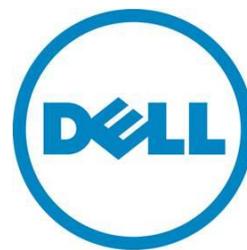

Dell PowerEdge 12th Generation Server BIOS Configuration

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June 2012 | Rev 1.0

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Executive summary

Dell was founded on the premise that customers should be able to purchase what they want, and have the product operate in a manner that suits their needs. Dell applies customer input and feedback all the way to the core of the server at the platform BIOS level.

Dell PowerEdge 12th generation servers feature a simplified BIOS interface based on customer input and requests to modernize the interface in accordance with the Unified Extensible Firmware Interface (UEFI) specification—while maintaining the option to boot from the legacy mode. The BIOS features fewer reboot cycles, user-friendly menus through the F2 hot key, and integrated help menus with text for each configurable option. The new BIOS provides the same interface for configuring iDRAC, PERC, LOM, and other adapter settings. The new BIOS setup also gives you a System Profiles menu for choosing the ideal operating profile for your server system environment.

Introduction

This paper identifies the new BIOS setup options as well as the changes from the 11th generation BIOS setup. Some of the differences between the 11th and 12th generation BIOS features include:

- The Power Management page has been replaced with a System Profiles Settings page.
- The additional PCIe slot disablement settings are now available on the Integrated Devices page.
- The System Security page captures changes in the behavior for power recovery.
- SATA settings are new for the PowerEdge 12th generation servers:
 - Adds support for AHCI and RAID modes
 - Supports up to 6 SATA devices

PowerEdge 12th generation server preboot configuration

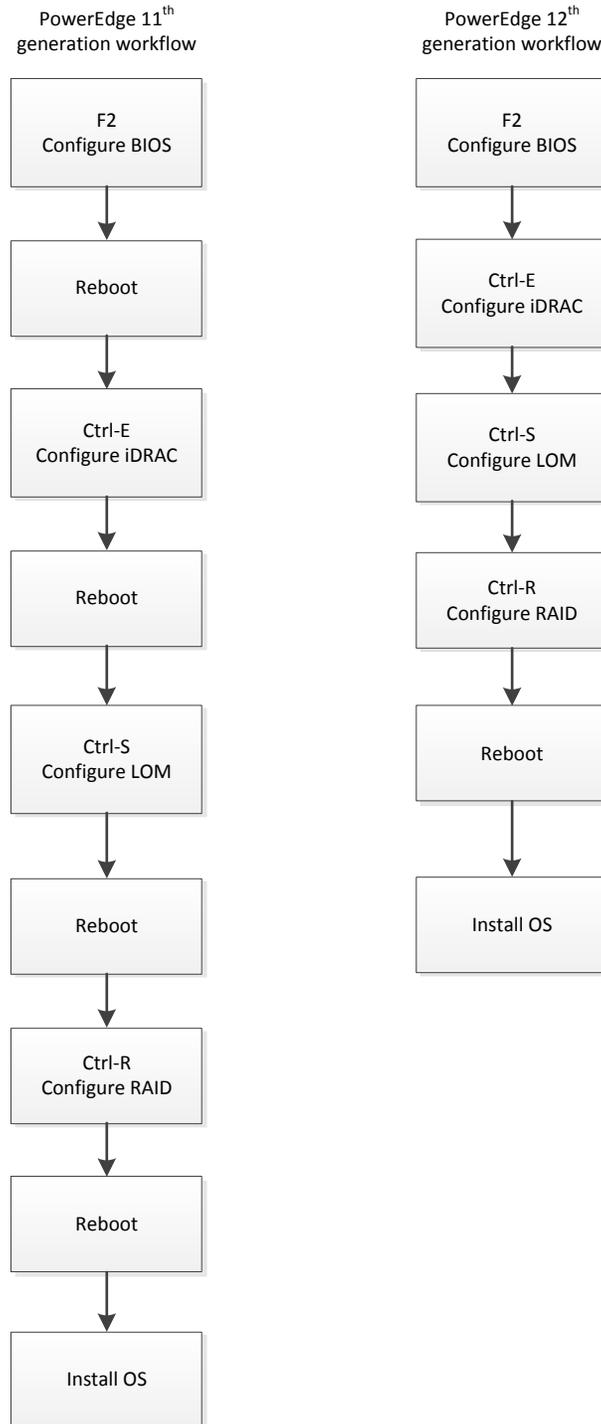
In previous PowerEdge generations, configuration screens for each hardware component (BIOS, iDRAC, PERC, LOM) were accessed by different hot keys, and each hot key was active during a narrow window of time during preboot. In order to improve customer experience, Dell™ PowerEdge™ 12th generation servers support an integrated system setup utility that is launched from a single hot key (F2).

