A Technical Overview of the Dell Modular Server Enclosure and I/O Modules

The Dell™ Modular Server Enclosure is designed to be a high-performance, highly integrated system. This article discusses various aspects of this modular system’s shared chassis and I/O components, including interconnections and redundancies as well as interfaces that can be used to configure the shared components.

BY MICHAEL BRUNDRIDGE, BABU CHANDRASEKHAR, JYEH GAN, AND ABHISHEK MEHTA

The chassis of the Dell PowerEdge™ 1855 server—also known as the Dell Modular Server Enclosure—houses various types of modules, which are listed in Figure 1. Shared components in this modular server system help reduce rack space and the number of power supplies, fans, rails, and cables required when compared to a typical two-processor server occupying 1U of rack space. These shared modules are accessible from the rear of the chassis, as shown in Figure 2.

By understanding how each module fits into the overall architecture of the system, administrators can configure shared chassis and I/O components to be swapped among different Dell Modular Server Enclosures without causing errors. The Dell Modular Server Enclosure also allows various components to be configured for redundancy, enabling a system to use secondary or reserve components to maintain the current state or to help prevent failure of the entire shared chassis.

The Dell Modular Server Enclosure is designed to accommodate future growth and flexibility by allowing administrators to configure it with different types of modules (see Figure 3) for use in various environments. This article examines various components of the Dell Modular Server Enclosure and describes how these components can be configured and managed.

Management interfaces for the Dell Modular Server Enclosure

Various hardware interfaces can be used to connect and manage Dell PowerEdge blade server components.

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<table>
<thead>
<tr>
<th>Type of module</th>
<th>Minimum required</th>
<th>Maximum supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>DRAC/MC</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Power supply</td>
<td>2 (nonredundant)</td>
<td>4 (redundant)</td>
</tr>
<tr>
<td>Fan</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>KVM</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Server blade</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Server blade I/O</td>
<td>N/A</td>
<td>10</td>
</tr>
<tr>
<td>daughter card</td>
<td></td>
<td>(1 per server blade)</td>
</tr>
</tbody>
</table>

Figure 1. Shared chassis and I/O modules supported within the Dell Modular Server Enclosure
within the Dell Modular Server Enclosure. Figure 4 presents an overview of these interconnections. In addition, various user interfaces—described in Figures 5 and 6—can be used for configuring, managing, monitoring, and updating the shared components.

The chassis and shared components are managed through the Dell Remote Access Controller/Modular Chassis (DRAC/MC). The DRAC/MC can be configured to send Simple Network Management Protocol (SNMP) alerts and e-mail alerts to specific locations when a shared component fails or its performance exceeds preset thresholds. The DRAC/MC also features a Web interface and a command-line interface (CLI), through which administrators can track the health of the enclosure’s shared components.

Each server blade has an on-board baseboard management controller (BMC) that is designed to monitor the server blade’s status and health; the status and health of an individual server blade can be viewed through the Dell OpenManage Server Administrator (OMSA) Web interface. If the BMC is network-enabled and configured to do so, it will send SNMP alerts to designated IP addresses. Some network-enabled I/O switch modules can also be systems management–enabled and send alerts to designated IP addresses.

Note: Pass-through modules—including the Dell Gigabit Ethernet and Fibre Channel pass-through modules and the Topspin InfiniBand pass-through modules—cannot be configured by administrators and provide limited health and status information from temperature or voltage sensors.

**Chassis midplane**

One major component that differentiates blade servers from monolithic servers is an interposer board called the midplane (see Figure 7). Unlike monolithic servers, server blades share common resources such as power, cooling, management, and I/O modules. These resources are shared through the midplane, which is passive to help ensure high reliability—that is, the midplane contains no active logic, just connectors and traces. The midplane performs the following functions:

- Distributes power to the various modules
- Provides low-speed and high-speed interfaces between modules
- Provides a management interface between various modules
- Helps ensure that cooling resources (fans) can be shared among modules

