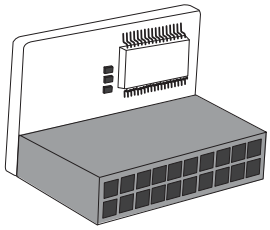
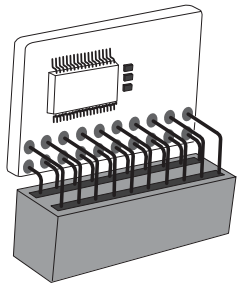
TPM

AOM-TPM-9655V
AOM-TPM-9655V-S
AOM-TPM-9655V-C
AOM-TPM-9655H
AOM-TPM-9655H-S
AOM-TPM-9655H-C





USER'S MANUAL

1.1a

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Preface

About This User's Guide

This user's guide is written for system integrators, IT professionals, and knowledgeable end users who wish to add additional data security levels to their systems to protect highly sensitive applications. It provides detailed information on configuring, provisioning, and using the trusted platform module (TPM).

User's Guide Organization

Chapter 1 provides an overview of the trusted platform module (TPM), including its features and uses.

Chapter 2 provides detailed instructions on installing, provisioning, and using the TPM.

Conventions Used in This User's Guide

Pay special attention to the following symbols for proper TPM configuration.

Note: Additional information given to ensure correct TPM configuration setup.

Contacting Supermicro

Headquarters

Address:	Super Micro Computer, Inc. 980 Rock Ave. San Jose, CA 95131 U.S.A.
Tel:	+1 (408) 503-8000
Fax:	+1 (408) 503-8008
Email:	marketing@supermicro.com (General Information) support@supermicro.com (Technical Support)
Website:	www.supermicro.com

Europe

Address:	Super Micro Computer B.V. Het Sterrenbeeld 28, 5215 ML 's-Hertogenbosch, The Netherlands
Tel:	+31 (0) 73-6400390
Fax:	+31 (0) 73-6416525
Email:	sales@supermicro.nl (General Information) support@supermicro.nl (Technical Support) rma@supermicro.nl (Customer Support)
Website:	www.supermicro.nl

Asia-Pacific

Address:	Super Micro Computer, Inc. 3F, No. 150, Jian 1st Rd. Zhonghe Dist., New Taipei City 235 Taiwan (R.O.C)
Tel:	+886-(2) 8226-3990
Fax:	+886-(2) 8226-3992
Email:	support@supermicro.com.tw
Website:	www.supermicro.com.tw

Table of Contents

Chapter 1

Introduction

1.1 Overview of the Trusted Platform Module (TPM)

The Trusted Platform Module (TPM) is a special add-on module that may be installed onto most Supermicro X9, all Supermicro X10, and some Supermicro AMD motherboards. It holds computer-generated encryption keys used to bind and authenticate input and output data passing through a system.

Types of TPMs

Note: Currently, all TPMs must be provisioned before they can be used. Contact Supermicro technical support to get the Intel® Provisioning Utility.

The **TPM-9655 series** uses TCG (Trusted Computing Group) version 1.2 firmware, which is the most commonly supported.

The following SKUs are available:

- AOM-TPM-9655V, a vertical TPM without provisioning
- AOM-TPM-9655H, a horizontal TPM without provisioning
- AOM-TPM-9655V-S, a vertical server TPM provisioned for TXT
- AOM-TPM-9655H-S, a horizontal server TPM provisioned for TXT
- AOM-TPM-9655V-C, a vertical client TPM provisioned for TXT
- AOM-TPM-9655H-C, a horizontal client TPM provisioned for TXT

Horizontal vs. Vertical: Generally, whether you should use a TPM with a horizontal or vertical form factor depends on the physical space available. Horizontal TPMs are used in 1U chassis. Vertical TPMs are used in 2U or taller chassis heights; they are also designed with a smaller footprint to occupy less space on the motherboard.

Server vs. Client: To use the TXT function, each TPM has been provisioned as a server model or client model. Be sure to use the appropriate TPM for your needs. The server TPM is designed to run on Intel Xeon® E5 and E7 processors. It has a 96-byte index memory. The client TPM is designed to run on Intel Core™ i5, Core i7, and Xeon E3 processors. It has a 48-byte index memory.

1.2 Supermicro TPM Features

1. TCG 1.2 compliance
2. Microcontroller in 0.22/0.09-µm CMOS technology
3. Compliant embedded software
4. EEPROM for TCG firmware enhancements and for user data and keys
5. Hardware accelerator for SHA-1 and SHA-256 hash algorithm
6. True Random Number Generator (TRNG)
7. Tick counter with tamper detection
8. Protection against dictionary attack
9. Infineon's TPM 1.2 is Common Criteria certified at Evaluation Assurance Level (EAL) 4 Moderate
10. General-purpose I/O
11. Intel® Trusted Execution Technology (TXT) support
12. AMD® Secure Virtual Machine Architecture support
13. Full personalization with Endorsement Key (EK) and EK certificate
14. Power-saving sleep mode
15. 3.3V power supply
16. WHQL dual-mode 1.1b + 1.2 TPM Windows Kernel Mode Driver

1.3 Motherboards Supported for TPM

Please refer to the Supermicro website (http://www.supermicro.com/) for a complete and most up-to-date list of the motherboards that can support the TPM. As a general rule, these are most X9 motherboards, all X10 motherboards, and some AMD motherboards. Such motherboards will have a specially designated JTPM1 connector, which will be listed in the respective motherboard's manual.

1.4 Intel® TXT

The Intel TXT is a software tool that may be used in conjunction with the TPM to provide additional security for pre-launch firmware of clusters and clouds, including the BIOS, IPMI, SAS firmware, CMM firmware, and more. It is optional, but the TPM is required for it to be provisioned. It further increases system security by protecting firmware against malicious attacks to vulnerable areas.

It works by matching hypervisor measures with encryption keys upon system launch. If the hypervisor does not match the keys, then the hypervisor will be prevented from starting up.

To use the TXT, you need to enable TXT support after provisioning the TPM.

Note: TXT is only supported on Intel platforms that support TPM use.