The benefits of the integrated utility include:

- Single hot key to access BIOS, iDRAC, PERC, LOM, and other PCIe adapter card configuration
- Single boot to configure all hardware (no rebooting between each device)
- Keyboard and mouse configuration access

The new integrated system setup utility results in a much more efficient workflow for customers who wish to configure a single server using an interactive, menu-driven method. Figure 1 compares the preboot configuration workflow of the previous and new generation of PowerEdge servers.

Figure 1. Workflow comparison for 11th and 12th generation PowerEdge servers



PowerEdge 12th generation servers continue to support the traditional, text mode configuration utilities for PERC (Ctrl-R) and LOM (Ctrl-S). See Table 1 for a summary of the preboot configuration utilities available on the PowerEdge 12th generation servers.

System BIOS Settings

This section describes changes in the Dell PowerEdge 12th generation server BIOS settings.

Processor Settings page

The following processor settings are new to the 12th generation server BIOS. The Turbo Mode, C-States, and C1E enable/disable options have been moved from the Processor menu to the System Profile Settings menu. Most of these settings are fixed for a system profile, however, you can change these settings individually by selecting the Custom System Profile.

Alternate RTID (Requestor Transaction ID) Settings

When enabled, this setting provides more remote memory bandwidth at the expense of local memory bandwidth. The factory default for this setting is disabled. If you load defaults, this setting will also be disabled. A non-default value can be set in the factory or you can change it through the BIOS setup.

DCU Streamer Prefetcher

DCU streamer prefetcher is an L1 data cache prefetcher. When it detects multiple loads from the same cache line within a certain time, it assumes that the next line will be required. This setting is enabled and helps with most workloads. Depending on the workload, however, it may be helpful to turn this setting off.

DCU I/P Prefetcher

DCU I/P prefetcher is an L1 cache prefetcher. It looks for sequential load history to determine whether to prefetch the next expected data into the L1 cache from memory or the L2 cache. The setting is enabled by default. A non-default value can be set in the factory or you can change it through the BIOS setup.

SATA settings

The section explains the behavior changes for the SATA settings.

Embedded SATA setting

This field allows the Embedded SATA Controller to be set to Off, ATA, AHCI, or RAID Mode.

- AHCI Mode: Factory setting
- ATA Mode
- RAID Mode
- OFF

SATA Port A to F

This field sets the drive type of the selected device.

When the Embedded SATA setting is ATA Mode, set this field to Auto to enable BIOS support for the device. Select Off to turn off BIOS support for the device. Auto is the factory setting for all SATA ports.

When the Embedded SATA setting is RAID Mode, BIOS always enables support for the device.

Boot settings

UEFI vs. Legacy Boot

This field determines the boot mode of the system. Selecting BIOS (factory setting) ensures compatibility with operating systems that do not support UEFI. Selecting UEFI enables booting to UEFI capable operating systems.

Refer to the following white paper for more information on deploying a UEFI-aware operating systems: http://support.dell.com/support/edocs/systems/per410/en/Whitepaper/uefi_dpt.pdf

Integrated Devices page

PCIe Slot Disablement

This field controls the configuration of the card installed in this slot. You can set one of the following options for each of the cards:

- **Enabled:** The card is available during POST or to the operating system.
- **Disabled:** The card is not available during POST or to the operating system.
- **Boot Driver Disabled:** The Option ROM does not run during POST, the system cannot boot from the card, and its preboot services are also not available. However, it is available to the operating system. If the boot driver is disabled, note that systems management support through Lifecycle Controller will be disabled.
 - This option is not available if the slot contains a Dell RAID controller card (PERC).
 - When the boot driver is disabled, the OS driver is still available so a NIC or PERC that is not bootable could still be used from within the OS. This would be equivalent as if the card has no OPROM or UEFI driver installed.

Note: If multiple cards from the same manufacturer are managed using the same boot driver, select Boot Driver Disabled for all the cards from the same manufacturer so that the Option ROM does not run.

There are a few reasons why you might choose to change the default setting of this field.

