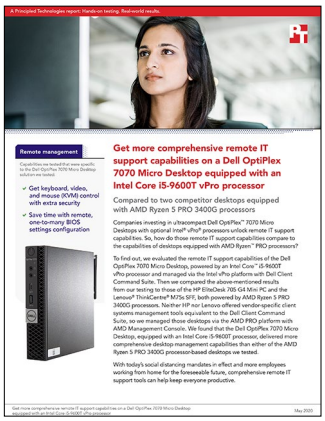

The science behind the report:

Get more comprehensive remote IT support capabilities on a Dell OptiPlex 7070 Micro Desktop equipped with an Intel Core i5-9600T vPro processor

This document describes what we tested, how we tested, and what we found. To learn how these facts translate into real-world benefits, read the report Get more comprehensive remote desktop management capabilities on a Dell OptiPlex 7070 Micro Desktop equipped with an Intel Core i5-9600T vPro processor.

We concluded our hands-on testing on May 14, 2020. During testing, we determined the appropriate hardware and software configurations and applied updates as they became available. The results in this report reflect configurations that we finalized on May 11, 2020 or earlier. Unavoidably, these configurations may not represent the latest versions available when this report appears.

Our results

We tested three solutions:

- **Dell/Intel vPro solution:** We managed two Dell OptiPlex™ 7070 Micro Desktops, powered by Intel® Core™ i5-9600T vPro® processors, via the Intel vPro platform with Dell Client Command Suite.
- **HP/AMD PRO solution:** We managed two HP EliteDesk 705 G4 Mini PCs, powered by AMD Ryzen™ 5 PRO 3400G processors, via the AMD PRO platform with AMD Management Console.
- **Lenovo/AMD PRO solution:** We managed two Lenovo® ThinkCentre® M75s SFFs, powered by AMD Ryzen 5 PRO 3400G processors, via the AMD PRO platform with AMD Management Console.

Neither HP nor Lenovo offered vendor-specific client systems management tools equivalent to the Dell Client Command Suite, so we managed those desktops via the AMD PRO platform with AMD Management Console.

We remotely enabled fastboot, front USB port, Bluetooth, wake on keyboard entry, and virtualization on processor functionality via KVM on the Dell OptiPlex 7070 Micro Desktops and HP EliteBook 705 G4 Mini PCs. The Lenovo ThinkCentre M75s SFFs did not support this action.

Table 1: Changing five BIOS settings on all solutions

Solution	Dell/Intel vPro solution	HP/AMD PRO solution	Lenovo/AMD PRO solution	Dell/Intel solution time savings win against HP/AMD PRO solution	Dell/Intel solution percentage win against HP/AMD PRO solution
For one system Time (sec)	76	123	Not supported		
For two systems Time (sec)	77	248		171	68%

System configuration information

Table 2: Detailed information on the business desktops we tested

System configuration information	Dell OptiPlex 7070 Micro Desktop	HP EliteDesk 705 G4 Desktop Mini PC	Lenovo ThinkCentre M75s SFF
Processor			
Vendor	Intel	AMD	AMD
Name	Core i5	Ryzen 5 PRO	Ryzen 5 PRO
Model number	9600T	3400G	3400G
Core frequency (GHz)	2.3-3.9	3.7-4.2	3.7-4.2
Number of cores	6	4	4
Memory			
Amount (GB)	8	8	8
Type	DDR4	DDR4	DDR4
Speed (MHz)	2,666	2,666	2,666
Graphics			
Vendor	Intel	AMD	AMD
Model number	UHD 630	Radeon™ RX Vega 11	Radeon RX Vega 11
Storage			
Vendor	Toshiba	Western Digital	Samsung®
Model number	KBG40ZNS256G	PC SN720 SDAPNTW-256G-1006	MZVLB256HBHQ-000L7
Amount (GB)	256	256	256
Type	M.2 PCIe NVMe	M.2 PCIe NVMe	M.2 PCIe NVMe
Connectivity/expansion			
Wired internet	Intel I219-LM	Realtek PCIe Gbe	Realtek PCIe Gbe
Wireless internet	Intel Wireless-AC 9560	Intel Wireless-AC 9260	Realtek 8822CE Wireless
Bluetooth	5.0	5.0	5.0
USB	**Front** 1 USB 3.1 Gen 2 Type-C 1 USB 3.1 Gen 1 Type-A (charging) **Rear** 2 USB 3.1 Gen 1 Type-A 2 USB 3.1 Gen 2 Type-A	**Front** 1 USB 3.1 Gen 2 Type-C 1 USB 3.1 Gen 1 Type-A (charging) 1 USB 3.1 Gen 1 Type-A **Rear** 4 USB 3.1 Gen 2 Type-A	**Front** 2 USB 3.1 Gen 1 Type-A 2 USB 3.1 Gen 2 Type-A **Rear** 2 USB 2.0 Type-A 2 USB 3.1 Gen 1 Type-A
Video	2 DisplayPort	2 DisplayPort	2 DisplayPort
Operating system			
Vendor	Microsoft	Microsoft	Microsoft
Name	Windows 10 Pro	Windows 10 Pro	Windows 10 Pro
Build number or version	10.0.18363	10.0.18363	10.0.18363
ACU Config/RealTek Dash Client version	12.1.0.87	4.0.18.0	4.0.17.1