How the TXT Works

The Intel TXT, when enabled, follows a step-by-step process to ensure security of pre-launch components.

1. Measures the hypervisor launch upon system startup
2. Checks for a match
3. If matched: The TXT signals "trusted," and the launch is allowed to proceed.
4. If mismatched: The TXT signals "untrusted," and the launch is blocked.

1.5 An Important Note to the User

The graphics shown in this user's guide were based on the latest information available at the time of publishing of this guide. The TPM screens shown on your computer may or may not look exactly like the screen shown in this user's guide.

Chapter 2

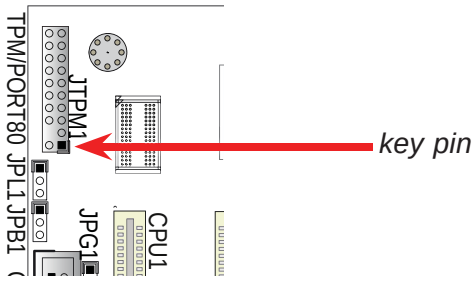
Deploying and Using the TPM

Follow the instructions below to begin using the TPM.

2.1 Installing the TPM Onto the Motherboard

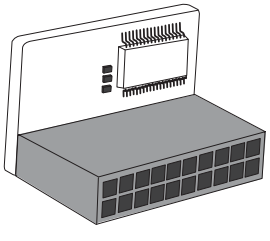
To install the Trusted Platform Module onto your motherboard, follow the steps below.

1. Find the 20-pin male JTPM1 connector on the motherboard. If you need help locating this connector, consult your motherboard manual. If the board does not have this feature, then it does not support the TPM.
2. Using the key pin as a reference, orient and align your TPM with the connector.

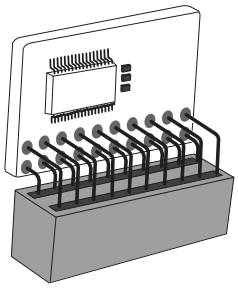


3. Carefully insert the TPM into the connector on the motherboard, taking care not to damage the pins.

Note: The orientation of the TPM to be installed depends on whether it has a horizontal or vertical form factor. The vertical TPM is intended to "stand" perpendicular to the motherboard, while the horizontal TPM lies flat (parallel) on the motherboard. See the below two images for the correct orientation.



Horizontal TPM



Vertical TPM

2.2 Enabling the TPM via the SUM

The SUM (Supermicro Update Manager) is an optional tool that can be used to update and monitor Supermicro servers, as well as configure some firmware settings. Among these features is the ability to enable and provision the TPM. For the sake of efficiency and ease, it is highly recommended that you use the SUM. However, if you do not have the SUM available, you may also use the BIOS and Intel Provision Utility, as described in section 2.3.

Note: If you don't have the SUM, you must request authorization to download it. For more information on the SUM and to request and download it, visit the Supermicro website at *http://www.supermicro.com/products/nfo/SMS_SUM.cfm*.

Note: The below commands are not applicable to motherboards that are not X10, which have the Intel E5-2600 CPUs. If you have an X9- or earlier-generation motherboard, you must use the method described in section 2.3.

1. Set up and activate the SUM if you have not done so. For instructions on how to do this, refer to the SUM user's guide.
2. Enter the following command:

```
sum -i <IP or host name> -u <username> -p <password> -c TpmProvision
--image_url <URL> --reboot [--id <id for URL> --pw <password for URL>]
```

   For example,

```
<SUM_HOME#> ./sum -i 192.168.34.56 -u ADMIN -p ADMIN -c TpmProvision
--image_url 'smb://192.168.35.1/MySharedPoint/MyFolder/TPM.iso' --id
smbid --pw smbpasswd --reboot
```

3. The TPM should now be ready for use.

Note: The TpmProvision command of SUM does not support TPM 2.0 on the Grantley platform.

2.3 Enabling the TPM via the BIOS and Intel® Provision Utility

Note: The steps described in the entirety of this section are for those who do not have the SUM, have motherboards incompatible with the SUM, or have experienced issues enabling the TPM with the SUM. If you have already enabled the TPM using the SUM as described in section 2.2, you do not need to complete the steps below.

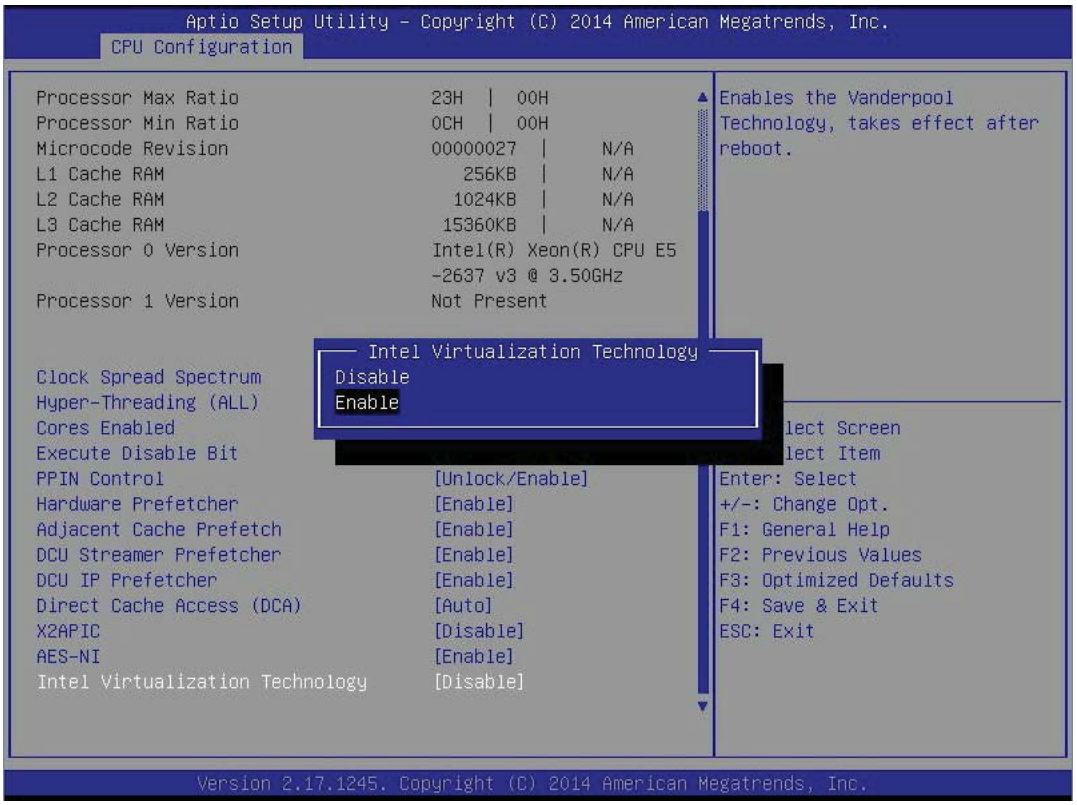
Note: As described in subsections C and D, you will need the Intel Provision Utility to successfully provision the TPM for use. Please contact Supermicro to download this utility.