- The PCIe slot can be set to Boot Driver disabled to allow quicker boot times if the adapter is not a boot device.
- The UEFI standard introduces a standard preboot configuration interface known as Human Interface Infrastructure (HII). For adapters that support HII, locate their configuration pages using

System Setup > Device Settings menu then pressing F2 during POST. However, new technology compatibility issues have been seen with some vendors. If any issues are detected and the system cannot boot or System Setup cannot be entered with a new card, the slot can be set to Boot Driver Disabled with the card removed.

System Profile settings

For PowerEdge 12th generation servers, the Power Management page has been replaced with a System Profiles Settings page. This section describes each of the selectable System Profiles in more detail.

Performance Per Watt Optimized (DAPC)

Using Dell Advanced Power Control (DAPC), this mode allows the BIOS to manage the processor power states for maximum performance/watt at all utilization levels and workload types while still meeting performance requirements. BIOS also manages system Power Capping in this mode.

When this mode is selected, BIOS sets the CPU Power Management as System DBPM and the Memory Speed to Maximum Performance. Turbo Boost, C1E, and C-States are all enabled. BIOS sets the Memory Patrol Scrub rate to Standard, the Memory Refresh Rate to single refresh (x1) and the Memory Operating Voltage to Auto mode.

This mode enables the Monitor/Mwait setting.

Performance Per Watt Optimized (OS)

Under this mode, the CPU Power Management field is set to OS DBPM. This means that the operating system (OS) controls the processors' power management. The main controls are the processor frequency or performance states (P-States: P0, P1 ... Pn), and the processor clock throttling (T-States: T0, T1 ... Tn). The OS modifies the power states to achieve the best operating performance, based on the Node Manager inputs and the processor utilization.

The Memory Frequency field is set to its maximum frequency. The Memory Patrol Scrub field is set to the standard mode. The Memory Refresh Rate is set to 1X, and the Memory Operating Value Voltage is set to auto. The Turbo Boost, C1E, and C-States fields are enabled to achieve the desired balance between power consumption and performance.

This mode enables the Monitor/Mwait setting.

Performance Optimized

Under this mode, the CPU Power Management field is set to Performance and allows the BIOS to program the processor for the maximum performance state. The Memory Frequency field is set to its maximum frequency. The Memory Patrol Scrub field is set to the standard mode. The Memory Refresh Rate is set to 1x, and the Memory Operating Value Voltage is set to auto. The Turbo Boost is enabled to allow the maximum performance. The C1E and C-States fields are disabled to maximize the performance.

This mode enables the Monitor/Mwait setting.

Dense Configuration Optimized

This mode is typically selected for systems with a high DIMM count where reliability is prioritized over power savings or performance considerations. This mode optimizes the power settings for configurations that have a large number of DIMMs. In this mode, settings are optimized to achieve enhanced reliability. CPU Power Management is set to DAPC. The memory frequency is reduced to the minimum setting, which is 800Mhz for PowerEdge 12th generation servers. Turbo Boost, which is a performance setting, is disabled. The patrol scrub rate is extended, and the memory operating voltage is set to 1.5V to increase memory margins.

This mode enables the Monitor/Mwait setting.

Custom

Under this mode, you can change the setting of each option.

- **Memory Patrol Scrub**—This feature is built into the memory controller in the processor. Patrol Scrub searches the memory for errors and repairs correctable errors to prevent an accumulation of errors. There are three selectable BIOS settings for Memory Patrol Scrub:
 - Disabled: Turns off this feature.
 - Standard: Specifies that patrol scrubbing will occur at the standard or default rate of once every 24 hours.
 - Extended: The rate is increased for patrol scrubbing. A patrol scrub of the entire memory array is performed once every hour.
- **Memory Refresh Rate**—This setting allows the memory to operate more reliably by refreshing the memory data at twice the normal rate.
- **Memory Frequency**—This is the speed at which the memory bus operates. The maximum possible frequency in the system may not be the maximum frequency rated on the installed DIMM. The maximum memory bus frequency is dependent upon the currently selected profile, the capability of the DIMMs, the installed DIMM configuration in the system, the operating voltage, and the capability of the processor. In most profiles except the Dense Configuration Optimized profile, the BIOS will configure the memory bus frequency to the maximum possible frequency.

Using the Memory Frequency settings on the custom menu, a desired memory frequency can be selected. However, the selected frequency can never exceed the maximum possible frequency for the system, which is limited by the capabilities and configuration of the system as noted above. For 12th generation servers, the Memory Frequency options include the following:

- Maximum Performance: The memory frequency will be set to the maximum supported frequency. Note that the maximum possible frequency is limited by the capabilities and configuration of the system as noted above.