<table>
<thead>
<tr>
<th>Module</th>
<th>Module type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network switch</td>
<td>I/O module</td>
</tr>
<tr>
<td>Network pass-through</td>
<td>I/O module</td>
</tr>
<tr>
<td>Fibre Channel switch</td>
<td>I/O module</td>
</tr>
<tr>
<td>Fibre Channel pass-through</td>
<td>I/O module</td>
</tr>
<tr>
<td>InfiniBand pass-through</td>
<td>I/O module</td>
</tr>
<tr>
<td>2100 watt power supply</td>
<td>Power supply module</td>
</tr>
<tr>
<td>Dummy power supply</td>
<td>Power supply module</td>
</tr>
<tr>
<td>DRAC/MC</td>
<td>DRAC module</td>
</tr>
<tr>
<td>KVM pass-through</td>
<td>KVM module</td>
</tr>
<tr>
<td>Avocent Analog KVM switch</td>
<td>KVM module</td>
</tr>
<tr>
<td>Avocent Digital Access KVM switch*</td>
<td>KVM module</td>
</tr>
</tbody>
</table>

*This module will be available in the second half of 2005.*
**DRAC/MC**

The DRAC/MC is responsible for managing the chassis and its shared components. DRAC/MC responsibilities include health monitoring (including thermal, cooling, power, alerting, and redundancy settings); power budgeting, console redirection, and session services (such as Web and Telnet); session, user, and security management; and virtual media and console redirection when the optional Avocent Digital Access KVM (keyboard, video, mouse) switch is present.

**Configuring the DRAC/MC**

Administrators can choose between two interfaces to configure the DRAC/MC—the serial port and the Ethernet port—and can use one of two user interfaces—the Racadm CLI or the Web-based interface. For more information about configuring the DRAC/MC, see the *Dell Remote Access Controller/Modular Chassis User’s Guide* at support.dell.com/support/edocs/software/smdrac3/dracmc.

**Providing redundancy with the DRAC/MC**

Beginning with the DRAC/MC 1.1 firmware release, two DRAC/MC modules installed in the same chassis are designed to automatically configure themselves to be redundant. When in redundancy mode, the DRAC/MC modules are configured as an active/passive pair.

The active DRAC/MC manages and monitors the chassis and its shared components, while the passive module monitors the active DRAC/MC in case of failure.

If the passive DRAC/MC detects a failure of the active DRAC/MC, it will assume the active role and take over the responsibility of managing the chassis. If this failover is successful, the failed DRAC/MC will assume the passive role. Otherwise, its error LED will be lit, an entry will made in the system event log (SEL), and an alert will sent about the failure.

*Note: Both DRAC/MC modules must have the same firmware version (1.1 or later) to support redundancy.*

**Updating DRAC/MC firmware**

The DRAC/MC is designed in such a manner that, if the administrator updates the firmware on the active DRAC/MC, the system will automatically update the passive DRAC/MC upon successful completion of updating the active DRAC/MC. However, if the active DRAC/MC fails to update successfully, the passive DRAC/MC will not update—thereby helping to ensure that at least one operational DRAC/MC is available.

The DRAC/MC uses Trivial FTP (TFTP) to receive its updates. Administrators can start the update by using

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**System Architecture**

**Figure 5. User and systems management interfaces for the Dell Modular Server Enclosure**

**Figure 6. Firmware/BIOS update and configuration interfaces for the Dell Modular Server Enclosure**

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<table>
<thead>
<tr>
<th>Component</th>
<th>TFIP</th>
<th>FTP</th>
<th>Application</th>
<th>Firmware</th>
<th>BIOS</th>
<th>DTK</th>
<th>OMSA</th>
<th>DRAC/MC</th>
<th>Telnet</th>
<th>Device (Web-based)</th>
<th>OSCAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server blade</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRAC/MC</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avocent Analog KVM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avocent Digital Access KVM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dell PowerConnect Gigabit Ethernet switch</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brocade Fibre Channel switch</td>
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<td>✔</td>
<td>✔</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
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<td></td>
</tr>
<tr>
<td>McDATA 4314 Fibre Channel switch</td>
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<td>✔</td>
<td>✔</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dell Gigabit Ethernet pass-through module</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dell Fibre Channel pass-through module</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Topspin InfiniBand pass-through module</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**User interfaces**