System configuration information	Dell OptiPlex 7070 Micro Desktop	HP EliteDesk 705 G4 Desktop Mini PC	Lenovo ThinkCentre M75s SFF
BIOS			
BIOS name and version	Dell 1.3.1	HP R26 Ver.02.03.02	Lenovo M2CKT29A
AMT version/DASH Firmware version	12.0.49.1556	3.0.0.20190521	3.0.0.2019.0906

How we tested

We used VMware vCenter® to manage the five virtual machines in our test environment. We created two separate virtual switches: one for use with the Dell OptiPlex 7070 Micro Desktops we managed via the Intel vPro platform with Dell Client Command Suite, and one for both the HP EliteDesk 704 G4 Mini PCs and Lenovo ThinkCentre M75s SFFs we managed via the AMD PRO platform with AMD Command Console. We connected each virtual switch to a physical switch. We connected our managed systems to the isolated networks for access to Dynamic Host Configuration Protocol (DHCP) and the management server. The Dell OptiPlex 7070 Micro Desktops we managed via the Intel vPro platform with Dell Client Command Suite used three virtual machines, while the EliteDesk 704 G4 Mini PCs and Lenovo ThinkCentre M75s SFFs we managed via the AMD PRO platform with AMD Command Console used two. Our test environment included the following identically configured virtual machines:

- An Active Directory Server with Active Directory, Domain Name Services, and Dynamic Host Configuration Protocol roles installed on Windows Server 2019 Datacenter Edition
- A management server with Microsoft SCCM (System Center Configuration Manager) 1910 and SQL Server 2016 Enterprise Evaluation Edition installed on Windows Server 2016 Datacenter Edition

Note that Microsoft has re-branded System Center Configuration Manager (SCCM) as Microsoft Endpoint Manager; however, we were using an older version of the software. We used Windows Server 2016 and SCCM v1910 as they were the latest supported version listed on AMD's website. To maintain consistency, we used those versions on the Dell/Intel solution as well. Additionally, we used the third VM in our Dell/Intel solution as a Certificate Authority server installed on Windows Server 2019 Datacenter Edition. We joined all virtual machines to the domain.

We installed the following roles on both Microsoft SCCM environments:

- Component server
- Distribution point
- Service Connection point
- Fallback status point
- Management point
- Site server
- Site database server (Database)
- Site database server (Transaction log)

All systems used their OEM-provided images. Before we started testing, we domain-joined each system and managed them with SCCM (this process included installing the SCCM agent).

Configuration steps for Intel AMT deployment on the Dell/Intel solution

We completed the following procedures for tests involving the two Dell OptiPlex 7070 Micro Desktops only.

Creating Active Directory accounts for Microsoft SCCM

1. On the Domain Controller, open Active Directory Administrative Center.
2. Under the domain name, in the Tasks panel, click New, and select Group from the drop-down menu.
3. In the Create Group window, for Group name, use Kerberos Admins. For Group type, use security. For Group scope, select Global.
4. Add Kerberos Admins as a member of the Domain Admins group.
5. Add the computer account of the SCCM server to the Kerberos Admins security group, and click OK.
6. Create an Organizational Unit for AMT managed systems called AMT Managed Systems.