This setting would be selected for environments where maximum system performance is required and power savings is not the most critical consideration.

- Maximum Reliability: The memory frequency will be set to the minimum supported frequency. For 12th generation servers, this is 800Mhz.

This setting would be selected for environments where maximum power savings is required and system performance is not the most critical consideration.

- 1600Mhz: The memory frequency will be set to 1600Mhz, the maximum supported frequency on 12th generation servers, if the system capabilities and configuration support this frequency setting.
See the maximum performance setting description above for an explanation of when to use this setting.
- 1333Mhz: The memory frequency will be set to the second highest supported memory frequency on 12th generation servers, if the system capabilities and configuration support this frequency setting.
This setting would be selected for environments where both performance and power savings are required. This setting will allow the memory to run at a higher performance setting while also saving power.
- 1067Mhz: The memory frequency will be set to the third highest supported memory frequency on 12th generation servers, if the system capabilities and the configuration support this frequency setting.
This setting would be selected for environments where both performance and power savings are required. This setting will allow the memory to run at a frequency above the minimum supported frequency while saving more power than the 1333Mhz setting.
- 800Mhz: The memory frequency will be set to 800Mhz, which is the minimum supported frequency on 12th generation servers.
See the maximum reliability setting description above for an explanation of when to use this setting.
- **Turbo Boost**—Turbo mode allows the processors to engage to a higher frequency than the processors nominal or rated frequency if the current operating environment allows it. This results in higher system performance. Turbo boost is engaged on per socket basis. If some of the cores of a socket are idle, then other cores of the same socket can go to a higher processor performance state.
- **C1E and C-States**—These settings were moved to System Profile settings. C1E and C-States are low power idle states that are used to minimize the power consumption.
- **Monitor/Mwait**—This setting allows you to provide an option to enable/disable the monitor/mwait instructions of the processor. When this option is set to disabled monitor/mwait, instructions are not supported by processor. This setting under custom profile should only be changed when C-States is set to disabled.

System Security page

This section details the behavior changes for AC recovery.

AC Power Recovery Delay

This field specifies how the system will support the staggering of power-up after AC power has been restored to the system. You can set one of the following options:

- **Immediate:** There is no delay before powering-up.
- **Random:** The system will create a random delay (60s to 240s) before powering-up.
- **User Defined:** The system will delay powering-up by the amount set by the user. The system supported user defined power-up delay range is from 60s to 240s.

TXT

To enable Intel[®] TXT, VT must be enabled, and the TPM must be enabled with preboot measurements and activated. The setup option is displayed, but be read-only and disabled if the software requirements are not met.

If a server does not support TPM, the server cannot support TXT.

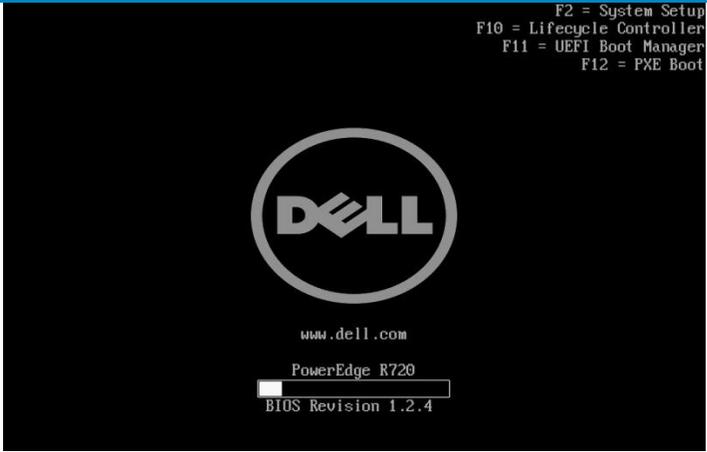
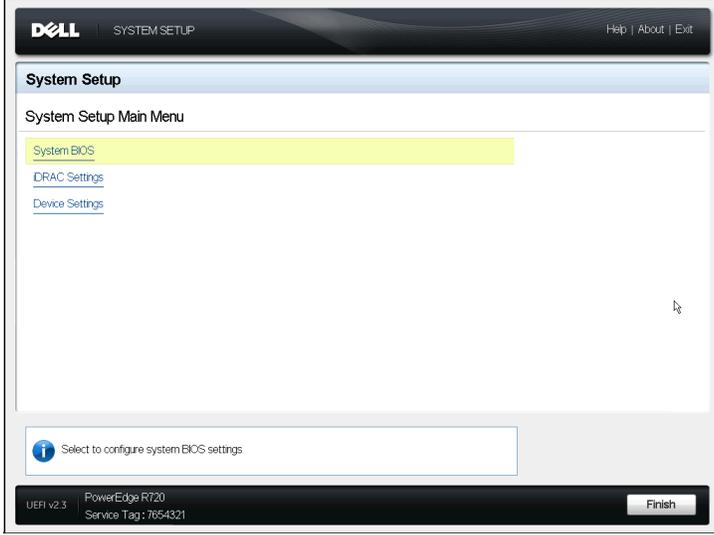
Miscellaneous Settings page