<table>
<thead>
<tr>
<th>Component</th>
<th>Serial</th>
<th>Web-based</th>
<th>SOL</th>
<th>Telnet</th>
<th>OSCAR</th>
<th>OMSA</th>
<th>BMC</th>
<th>DRAC/MC</th>
<th>SNMP (such as Dell OpenManage IT Assistant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server blade</td>
<td>*</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
</tr>
<tr>
<td>DRAC/MC</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
</tr>
<tr>
<td>Avocent Analog KVM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
</tr>
<tr>
<td>Avocent Digital Access KVM</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
</tr>
<tr>
<td>Dell PowerConnect Gigabit Ethernet switch</td>
<td>*</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
</tr>
<tr>
<td>Brocade Fibre Channel switch</td>
<td>*</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
</tr>
<tr>
<td>McDATA 4314 Fibre Channel switch</td>
<td>*</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>*(Serial console redirection is available from the DRAC/MC to the device.)</td>
</tr>
</tbody>
</table>

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**Configuration interfaces**

**Figure 8. Firmware/BIOS update and configuration interfaces for the Dell Modular Server Enclosure**

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Figure 7. Midplane within the Dell Modular Server Enclosure

either the Web-based DRAC/MC interface or the Racadm interface. For more information about updating the DRAC/MC, see the Dell Remote Access Controller/Modular Chassis User’s Guide.

Power supplies
The Dell Modular Server Enclosure can accommodate up to four power supply modules. The base system comes with two 2100 watt power supplies, which can power a fully loaded chassis in nonredundant mode. Optionally, administrators can add two more power supplies to provide redundancy in the event of a power supply failure or—if correctly wired to an external AC power grid—an AC power grid failure.

With four power supplies installed, the blade server system supports a 2+2 redundancy scheme. In this scheme, the four supplies load balance during normal operation, sharing the power load for the system. If one or two of the power supplies fail, the system can continue to run off the remaining power supplies. The power supplies require no configuration. However, administrators can monitor their status through the DRAC/MC interfaces; see the Dell Remote Access Controller/Modular Chassis User’s Guide for more information.

Cooling systems
Two types of modules are used to cool the Dell Modular Server Enclosure:

- Two main fan modules located in the middle of the rear of the chassis (These modules are hot-pluggable and redundant, each containing two fans that can be replaced individually.)
- Fans located in each power supply module

When a fan failure occurs in one of the modules, an entry will be made in the DRAC/MC SEL, and if configured to do so, the system will send alerts to the appropriate management consoles and e-mail accounts. The fans require no configuration. However, administrators can monitor their status through the DRAC/MC interfaces; see the Dell Remote Access Controller/Modular Chassis User’s Guide for more information.

Server blades
A server blade comprises the components required to run an OS and execute applications just like a monolithic server, except that the server blade uses shared chassis and I/O components, including power supplies, fans, I/O modules, the DRAC/MC, and a KVM switch. Each server blade has an on-board BMC that is responsible for monitoring the server blade health, in-band alerts, and Serial Over LAN (SOL) connectivity. The BMC also acts as the server blade’s interface to the DRAC/MC. The DRAC/MC manages the server blade’s power, out-of-band alerts, connection to the KVM switch, and serial console redirection mode.

Configuring server blades
Administrators can perform the initial system setup of a server blade through two methods:

- Pressing F2 during the server blade’s BIOS power-on self-test (POST)
- Booting a Dell OpenManage Deployment Toolkit (DTK) image onto the server blade

For more information about these methods, see the Dell PowerEdge 1855 Systems User’s Guide (support.dell.com/support/edocs/systems/pel1855), the Dell OpenManage Deployment Toolkit Version 1.3 User’s Guide (support.dell.com/support/edocs/software/dtk/1.3), and the Dell OpenManage Server Administrator Version 2.1 User’s Guide (support.dell.com/support/edocs/software/svradmin/2.1).