Installing the Active Directory Certificate Authority

1. On the Certificate Authority Server, log in using the test.local\administrator account.
2. Launch Server Manager.
3. Click Add roles and features.
4. In the Add Roles and Features Wizard, click Next three times.
5. Select Active Directory Certificate Services. On the pop-up, click Add Features. Click Next.
6. Click Next until you reach the confirmation screen.
7. Click Install. When complete, click Close.
8. In Server Manager, click the flag, and select the Post-deployment Configuration task.
9. In the AD CS Configuration Window, click Next.
10. Check the box for Certification Authority, and click Next.
11. For the setup type, select Enterprise, and click Next.

12. Choose Root CA for the CA type, and click Next.
13. Select Create a New Private Key, and click Next.
14. Accept all remaining defaults, and click Next through the remaining screens.
15. When prompted to begin configuration, click Configure.
16. To exit the wizard, click Close. Before continuing to the next steps, restart the server.

Creating certificate templates for Intel AMT management

1. Using the domain\administrator account, sign into ca.test.local.
2. Open the Certification Authority.
3. Right-click the test-CA-CA, and click Properties.
4. On the General tab, click View Certificate.
5. On the Details tab, scroll to and select Thumbprint. Copy the 40-character hash displayed in the details. You will add this information to the AMT BIOS later.
6. To close the Certificate Authority properties, click Ok.

Creating the Intel AMT Provisioning Certificate

1. Expand the Certification Authority, and select Certificate Templates.
2. Right-click Certificate Templates, and select Manage.
3. In the list of available certificate templates, locate Web Server. Right-click the template, and select Duplicate Template.
4. Select Windows 2003.
5. In the General tab, change the template name to `AMT Provisioning`
6. On the General tab, choose the option Publish Certificate in Active Directory.
7. On the Subject Name tab, select Build from this Active Directory Information. Select Common Name, and choose the option UPN.
8. On the Request Handling tab, check the box for Allow private key to be exported.
9. On the Security tab, add Kerberos Admins and domain computers. Add the Enroll permission for the security group. Ensure that the administrator and domain computers have Enroll permissions.
10. On the Extensions tab, select Application Policies, and click Edit.
11. Click Add. Click New. Type `AMT Provisioning` for the name, and `2.16.840.1.113741.1.2.3` as the Object Identifier. Click OK.
12. Ensure AMT Provisioning and Server Authentication are listed, and click OK.
13. Click OK to close the template properties.

Creating the Intel AMT Web Server Certificate

1. Right-click the web server template, and select Duplicate Template.
2. Select Windows 2003AMT.
3. On the General tab, change the template name to AMT Web Server Certificate.
4. On the General tab, choose the option Publish Certificate in Active Directory.
5. On the Subject Name tab, select Build from this Active Directory Information. Select Common Name, and choose the option UPN.
6. On the Security tab, ensure Domain Admins and Enterprise Admins have Enroll permissions.
7. To close the template properties, click OK.

Issuing the AMT Provisioning Certificate templates

1. In Certification Authority, expand test-CA-CA.
2. Right-click the Certificate Templates, and select New Certificate Template to Issue. If it is not available, restart the virtual machine.
3. Select the AMT Provisioning Template.
4. Click OK.
5. Repeat steps 2 through 4 for the AMT Web Server Certificate Template.

Requesting the AMT Provisioning Certificates on the management server

1. Using the domain/administrator account, log into the Configuration Manager server.
2. Start, and click Run. Type `mmc`, and press Enter.
3. In the mmc console, click File, and select Add/Remove Snap-in…
4. Select Certificates, and click Add. Select Computer account.
5. Click Next.
6. Select Local computer, and click Finish.
7. Click OK.
8. Expand Certificates→Personal.
9. In the right panel, click More Actions→All Tasks→Request a new certificate…
10. Click Next.
11. Accept the defaults, and click Next.
12. Select the AMT Provisioning and AMT Web Server Certificate. Click Enroll. If they do not appear in the list, you may need to restart your Configuration Manager server.