ISC (In System Characterization)

This setup option is enabled from the factory. ISC tries to characterize the system for maximum power usage. The output of ISC is used to program memory VRs settings. If ISC is disabled, then default memory VR settings are programmed.

Table 1. Preboot configuration utilities

The following table summarizes the preboot configuration utilities available with the 12th generation servers, and the different methods for launching those utilities.

BIOS boot screen	
Feature	BIOS boot screen
Description	Splash screen displayed during BIOS boot. Preboot configuration utilities are accessible from this screen using hot keys.
	
BIOS configuration	
Feature	BIOS configuration
Description	Main menu for the system setup utility used to configure BIOS, iDRAC, LOM, RAID, and other add-in PCIe cards.
Legacy hot key	F2
New hot key	F2
	

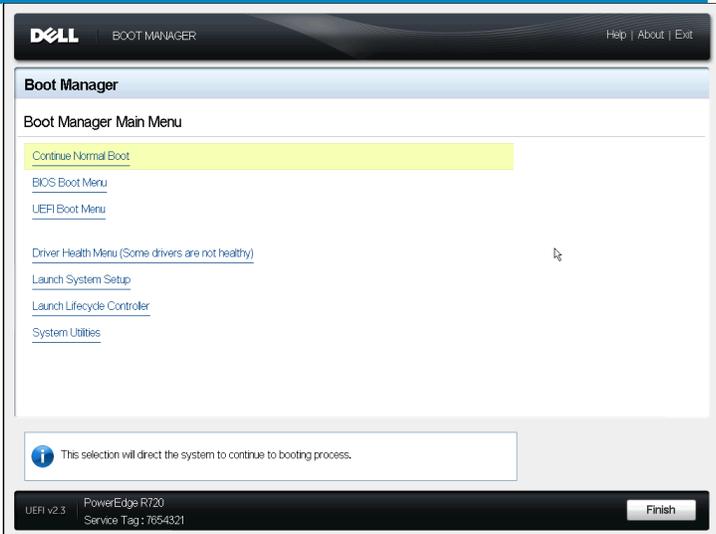
System services

Feature	System services
Legacy hot key	F10
New hot key	F10
Description	Launch Unified Server Configurator (USC)



Boot Manager menu

Feature	Boot Manager menu
Description	Enters the BIOS Boot Manager or the UEFI Boot Manager, depending on your system's boot configuration.
Legacy hot key	F11
New hot key	F11



One Time PXE Boot

Feature	One Time PXE Boot
Description	Forces a one time boot to PXE. If more than one LOM is enabled for PXE boot, then a menu is displayed which allows selection of which LOM to use.
Legacy hot key	F12
New hot key	F12

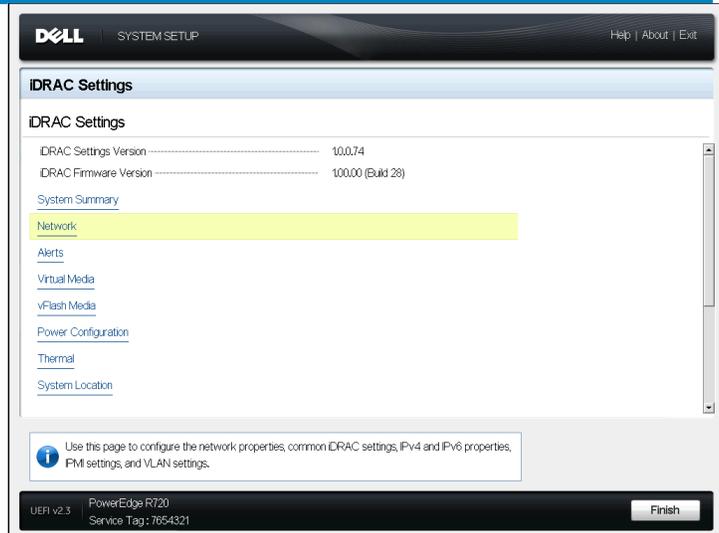
```
Scanning for devices. Please wait, this may take several minutes...

Broadcom UNDI PXE-2.1 v15.0.10
Copyright (C) 2000-2011 Broadcom Corporation
Copyright (C) 1997-2000 Intel Corporation
All rights reserved.

CLIENT MAC ADDR: 14 FE B5 FF B5 CD GUID: 44454C4C 3600 1035 0034 B7C04F333231
DHCP. >
```