There are two components to the process of enabling the TPM. After you have installed the TPM onto the motherboard, you must first "verify" the TPM for the

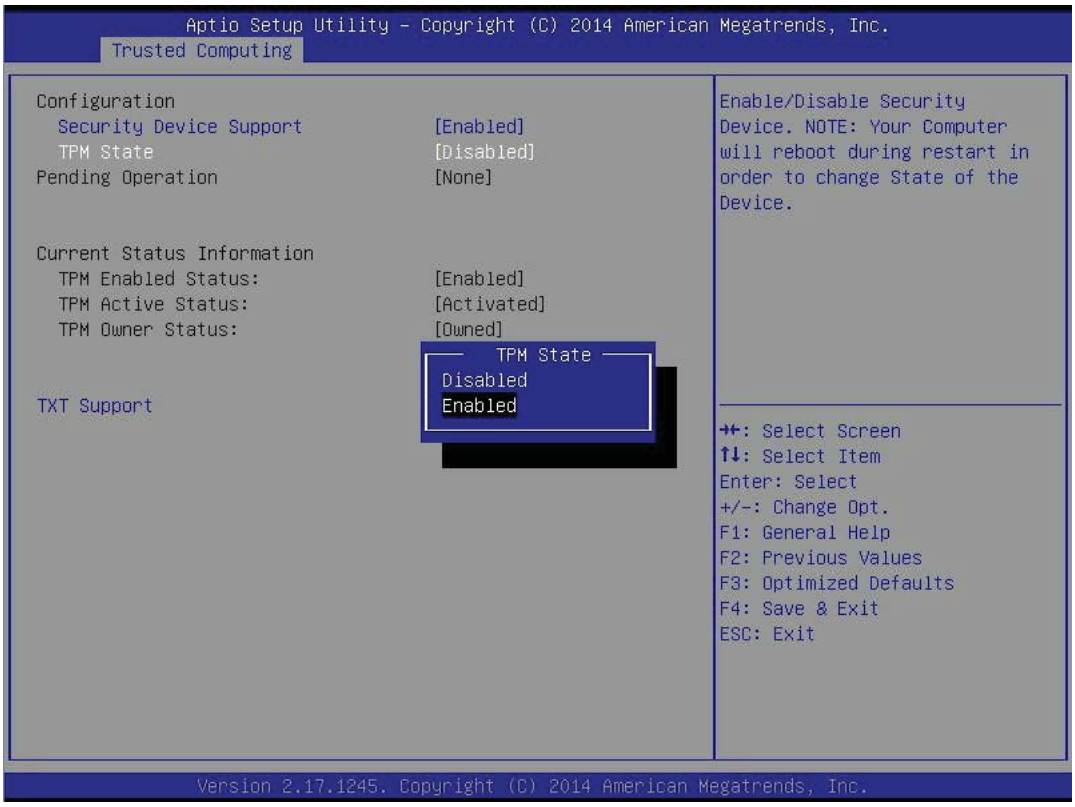
motherboard; this is done through the BIOS. (Also in the BIOS, you should enable TXT support.) After that, you then "lock" the TPM in the firmware. This is done through the provision utility provided by Intel.

A. Enabling the TPM in the BIOS

1. Enter the BIOS setup screen. You may do this either from the IPMI remote console or from the server directly using KVM. Reboot the system, and press the <Del> key as the system boots until you reach the BIOS screen.
2. You will be presented with the BIOS Setup main screen. Using your arrow keys, navigate to the *Advanced* tab. From there, navigate down and select the "CPU Configuration" option, as shown below. Press <Enter>.
3. You will be taken to the CPU Configuration page. Using your arrow keys, navigate down to the "Intel Virtualization Technology" option, and press <Enter>. If this item is not already enabled, select "Enable" and press <Enter>.



4. Once you have enabled virtualization support, press your <Esc> key until you are back to the *Advanced* tab. Navigate down to the "Trusted Computing" option and press <Enter>.
5. The Trusted Computing window will appear. Select "TPM State," and press <Enter>.
6. From the window that pops up, select "Enabled," as shown on the next page, and press <Enter>.