Installing Intel Setup and Configuration Software (SCS) 12.1

1. Download IntelSCS_12.1.0.87.zip from https://downloadcenter.intel.com/download/26505/Intel-Setup-and-Configuration-Software-Intel-SCS-.
2. Extract the contents to C:\IntelSCS_12.1.
3. Browse to the extracted SCS_download_package_12.1.0.87.
4. In the RCS folder, run IntelSCSInstaller.exe.
5. At the Welcome screen, click Next.
6. Select I accept the terms of the license agreement, and click Next.
7. Check the Boxes for Remote Configuration Service (RCS), Database Mode, and Console.
8. Enter the credentials of the Domain account that will run the service. We used `test.local\administrator`. Click Next.
9. Select cm.test.local as the location for the SCS database. This information may populate automatically. Select Windows Authentication, and click Next.
10. On the Create Intel SCS Database pop-up, click Create Database.
11. On the confirmation screen, click Close.
12. On the confirmation screen, leave the default Installation Folder, and click Install.
13. Once the installation is complete, click Next.
14. Click Finish.

Creating the Intel AMT configuration profile

1. On the management server, launch the Intel Setup and Configuration Console.
2. Click Profiles.
3. To construct a profile for deployment, click New.
4. For Profile Name, enter a description of the target clients. We used `wired`. Click OK.
5. On the Getting Started Screen, choose Configuration / Reconfiguration.
6. On the Optional Settings screen, choose the options Active Directory Integration, Access Control List (ACL), and Network Configuration - Wired 802.1x and click Next.
7. On the AD Integration screen, browse for the OU created for the AMT managed devices. We used OU=AMT, DC=test, DC=local. Click Next.
8. On the Access Control List screen, click Add.
9. Select Active Directory User/Group. Click Browse.
10. Add Kerberos Admin. Click OK.
11. For Access Type, select Remote.
12. Choose the option for PT Administration. Click OK.
13. Repeat the steps. Click Next.
14. On the System Settings screen, choose the options Web UI, Serial Over LAN, IDE Redirection, and KVM Redirection.
15. Select Use the following password for all systems. Enter the password for use after provisioning is complete. We used `P@ssw0rd`
16. Enter the RFB Password for KVM sessions. We used `P@ssw0rd`
17. Enter the MEBX password. We used `P@ssw0rd`
18. Click KVM Settings…, and uncheck User Consent required before beginning KVM session. Click OK.
19. Check the box for the following options:

    - Synchronize Intel AMT clock with operating system
    - Enable Intel AMT to respond to ping requests
    - Enable Fast Call for Help (within the enterprise network)

20. To edit IP and FQDN settings, click Set.
21. In the Network Settings window, select Use the following as the FQDN, and choose Primary DNS FQDN from the drop-down menu.
22. Choose the option that indicates the device and the OS will have the same FQDN (Shared FQDN).
23. Select Get the IP from the DHCP server.
24. Select Update the DNS directly or via DHCP option 81. Click OK.
25. Click Next.
26. Click Finish.

Adding the configurator to a shared folder

1. Create a shared folder called amtshare.
2. Copy the contents of the file SCS_download_package_12.1.0.87 folder to the shared C:\amtshare folder.

Installing the Intel AMT Provisioning Certificate

1. On the management server, open MMC, and add the certificate's snap-in, which is targeted at the local computer.
2. Navigate to Personal→Certificates.
3. Right-click the AMT Provisioning Certificate, and choose Open.
4. On the Details tab, click Copy to file.
5. On the Welcome screen, click Next.
6. On the Export Private Key screen, choose Yes, export the private key, and choose Next.
7. On the Export File Format screen, check the boxes for Include all certificates in the certification path if possible and Export all extended properties. Click Next.
8. On the Password screen, enter a password to protect the private key. We used `Password1`
9. On the File to Export screen, enter `C:\Share\scs-prov-cert.pfx`, and click Next.
10. On the Completed screen, click Close.
11. From an elevated command prompt, run the following commands:

```
\SCS_download_package_12.1.0.87\utils\RCSutils.exe /Certificate Add c:\Install_Files\scs-prov-cert.pfx
Password1
net stop rcsserver
net start rcsserver
```

12. To verify, run the following command, and make sure the expected certificate is listed:

```
RCSUtils.exe /certificate view /RCSuser NetworkService /log file C:\rcsout.txt
```

Installing The Intel AMT Provisioning Certificates

1. To enter the Intel Management Engine BIOS Extension on each target system, during boot, press Ctrl+P.
2. Enter the Intel ME Password. The default is admin. We changed ours to `P@ssw0rd`
3. Navigate to Intel ME General Settings→Remote Setup and Configuration→TLS PKI, and select Manage Hashes.
4. To add a certificate hash, edit the insert key.
5. Enter a name for the hash.
6. Enter the 40-character thumbprint recorded before.
7. Exit the MEBx menu.