iDRAC Configuration

Feature	iDRAC Configuration
Description	Enters the iDRAC settings screen within the system setup utility. Allows access to the system event log (SEL) and configuration of remote access to the system.
Legacy hot key	Ctrl-E
New hot key	F2 > iDRAC Settings



PERC Configuration

Feature	PERC Configuration
Description	Enters the PERC configuration screen within the system setup utility.
Legacy hot key	Ctrl-R
New hot key	F2 > Device Settings > Integrated RAID Controller

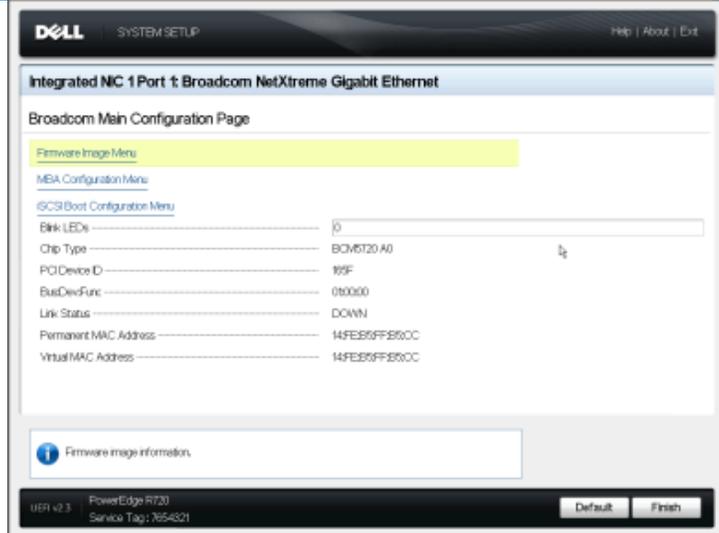


Feature	PERC Configuration
Description	May be used to launch the traditional text mode PERC configuration utility (similar to 11 th generation).
New hot key	Ctrl-R

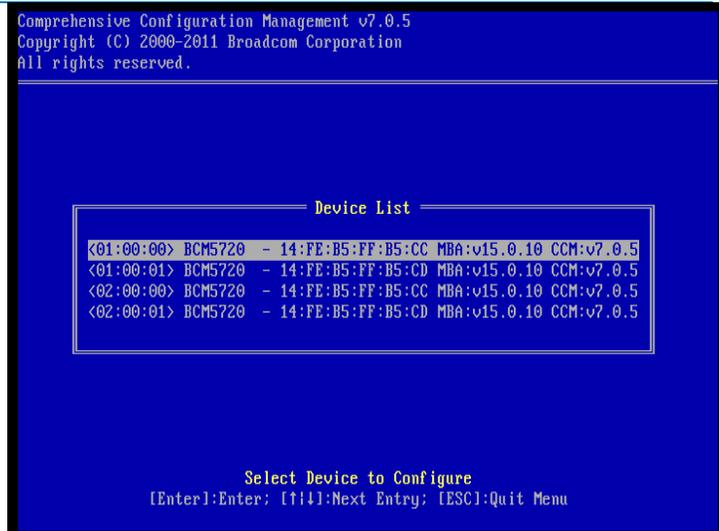


LOM Configuration

Feature	LOM Configuration
Description	Enters LOM configuration screen within the system setup utility.
Legacy hot key	Ctrl-S
New hot key	F2 > Device Settings > Integrated NIC ...



Feature	LOM Configuration
Description	May be used to launch the traditional text mode LOM configuration utility (similar to 11 th generation).
New hot key	Ctrl-S



Summary

The 12th generation server BIOS architecture helps you more fully configure your servers, with fewer reboot cycles and greater consistency across your user profiles than in previous generation servers. To find out more, refer to your server *Getting Started Guide* on Support.Dell.com.