thead>
<tr>
<th>Operating System</th>
<th>vCPU</th>
<th>RAM (GB)</th>
<th>DISK (GB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photon OS</td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>

TOOLS USED FOR STRESS TESTING:

HCIBENCH

HCIBench stands for “Hyperconverged Infrastructure Benchmark”. It’s essentially an automation wrapper around the popular and proven open source benchmark tools: Vdbench and Fio that make it easier to automate testing across an HCI cluster. The tool fully automates the end-to-end process of deploying test VMs, coordinating workload runs, aggregating test results, performance analysis and collecting necessary data for troubleshooting purposes.
**OBSERVATION**

As CPU capacity is less on the host with respect to memory, so the number of VM count saturated first where there are 55% memory capacity still left unused on the host. This validation provides an observation based on our lab environment and hardware resources.

Note: If a host has more number of CPU cores, and memory, then there is a chance that you can run more VMs on each host. This exercise will help you providing a guidance to start looking at your environment sizing with respect to your hardware resources.

**Host Network Utilization:**

![Host Network Utilization Graph]

**Metrics about clusters in the perspective of vSAN backend:**

![Metrics about clusters in the perspective of vSAN backend Graph]

**About the Author:**
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**About the Contributor:**
Simon Richardson is a Principal Systems Engineer and a member of the Office of CTO Global Field. Simon’s primary focus is pre-sales with Enterprise Retail accounts in NEMEA, he has led the definition, concept and built the business case for Project nanoEDGE.