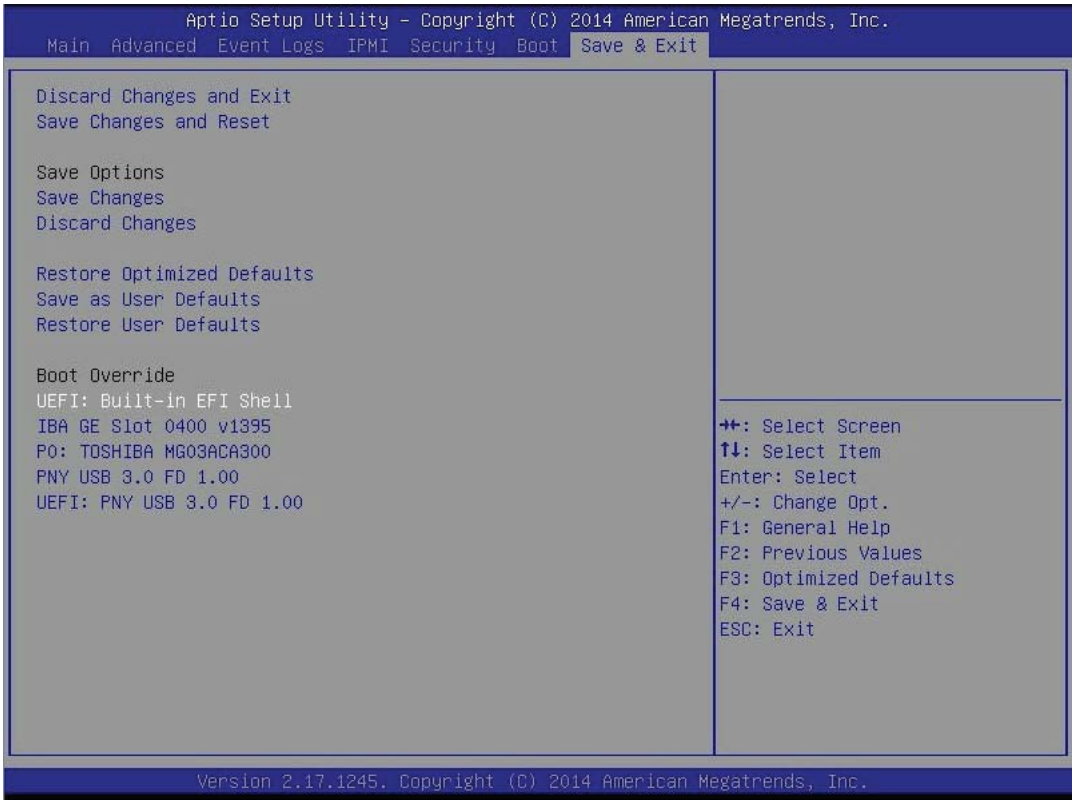


7. You must save your changes and reset for the changes to take effect. Scroll to the *Save & Exit* tab and select "Save Changes and Reset." The TPM is now enabled.

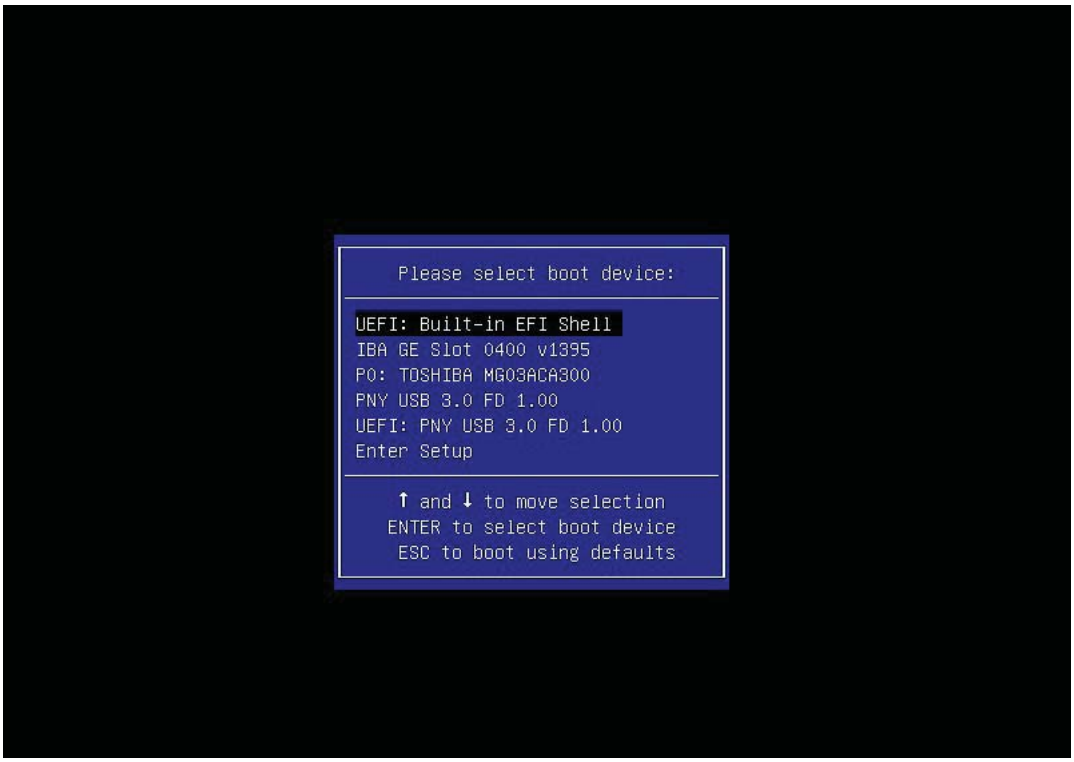
B. Provisioning via the Intel Provision Utility (Server)

After you enable the TPM in the BIOS, you must provision it. Follow the steps below to do so on a server (-S model) TPM. For provisioning on the client side, please refer to subsection D.

1. Save a copy of the utility to a USB flash drive, and plug the drive into your sytem. To download the utility, contact Supermicro support.
2. Boot into the UEFI shell. There are two ways you can do this, described below:
   - *Option 1:* From the BIOS, scroll to the *Save & Exit* tab. Select the option "UEFI: Built-in EFI Shell" under *Boot Override*, as shown in the screenshot on the next page. Press <Enter>. If a window pops up that prompts, "Save configuration and reset?" select "Yes" and press <Enter>.



- *Option 2:* Reboot the system. As the system boots up, press the <F11> key. The following list will appear. Using your arrow keys, select "UEFI: Built-in EFI Shell." Press <Enter>.