I/O interfaces and I/O modules
Each server blade has multiple I/O interfaces that can be accessed via I/O modules connected to the rear of the chassis. These I/O interfaces include:

- **KVM**: Connection via an internal KVM switch (allows access to only one server blade at a time)
- **Gigabit Ethernet**: Connection via I/O modules in chassis I/O bays 1 and 2
- **I/O fabric**: Connection via I/O modules in chassis I/O bays 3 and 4 (requires a daughter card installed on the blade)

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1 This term does not connote an actual operating speed of 1 Gbps. For high-speed transmission, connection to a Gigabit Ethernet server and network infrastructure is required.
**SYSTEM ARCHITECTURE**

- **Serial**: Connection via the BMC for SOL use or connection via the DRAC/MC for text console redirection—that is, no external serial connection exists on a server blade, but the server blade’s serial port can be redirected to the BMC or to the DRAC/MC.

**I/O fabrics.** Each server blade has four sets of high-speed buses (see Figure 8). Two sets of buses originate from the LAN on Motherboard (LOM): one connects to the I/O module in I/O bay 1, and the other connects to I/O bay 2. These buses are dedicated to Gigabit Ethernet transmissions and can be accessed via a Dell PowerConnect™ 5316M Gigabit Ethernet switch or a Gigabit Ethernet pass-through module in I/O bay 1 (and optionally I/O bay 2).

The other two sets of buses connect the daughter card on the server blade to I/O modules in I/O bays 3 and 4. To allow these I/O modules to be used, a daughter card must be installed with the corresponding fabric on each server blade that is to utilize the I/O module. The I/O modules in bays 3 and 4 must be the same fabric, as must all the daughter cards on the server blades. Although a server blade can be installed in the Dell Modular Server Enclosure without a daughter card, a server blade may not power up if it is equipped with a daughter card of a different fabric from that of the I/O module fabric in I/O module bay 3 or 4.

The Dell Modular Server Enclosure supports various I/O fabrics:

- Gigabit Ethernet
- Fibre Channel
- InfiniBand

The generic I/O bus to I/O bays 3 and 4 is designed to allow for future expansion to support other fabrics.

**I/O modules.** The Dell Modular Server Enclosure offers several options for connectivity through a combination of embedded Ethernet controllers, optional I/O daughter cards on the blades, and chassis I/O modules. Figure 9 shows examples of valid I/O daughter card and I/O module configurations.

**Configuring I/O modules**

I/O modules can be configured through several interfaces. Administrators can use the DRAC/MC console redirection feature (connect switch-x) to redirect the switch’s console through the DRAC/MC. Some switches have Web or Telnet interfaces as well. Figure 6 lists the available configuration interfaces for the Dell Modular Server Enclosure. For more information, see the specific user’s guide for each I/O module.

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Updating I/O module firmware

An I/O module’s firmware is updated through either TFTP or FTP. See Figure 6 for the I/O module vendor’s methods for updating its products. For more information about updating firmware, see the specific user’s guide for each I/O module.

KVM switch modules

The KVM switch module integrated into the Dell Modular Server Enclosure allows administrators to access the console of blade server modules in the chassis using a single keyboard, mouse, and monitor. The blade server chassis supports one of the two types of KVM modules: an Avocent Analog KVM switch (the base KVM switch) or an Avocent Digital Access KVM switch. Each type of KVM switch is designed in the same form factor and can fit into the slot next to the DRAC/MC (on the right side of the chassis when viewing from the rear). The KVM modules have hardwired connections to the keyboard, mouse, and video ports of each server module.

The server blade selection can be changed by using the On-Screen Configuration and Activity Reporting (OSCAR®) interface. Both digital and analog KVM switch modules support the OSCAR interface. The OSCAR interface can be displayed by pressing the Print Screen button. The arrow keys or number keys can then be used to select the appropriate server.

Avocent Analog KVM switch module

The Avocent Analog KVM switch module includes a custom connector that attaches to a dongle with two PS/2 and video ports. In addition to the custom PS/2 and video connection, the Avocent Analog KVM module has an Avocent Console Interface (ACI) RJ-45 connector that can be used to tier into an external KVM over IP switch, such as the Dell 2161DS Console Switch or the Dell 180AS and 2160AS external analog KVM switches.