Enabling Intel vPro

1. Using the test/administrator account, log into the target system over RDP.
2. Navigate to the shared folder on the configuration server, and copy the Configurator folder onto the desktop.
3. From the copied file, under the Configurator folder, run the ACUConfigInstaller.
4. In the setup wizard, accept all defaults to complete the installation.
5. In Windows Explorer, navigate to C:\Program Files (x86)\Intel\SCS ACUWizard.
6. Click File, navigate to Open command prompt, and click Open command prompt as Administrator.
7. Run the following command in the elevated command prompt:

```
ACUConfig.exe /Verbose /Output console ConfigViaRCSOnly cm.test.local wired
```

Installing the Dell Client Command SCCM Integration

1. On the management server, download the Dell Client Command | Integration Suite from https://www.dell.com/support/home/us/en/04/drivers/driversdetails?driverid=79TR1.
2. Run the DCIS_29_ZPE.exe file.
3. On the Systems Management window, click Continue.
4. On the extract location screen, click Ok.
5. Navigate to the extracted location, and run the DCIV_Setup_3_1_0.exe file.
6. Accept all defaults during the installation.

Configuring the Dell Client Command Suite SCCM Integration

1. Run Dell Client Command | Intel vPro Out of Band.
2. In the Dell Client Command console, on the settings screen, for Configuration Manager SQL server, Click search, and select the management server's hostname.
3. For the SQL server authentication, select Integrated security.
4. For the Configuration Manager database, click Search. Select the appropriate Configuration Manager database.
5. For client credentials, enter the domain, username, and password for the domain administrator account.
6. For the AMT Administrative User Account, enter the following

   - Domain: [Leave blank]
   - Username: `admin`
   - Password: `P@ssw0rd`
7. Click Ok.

Managing the Dell/Intel solution using Dell Client Command Suite with Intel vPro Out of Band capabilities

Controlling the system power state

1. In the Dell Client Command console, under Operations, click Power Management.
2. On the Power Management screen, select the Power management control to be applied. Click Next.
3. On the Select Clients screen, select the target client(s) to target. For description, type `Test`. Click Next.
4. On the Schedule Task screen, select Run Now, and click Next.
5. On the Summary screen, click Finish.

Connecting to a Dell OptiPlex 7070 Micro Desktop using Intel AMT KVM

1. In the Dell Command console, under Operations, click KVM Connect.
2. Select the target client, and click Connect.

Changing five BIOS settings on the Dell OptiPlex 7070 Micro Desktops

We timed the process of changing BIOS settings for a single Dell OptiPlex 7070 Micro Desktop. Next, we repeated the process and captured timing data for two Dell OptiPlex 7070 Micro Desktops. We completed these changes from the Dell Client Command console.

1. In the Dell Client Command console, under Client Configuration, click BIOS settings.
2. Sort the list in alphabetical order and check the box for each listed option, and select the corresponding value:

   - Fastboot: Enable
   - USB Front Port 1: Enabled
   - Bluetooth: Enabled
   - Enable Wake Support: Enabled
   - Enable Intel Virtualization Technology: Enabled
3. Select Reboot client after applying changes, and click Next.
4. On the Select Clients screen, for a single system, select the option and click the arrow to add it to the selected clients list. For two systems, click the double arrow to add all systems to the Selected clients list. Click Next.
5. On the Schedule Task screen, type `test` for the Task Description. Click Next.
6. On the Summary screen, click Finish.

Configuration steps for AMD PRO deployment on the HP/AMD PRO and Lenovo/AMD PRO solutions

We completed the following procedures only for tests involving the two HP EliteDesk 705 G4 Mini PCs and two Lenovo ThinkCentre M75s SFFs.