3. You are now in the EFI shell. If a line prompts you to press <Esc> to skip *startup.nsh*, do so.

4. *(Optional)* Type `map` to find out your USB ID. A list of devices connected to the motherboard will appear. Your USB flash drive should, by default, be fs0.

```
Press ESC in 1 seconds to skip startup.nsh, any other key to continue.
Shell> map
Device mapping table
  fs0  :Removable HardDisk - Alias hd31a0c0b blk0
        PciRoot(0x0)/Pci(0x1A,0x0)/USB(0x0,0x0)/USB(0x2,0x0)/HD(1,MBR,0x0051F21C,0x3F,0x3B9A7C1)
  blk0 :Removable HardDisk - Alias hd31a0c0b fs0
        PciRoot(0x0)/Pci(0x1A,0x0)/USB(0x0,0x0)/USB(0x2,0x0)/HD(1,MBR,0x0051F21C,0x3F,0x3B9A7C1)
  blk1 :HardDisk - Alias (null)
        PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x0,0x0)/HD(1,MBR,0x1CA91D53,0x800,0x32000)
  blk2 :HardDisk - Alias (null)
        PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x0,0x0)/HD(2,MBR,0x1CA91D53,0x32800,0xFFFCD800)
  blk3 :BlockDevice - Alias (null)
        PciRoot(0x0)/Pci(0x1F,0x2)/Sata(0x0,0x0)
  blk4 :Removable BlockDevice - Alias (null)
        PciRoot(0x0)/Pci(0x1A,0x0)/USB(0x0,0x0)/USB(0x2,0x0)
  hd31a0c0b :Removable HardDisk - Alias fs0 blk0
            PciRoot(0x0)/Pci(0x1A,0x0)/USB(0x0,0x0)/USB(0x2,0x0)/HD(1,MBR,0x0051F21C,0x3F,0x3B9A7C1
)

Shell> _
```

5. Type the following command to enter the flash drive directory:

   `fs0:`

```
Shell> fs0:

fs0:\> _
```

6. Type `cd serverTPMTool`

```
fs0:\> cd serverTPMTool

fs0:\ServerTPMTool> _
```

7. Type `cd Executable`

```
fs0:\ServerTPMTool> cd Executable

fs0:\ServerTPMTool\Executable> _
```

8. Type `DefaultTPMProvision-Locked.nsh`

```
fs0:\ServerTPMTool\Executable> DefaultTPMProvision-Locked.nsh_
```

9. To check that the TPM has been successfully locked, type

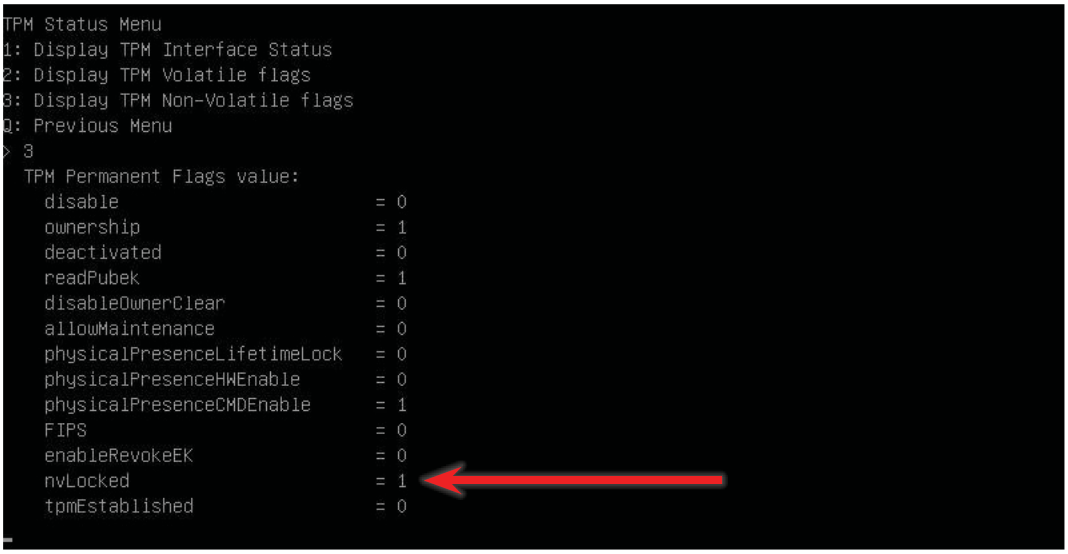
   `ServerTPMTool.efi`

```
fs0:\ServerTPMTool\Executable> ServerTPMTool.efi

Intel(R) TPM Tool x64 DEBUG. Major version:[1] Minor version:[.0] BUILD DATE:[Apr  9 2013].
1: Display TPM Status (Version, V-flags, P-flags, etc)
2: NV RAM Functions
3: Lock the TPM
4: Take Ownership
5: Clear Ownership
6: PCR Functions
7: TIS Functions
8: TPM Start Up
9: TPM Continue Self Test
Q: Quit
> 1_
```

10. From the menu that appears, press <1> ("Display TPM Status"), as shown on the previous page, and press <Enter>.
11. From the TPM Status Menu that appears, press <3>, and press <Enter>.

12. You should receive an output log. The "nvLocked" item, indicated by the arrow below, should be set to 1. This shows that the TPM has been successfully locked.



13. If you come across any error messages along the way, or if the "nvLocked" item is still set to 0 despite your following the instructions above, try the following troubleshooting tips:

- Make sure that the CPU you are using is compatible. It should be an Intel® Xeon® E5-2600 v2 or later model.

Note: AOM-TPM-9655V-S and AOM-TPM-9655H-S are compatible with Xeon E5/E7 processors. AOM-TPM-9655V-C and AOM-TPM-9655H-C are compatible with Intel Core i5/i7 and Xeon E3 processors.

- If the problem persists, contact Supermicro's technical support.

