**Time Analysis Report: VM Creation Methods for Deploying 1,200 VMs in Azure**

**Executive Summary**

This report evaluates two methods for deploying 1,200 virtual machines (VMs) in Microsoft Azure: the **Traditional VM Creation Method** and the **Golden Image VM Creation Method**. The traditional method involves provisioning raw VMs and installing software post-creation using System Center Configuration Manager (SCCM) for Windows and Ansible for Linux. The golden image method uses pre-configured VM images with software pre-installed, reducing deployment time. Based on the analysis, the golden image method is significantly faster, taking approximately **10-10.25 hours** compared to **14.5-18.5 hours** for the traditional method, offering a time savings of 4.5 to 8.5 hours.

**Assumptions**

* **VM Distribution**: 600 Windows VMs and 600 Linux VMs (50/50 split).
* **Azure Environment**: Region: eastus, VM size: Standard\_D2s\_v3, Terraform parallelism: 10.
* **Software Packages**:
  + **Windows (SCCM)**:
    - windows\_exporter-0.26.1-amd64.msi (~5-10 MB, monitoring).
    - SentinelInstaller\_windows\_64bit\_v24\_1\_5\_277.msi (~200 MB, security).
    - wincollect-10.1.3-24.x64\_6\_3\_(1).msi (~50-100 MB, log collection).
  + **Linux (Ansible)**:
    - node\_exporter-1.9.0.linux-amd64.tar.gz (~20-30 MB, monitoring).
    - SentinelAgent\_linux\_x86\_64\_v24\_2\_2\_20.deb (~50-100 MB, security).
    - nfs-common (~1-2 MB, NFS support).
    - Additional configurations: Add users, disable firewalls.
* **Golden Image Baseline**: ~4 minutes 57 seconds (~297 seconds) per VM, per provided data.

**Traditional VM Creation Method**

The traditional method consists of three sequential steps:

1. **Deploy Raw VMs in Azure**: Provision VMs from Marketplace images without software.
2. **Windows Software Installation via SCCM**: Install specified software on Windows VMs.
3. **Linux Software Configuration via Ansible**: Configure Linux VMs with specified software and settings.

**Step 1: Deploy Raw VMs in Azure**

* **Description**: VMs are created using Terraform from base Marketplace images (e.g., Windows Server 2022, Ubuntu 22.04 LTS).
* **Time per VM**:
  + Windows: 3-4 minutes.
  + Linux: 2-3 minutes.
* **Parallelism**: Terraform deploys 10 VMs concurrently (120 batches total).
* **Per Batch**: 5 Windows (~3.5 minutes midpoint) + 5 Linux (~2.5 minutes midpoint) = ~3.5 minutes (driven by longest VM time).
* **Total Time**: 120 batches × 3.5 minutes = **420 minutes (~7 hours)**.
  + Plus Terraform overhead (~10-15 minutes): **~7-7.25 hours**.

**Step 2: Windows Software Installation via SCCM**

* **Description**: SCCM deploys three MSI packages to 600 Windows VMs.
* **Packages**:
  + windows\_exporter-0.26.1-amd64.msi: ~30-60 seconds.
  + SentinelInstaller\_windows\_64bit\_v24\_1\_5\_277.msi: ~1-2 minutes.
  + wincollect-10.1.3-24.x64\_6\_3\_(1).msi: ~1-2 minutes.
* **SCCM Process**:
  + Initial distribution to Distribution Points: ~5-10 minutes (one-time).
  + Per VM:
    - Polling/download: ~2-5 minutes.
    - Installation: ~3.75-4.5 minutes (total for all packages).
    - Total per VM: 5.75-9.5 minutes.
* **Parallelism**: SCCM deploys to 10 VMs at a time (60 batches).
* **Total Time**: 60 batches × 7.625 minutes (midpoint) = **457.5 minutes (~7.6 hours)**.
  + Plus initial distribution (~10 minutes): **~7.75 hours**.

