# Best Practices: Deploying Turnium SD-WAN in Virtual Environments

All host types required to deploy Turnium SD-WAN can be run in virtual environments. Virtualizing Turnium Management Server, Aggregator Servers, and CPE/Edge devices makes provisioning and management easy. However, virtualization adds complexity for managing performance when multiple guests compete for the resources of a single host.

The following best practices apply to virtualizing Aggregator Servers and CPE/Edge devices. As core components of your SD-WAN data network, these hosts or node types are very sensitive to resource availability. The Turnium Management Server can be configured using practices generally accepted for web and database applications. For example, Management Server requirements focus on memory size and storage performance rather than CPU and network performance.

**The ideas here are applicable to all virtualization environments.**

# Best Practices

Following these recommendations will help maximize the performance and reliability of your SD-WAN environment.

## Host Configuration

**Host Clock:** Host clock must be configured using NTP. A misconfigured host clock will cause guest clocks to shift back and forth between the wrong host time and accurate guest time, creating a variety of serious errors.

**Storage Considerations:** For Local Storage, use mirrored RAID drive configuration for reliability. Network storage traffic should use a different network than customer SD-WAN traffic.

## Turnium Guest Virtual Machine (VM) Configuration and Resource Assignments

The following recommendations apply to both Aggregator and CPE/Edge device guests.

**CPU:** Do not over-allocate vCPU Begin with two (2) vCPU for a small environment of 10 sites/bonds or less. You can easily scale up as the number of customer sites grows. Reserve 1Ghz or more.

**Memory:** Do not over-allocate memory. Begin with 512 MB for a small environment. Reserve all memory. Set the reserved memory equal to the configured memory. This will prevent the host from swapping guest memory to disk, which negatively affects performance.

**Storage:** Aggregator Server and CPE/Edge node software uses very little storage. Virtual disks can be small (8 GB) and thin provisioning is acceptable. Storage IO reservations are not required.

**Network:** NICs should be VMXNET 3 for optimum performance. Consider setting up network resource reservations, depending on your network design and usage patterns.

## Turnium SD-WAN Guest OS Configuration

**Install VMware tools.** Opensource tools are acceptable. These can be installed from standard Debian repositories using:

```
apt-get install open-vm-tools -y
service bonding restart
```

**Guest Clock:** Ensure the guest clock is configured using NTP. This is the default for all Turnium nodes.

**Other Guests on the Same Physical Hardware:** Ensure that other guests using the same physical hardware as Turnium SD-WAN are "rightsized," meaning that the guests have not been assigned more resources than necessary. Failure to assign resources appropriately, especially for virtual CPU, can result in contention and actually reduce the performance of all guests on the host. See the Resources section below for information on rightsizing a VM environment.

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# Key Virtualization Performance Metrics

The following metrics are useful for ensuring good performance. These metrics are reported in vSphere Client. Turnium does not provide recommendations for memory size and network rates as these depend on actual usage patterns.

| Metric | Recommended Value | Comments |
|---|---|---|
| **CPU Usage** | <80% | Higher values indicate that CPU allocation is too low. |
| **CPU Ready** | <2.5% | Higher values indicate a higher proportion of time that the guest has tasks to process but is waiting to be scheduled. |
| **Memory Ballooned** | 0 | Ballooned memory indicates that the guest's memory reservation is too low or the host memory overcommitment ratio is too high. |
| **Memory Swapped** | 0 | Swapped memory indicates that the guest's memory allocation or reservation is too low. The guest's performance may be reduced significantly. |
| **Disk Bus Resets** | 0 | Bus resets can indicate overcommitment or hardware failures that can cause guests to hang or crash. |
| **Disk Commands Aborted** | 0 | Commands aborted can indicate over commitment or hardware failures that can cause guests to hang or crash. |

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