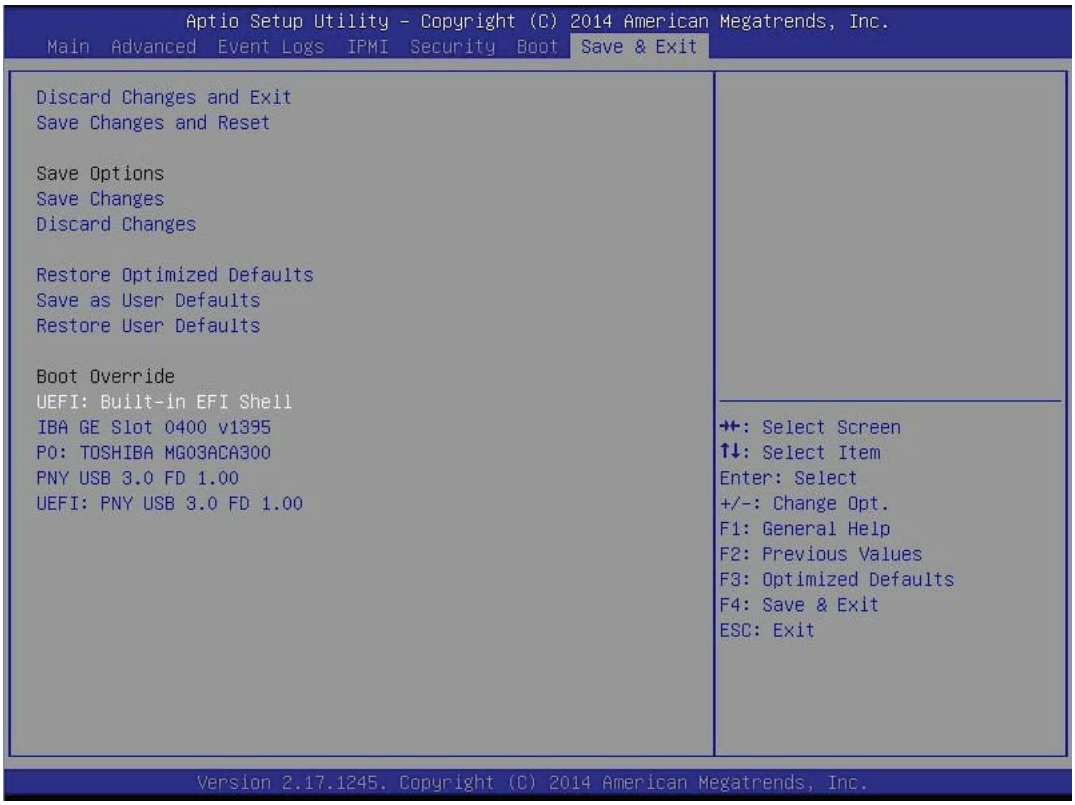
Note: To exit the UEFI Shell, press <Q> and <Enter> until you reach the `fs0:` command line. Then either press <Ctrl><Alt><Del> to reboot the system or type `exit`.

- If you entered the UEFI Shell from the BIOS, typing "exit" will send you back to the BIOS menu.
- If you entered the UEFI Shell from the F11 Boot Menu, typing "exit" will reboot the system.

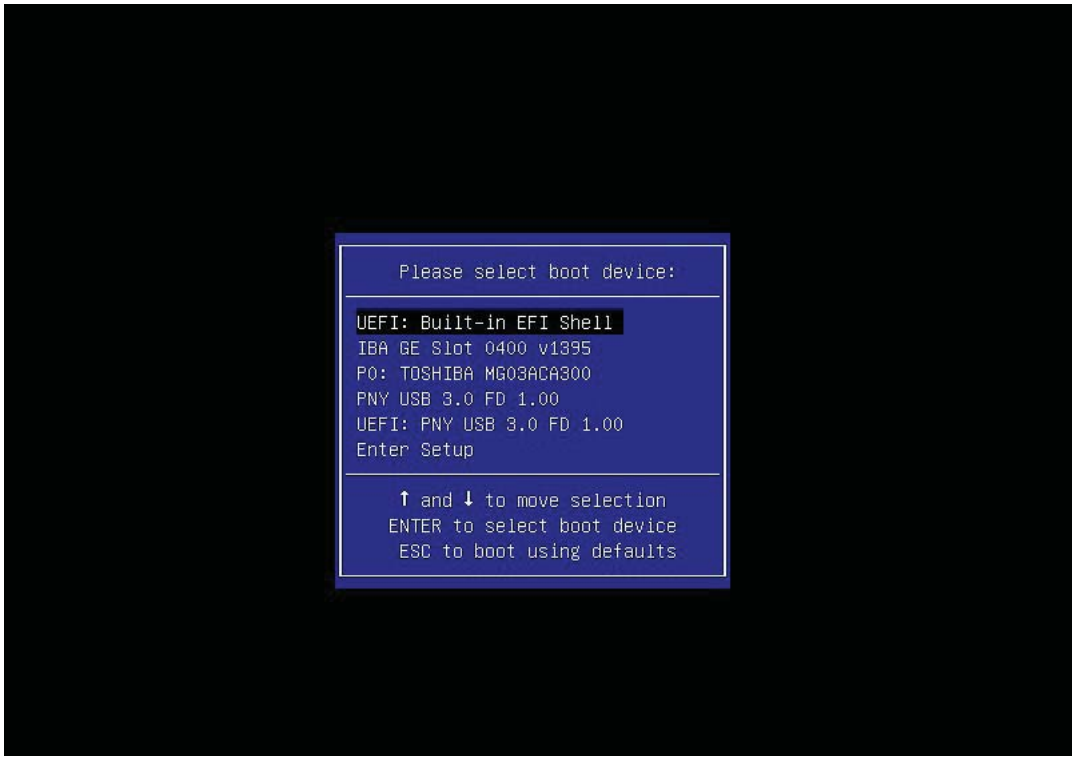
C. Provisioning via the Intel Provision Utility (Client)

After you enable the TPM in the BIOS, you must provision it. Follow the steps below to do so on a client (-C model) TPM.

1. Save a copy of the utility to a USB flash drive, and plug the drive into your sytem. To download the utility, contact Supermicro support.
2. Boot into the UEFI shell. There are two ways you can do this, described below:
   - *Option 1:* From the BIOS, scroll to the *Save & Exit* tab. Select the option "UEFI: Built-in EFI Shell" under *Boot Override*, as shown in the screenshot below. Press <Enter>. If a window pops up that prompts, "Save configuration and reset?" select "Yes" and press <Enter>.



   - *Option 2:* Reboot the system. As the system boots up, press the <F11> key. The following list will appear. Using your arrow keys, select "UEFI: Built-in EFI Shell." Press <Enter>.