Updating the Avocent Analog KVM switch firmware. The firmware on the Avocent Analog KVM switch can be updated using the Web-based DRAC/MC interface as well as the Racadm CLI. When an administrator initiates a firmware update, the DRAC/MC downloads the firmware image from a TFTP server and then copies the image internally to the Avocent Analog KVM module. The DRAC/MC should not be reset and the chassis should not be powered down during the Avocent Analog KVM switch firmware update.

Avocent Digital Access KVM switch module

As shown in Figure 10, the Avocent Digital Access KVM module looks similar to the Avocent Analog KVM module—it has the same custom connector for PS/2 and video, but instead of an ACI RJ-45 port, its RJ-45 port is an Ethernet port for connecting to the management Ethernet network. Unlike the Avocent Analog KVM switch, the Avocent Digital Access KVM switch can be assigned an IP address and can provide remote, OS-independent graphical console redirection without an external KVM over IP switch. The RJ-45 port on the Avocent Digital Access KVM switch does not support KVM tiering; a server interface pod (SIP) must be connected to the PS/2 and video ports to connect to external Dell 2161DS, 180AS, or 2160AS switches.

The virtual media feature of the Avocent Digital Access KVM module allows administrators to use a CD or DVD drive, ISO image, or floppy drive from the management station as a virtual device on a server blade module. Administrators can access the virtual media configuration settings through the Web-based DRAC/MC interface by clicking the “Media” link on the left side of the user interface. At any time, only one server blade module can be connected to the virtual media. The remote virtual devices will appear as USB devices to the server blade modules.

The console redirection feature allows administrators to access the local console of the server blades remotely, independent of the OS installed on the server blades. Administrators can access the console redirection option by clicking the “Console” link on the Web-based DRAC/MC interface.

Configuring the Avocent Digital Access KVM switch. Administrators can configure the Avocent Digital Access KVM switch from the Web-based DRAC/MC interface by going to Configuration > Network > Network Configuration. The Avocent Digital Access KVM switch can have a static or Dynamic Host Configuration Protocol (DHCP)-assigned IP address. The switch’s Ethernet network and IP address must be on the same subnet as the DRAC/MC. The configuration options are available only when the chassis is powered up.

Updating the Avocent Digital Access KVM switch firmware and certificate. The Avocent Digital Access KVM module supports certificate updates and firmware updates. The firmware update is performed using TFTP and is identical to the process used

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2 The Avocent Digital Access KVM module will be available in the second half of 2005.
for upgrading the Avocent Analog KVM module. For an Avocent Digital Access KVM module update, however, the TFTP download is handled directly by the KVM module because it has its own IP address. As in the Avocent Analog KVM module update, best practices recommend not resetting the DRAC/MC or powering down the chassis during a firmware update.

The certificate on the Avocent Digital Access KVM module can be updated using the Web-based DRAC/MC interface, in a method similar to that used for updating the DRAC/MC certificate. The Avocent Digital Access KVM module requires a certificate to support console redirection and virtual media features.

**Flexibility and scalability enhancements enabled by the Dell Modular Server Enclosure**

The Dell Modular Server Enclosure houses various components that comprise a flexible, modular system. In addition to as many as 10 server blades, the enclosure supports various I/O, power, cooling, switch, and management modules that are shared by the server blades. Administrators can manage these components and the system as a whole using several different interfaces that are discussed in this article. This flexibility combined with the modularity of the system’s design enables administrators to scale servers and adapt data center configurations to changing and unpredictable business requirements.  

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**FOR MORE INFORMATION**

- **Dell Remote Access Controller/Modular Chassis User’s Guide:**
  support.dell.com/support/edocs/software/smdrac3/dracmc

- **Dell PowerEdge 1855 Systems User’s Guide:**
  support.dell.com/support/edocs/systems/pe1855

- **Dell OpenManage Deployment Toolkit Version 1.3 User’s Guide:**
  support.dell.com/support/edocs/software/dtk/1.3

- **Dell PowerConnect 5316M System User’s Guide:**
  support.dell.com/support/edocs/network/PC5316M