Installing the AMD Management Console on the management server

1. Navigate to https://developer.amd.com/tools-for-dmtf-dash/ and download AMPS-4.5.0.1062-AMD.zip.
2. Run the AMC-setup-5.0.0.0779-AMD.exe.
3. On the Installation Wizard, click Install.
4. Agree to the license terms and conditions for the Microsoft Visual C++ 2015-2019 Redistributable.
5. In the AMD Management Console Installation Wizard, click Next.
6. On the License agreement screen, Accept the terms in the license agreement and click Next.
7. On the Readme Information screen, click Next.
8. On the Destination Folder screen, click Next.
9. On the Port Selection screen, leave the default ports as 3274 for the Web Service Port and 3275 for the Alert Reception Port, and click Next.
10. On the Ready to Install the Program screen, click Install. Allow the installation to complete and click Finish.

Configuring the AMD Management Console

1. Open the AMD Management Console.
2. On the Configuration tab, click Settings.
3. Enter the following information to create a connection profile:
   - Auth Identifier: Digest Profile
   - Scheme: Digest
   - Username: Administrator
   - Password: password
4. Leave the default management port options and select HTTP as the Management Transport.
5. Click Validate
6. Click Save.
7. Click Close.
8. Create a shared folder at C:\Share.
9. Navigate to the DASHConfigRT folder under the AMD Management Console folder, which is located by default at C:\Program Files (x86)\AMD Management Console\DASHConfigRT\.
10. Copy the DASHConfigRT folder to the Shared folder created above.

Enabling management on the HP or Lenovo target systems

1. Shut down the target system, and boot into the system setup menu.
2. In the vendor-specific submenu, enable AMT DASH.
3. Save and exit, and allow the system to boot.
4. Once the system has booted back into the operating system menu, copy the DashConfigRT folder from the share on the management server to the local system.
5. To confirm that the system is ready to be managed, at the bottom right of the screen, in the system tray, click the Realtek DASH Client. In the Realtek system tray, verify that the system says DASH "On.".
6. Open an elevated command prompt.
7. Navigate to the copied folder.
8. Run the following command:

```
DASHConfigRT.exe -xf:config.xml
```

9. On the management server, from the AMD Management Console, click Discover.
10. Select IP Address, and enter the IP address of the target system.

Installing the AMD Management Plug-in for SCCM

1. Download the AMPS-4.5.0.1062-AMD.zip file from https://developer.amd.com/tools-for-dmtf-dash/
2. Once the download is complete, extract the files and double-click the AMPS-4.5.0.1062-AMD.exe.
3. In the AMD Management Plugin for SCCM Installation Wizard, click Next.
4. On the License Agreement screen, accept the license agreement and click Next.
5. On the Destination Folder screen, click Next.
6. On the AMD plugin configuration screen, leave the default event port as 8080 and click Next.
7. On the Ready to Install the Program screen, click Install. Once complete, click Finish.

Managing the HP EliteDesk 705 G4 Micro PCs and Lenovo ThinkCentre M75s SFFs using the AMD Management Console

Controlling the system power state

1. In the AMD Management console, select the target system.
2. In the Home bar, click Power.
3. On the Power Management screen, select the power state to apply, and click Apply.

Changing five BIOS Settings on the HP EliteDesk 705 G4 Mini PCs

Note that the Lenovo ThinkCentre M75s SFFs didn't support KVM control.

We timed the process of changing BIOS settings for a single HP EliteDesk 705 G4 Mini PC. Next, we repeated the process and captured timing data for two HP EliteDesk 705 G4 Mini PCs. We completed these changes from the AMD Management Console.

1. In the AMD Management Console, select the HP target system and click Boot to BIOS.
2. In the boot to BIOS menu, click Start.
3. Wait for the KVM window to appear. In the HP computer setup menu, navigate to the Advanced Menu.
4. Under Boot Options, toggle the Fast Boot option, and click the back arrow.
5. Under Port Options, toggle the Front USB Port option, and click the back arrow.
6. Under Built-In Device Options, toggle the M.2 USB / Bluetooth option, and click the back arrow.
7. Under Power Management Options, toggle the Power on from Keyboard Ports option, and click the back arrow.
8. Under System Options, toggle the SVM CPU Virtualization option, and click the back arrow.
9. Navigate to the Main menu, and click Save Changes and Exit.
10. Repeat steps 1-9 for the second HP system. Do not repeat for the single-system test.

Read the report at http://facts.pt/kq1jfx4 ▶

This project was commissioned by Dell Technologies.