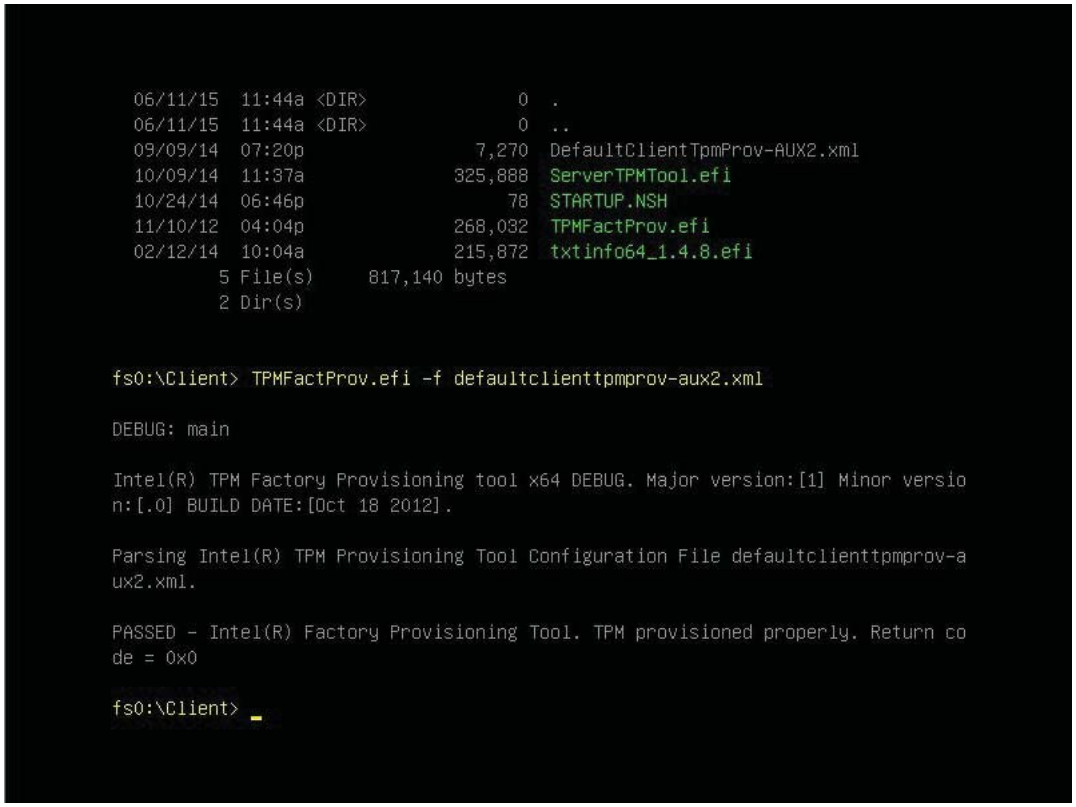


3. You are now in the EFI shell. If a line prompts you to press <Esc> to skip *startup.nsh*, do so.

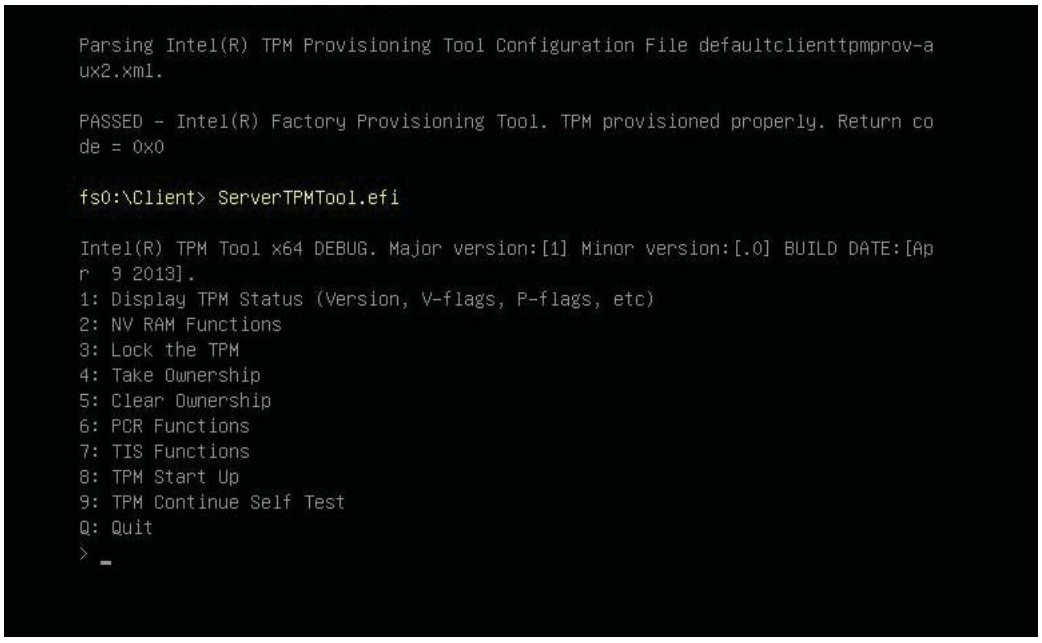
4. Type the following command to enter the flash drive directory:

   `fs0:`

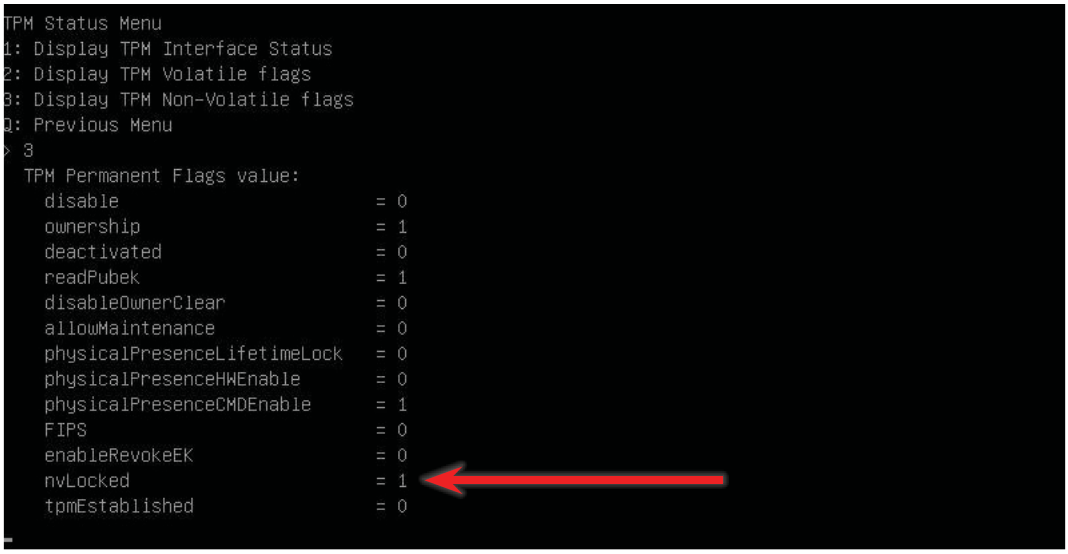
5. Type `TPMFactProv.efi -f defaultclienttpmprov-aux2.xml`
6. You should see the screen shown on the next page indicating that the TPM is now locked.



7. To check that the TPM has been successfully locked, type `ServerTPM-Tool.efi`



8. From the menu that appears, press <1> ("Display TPM Status"), and press <Enter>.
9. From the TPM Status Menu that appears, press <3>, and press <Enter>.
10. You should receive an output log. The "nvLocked" item, indicated by the arrow on the next page, should be set to 1. This shows that the TPM has been successfully locked.



11. If you come across any error messages along the way, or if the "nvLocked" item is still set to 0 despite your following the instructions above, try the following troubleshooting tips:

    - Make sure that the CPU you are using is compatible. It should be an Intel® Xeon® E5-2600 v2 or later model.

    Note: AOM-TPM-9655V-S and AOM-TPM-9655H-S are compatible with Xeon E5/E7 processors. AOM-TPM-9655V-C and AOM-TPM-9655H-C are compatible with Intel Core i5/i7 and Xeon E3 processors.

    - If the problem persists, contact Supermicro's technical support.

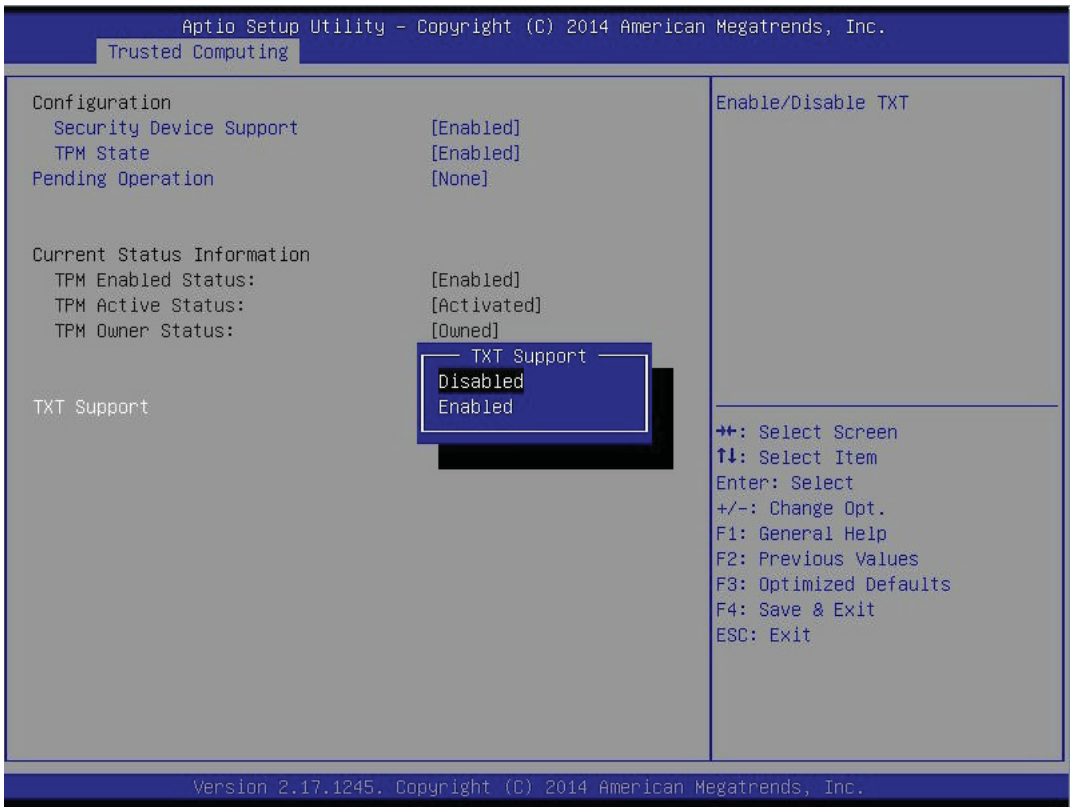
    Note: To exit the UEFI Shell, press <Q> and <Enter> until you reach the `fs0:` command line. Then either press <Ctrl><Alt><Del> to reboot the system or type `exit`.

    - If you entered the UEFI Shell from the BIOS, typing "exit" will send you back to the BIOS menu.
    - If you entered the UEFI Shell from the F11 Boot Menu, typing "exit" will reboot the system.

D. Enabling TXT Support

Follow the steps below to enable Intel TXT (Trusted Execution Technology). This is also done in the BIOS.

1. After provisioning the TPM via the provisioning utility, restart the system and enter the BIOS setup screen.
2. Navigate to the Trusted Computing screen as described in subsection A, steps 2-4.
3. Select the "TXT Support" item. Press <Enter>. A "TXT Support" window will pop up as shown on the next page.



4. Select "Enabled," and press <Enter>.
5. Save changes and reset to save your changes and allow them to take effect. The TXT is now enabled.
6. Use a third-party tool to test the hypervisor launch.

(Disclaimer Continued)

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