**Step 3: Linux Software Configuration via Ansible**

* **Description**: Ansible configures 600 Linux VMs with software and settings.
* **Tasks**:
  + node\_exporter-1.9.0.linux-amd64.tar.gz: ~30-60 seconds.
  + SentinelAgent\_linux\_x86\_64\_v24\_2\_2\_20.deb: ~60-90 seconds.
  + nfs-common: ~30-60 seconds.
  + Add users: ~10-20 seconds.
  + Disable firewall: ~5-10 seconds.
  + Overhead (SSH + playbook): ~30-60 seconds.
* **Total per VM**: ~3.25-4 minutes.
* **Parallelism**: Ansible configures 10 VMs at a time (60 batches).
* **Total Time**: 60 batches × 3.625 minutes (midpoint) = **217.5 minutes (~3.6 hours)**.

**Total Time for Traditional Method**

* **Sequential**: Step 1 (~7.125 hours) + Step 2 (~7.75 hours) + Step 3 (~3.6 hours) = **18.475 hours (~18.5 hours)**.
* **Overlapped**: If SCCM and Ansible start as VMs are created, total time is Step 1 + longest software step (~7.125h + 7.75h = **14.875 hours**), with Ansible finishing within this window.
* **Range**: **~14.5-18.5 hours**.

**Golden Image VM Creation Method**

This method uses pre-configured images with all software pre-installed, deployed directly via Terraform.

**Time Breakdown**

* **Description**: VMs are created from golden images containing all specified software.
* **Time per VM**: ~4 minutes 57 seconds (~297 seconds), per provided data.
  + Includes creation and pre-installed software (no post-creation steps).
* **Parallelism**: Terraform deploys 10 VMs at a time (120 batches).
* **Total Time**: 120 batches × 4.95 minutes = **594 minutes (~9.9 hours)**.
  + Plus Terraform overhead (~10-15 minutes): **~10-10.25 hours**.

**Golden Image Creation Time**

* **Windows**:
  + Base VM creation: ~3-4 minutes.
  + Install 3 MSIs: ~3-5 minutes.
  + Sysprep + capture: ~10-15 minutes.
  + Total: **~16-24 minutes**.
* **Linux**:
  + Base VM creation: ~2-3 minutes.
  + Install packages + configure: ~2-3 minutes.
  + Generalize + capture: ~5-10 minutes.
  + Total: **~9-16 minutes**.
* **Pipeline (e.g., Packer)**: ~15-30 minutes per image with automation overhead.

**Comparison**

| **Method** | **Windows VM Time** | **Linux VM Time** | **Total Time (1,200 VMs)** | **Golden Image Prep** |
| --- | --- | --- | --- | --- |
| **Traditional (SCCM/Ansible)** | 10-13.5 minutes | 5.25-7 minutes | ~14.5-18.5 hours | N/A |
| **Golden Image** | ~4.95 minutes | ~4.95 minutes | ~10-10.25 hours | ~15-30 minutes each |

**Analysis**

* **Traditional Method**:
  + **Advantages**: Flexible, uses standard SCCM and Ansible workflows, no image prep required.
  + **Disadvantages**: Significantly slower (~14.5-18.5 hours) due to post-creation software installation.
  + **Breakdown**: VM creation (~7 hours), Windows SCCM (~7.75 hours), Linux Ansible (~3.6 hours).
* **Golden Image Method**:
  + **Advantages**: Faster (~10-10.25 hours), eliminates software installation steps, consistent deployment.
  + **Disadvantages**: Requires upfront image creation (~15-30 minutes per image).
  + **Breakdown**: Single-step deployment with pre-installed software.

The golden image method saves approximately **4.5-8.5 hours** compared to the traditional method, making it the preferred approach for large-scale deployments like 1,200 VMs.

**Recommendations**

1. **Adopt Golden Image Method**: For 1,200 VMs, the time savings justify the initial image creation effort.
2. **Optimize Traditional Method**:
   * Increase Terraform parallelism (e.g., 20-50) to reduce VM creation time, if Azure API limits allow.
   * Pre-populate SCCM DPs and parallelize Ansible runs to overlap with VM creation.
3. **Automate Image Creation**: Use Packer in your CI/CD pipeline to streamline golden image preparation (~15-30 minutes each).