FX2 Power Management Features

This White Paper addresses the key power management features in FX2 Chassis and the variation in the power managed for FM120x4, FC430, and FC630 sleds.

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Executive summary

This white paper explains key feature changes in FX2 Chassis Power Management, including Power Redundancy Policies, Power Monitoring, and Bounds.

This white paper also explains how the monitoring for the FM120x4 sled is done differently, as compared to the FC430 and FC630 sleds.
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Introduction

Power management in the FX2 chassis has changed significantly relative to the earlier modular architecture. In the legacy architecture, the CMC determines the power allocation to each server. The server then regulates its own power consumption. Rather than granting or denying power allocation requests, the new FX2 CMC power management relies on hardware infrastructure to control the distribution of power to the components. There are some feature changes associated with this shift in control locus.

The following are new or changed features:
- New Power Redundancy Policy Selection—“Redundancy Alert Only”
- Chassis Power Bounds
- Power Monitoring
- PSU and Server Compatibility Checking

Features carried over to FX2 from previous chassis models:
- Real Time Power and Energy Statistics
- Chassis Power Capping
- Max Power Conservation Mode (enhanced for FX2)
- Remote Power Logging
- Chassis Power Button Disable
- Control of Power to each Server Module

Features appearing in earlier chassis but not included in the FX2 family:
- Server Power Priority
- Server-Based Power Management
- Dynamic Power Supply Engagement
- Standby Input Power Capacity Reporting
- Power Allocation Reporting
- 110 VAC Operation Acknowledgment
- “Power Supply” Redundancy Mode

Terminology

Sled: Form factor of modules that can be installed on an FX2 chassis. Analogous to a blade

FM120x4: PowerEdge FX2 multimode server blade or sled

FC430: PowerEdge FX2 quarter width server blade or sled

FC630: PowerEdge FX2 half width server blade or sled

PSU: Power Supply Unit.

OMPC: Open Manage Power Center. This free utility provides increased visibility to power consumption, anomalies, and utilization through fine-grained instrumentation.
CMC: Chassis Management Controller

iDRAC: Integrated Dell Remote Access Controller
Power Redundancy Policy

The FX2 Chassis supports the following redundancy policies:

- **Grid Redundancy**: This policy divides the available PSUs into two power grids. PSU 1 is power grid 1 and PSU 2 is power grid 2. For maximum power the PSUs should have the same capacity. If a grid or PSU fails then the power is provided by the other PSU. Chassis power consumption is limited to the level that a single PSU can provide.

- **No Redundancy**: This policy distributes the power between the two PSUs and their combined capacity is available to provide power to the chassis.

- **Redundancy Alerting Only**: This policy is new for FX2, and this setting is a variant of the “No Redundancy” setting. When the power usage exceeds the capacity of a single PSU (when redundancy breaks), logs and alerts are triggered - otherwise the chassis behavior is the same as “No Redundancy”. The combined capacity of the PSUs is available to provide power to the chassis. This is the default setting on the chassis.

Note: The “Power Supply Redundancy” setting is not applicable for FX2. See the FX2 Chassis GUI power configuration page screenshot later in the document, where you can change Redundancy policy.

Enhanced Max Power Conservation Mode

FX2 Chassis Power Management implements an aggressive power conservation strategy when Max Power Conservation Mode (MPCM) is enabled. The servers are throttled to consume far less power than normal, at the expense of performance. MPCM use is intended to be only temporary. For example, when a power failure results in an installation relying on batteries for uninterrupted service, a script could enable this mode to maximize operating time on the batteries.

Chassis Power Bounds

FX2 chassis provides a chassis power cap the same as the earlier chassis designs. FX2 chassis enables external console applications to control a power cap setting for the chassis as a whole, and bounds to guide the setting of that cap. The FX2 chassis power consumption does not exceed this power cap. The cap is set by the user (or application) and cannot be changed by the system. The lower and upper bounds are for guidance on setting the power.
cap and are new. They are intended to define the useful range of the power cap setting.

- **Lower bound**: The lower bound is based on the minimum power needed to operate the infrastructure and all processors in a fully throttled state. This is the minimum power required to operate the chassis with the servers running.

- **Upper bound**: The upper bound is based on the redundancy policy, PSU type, number of PSUs and also on PSU input voltage.

See the FX2 Chassis GUI power configuration page screenshot here, where you can change the power cap, and the power bounds are displayed for guidance for setting power cap.

You must set **System Input power cap** to a value between lower bound and upper bound. When the cap is changed, the chassis log displays “System Input Power Cap changed from X AC to Y W AC”, where X is the old power cap value and Y is the new. The power cap maximum value is 3371 W. Setting the value less than the lower bound displays one of three confirmation messages:

- **System Input Power Cap setting too low.** This will impact server performance.

- **System Input Power Cap setting too low.** This will cause a server or other components to shut down.

- **The power cap value cannot be less than the lower power bound.**

In a heavily configured chassis, the useful range of the power cap setting can be narrow (lower bound is close to the upper bound) because of the quantity of power required for reliable operation of a maximum configuration. When Grid Redundancy is chosen, the lower bound may be larger than the upper bound in a maximally configured chassis. To achieve the maximum performance from the servers in a chassis that exhibits this condition, choose a different redundancy policy or remove some of the hardware in the configuration. A power redundancy policy of **No Redundancy** or **Redundancy Alerting Only** may provide enough additional power for the servers to operate at full speed.
Power Monitoring

FX2 Chassis Management GUI provides the power monitoring that includes System Power Status, Real-Time Power Statistics, Real-Time Energy Statistics, and power consumption for FC430 and FC630 server modules. Open Manage Power Center (OMPC) can be used to monitor and control power consumption of the systems in a data center. Power monitoring is also available for the iDRAC GUI for these servers.

The power monitoring for the new multi-node half-width sled, the FM120x4, is performed differently from earlier sleds. The FM120x4 has four servers with four associated iDRACs, targets applications which require very low power consumption, and thus is designed for optimal power efficiency. The sled occupies a single slot. Unlike the individually removable FC430 servers in a sleeve, the servers in the FM120x4 sled share the same system board and common power infrastructure. There is a single power and temperature sensor for the entire sled. Power information for an individual FM120x4 server is not available. Console level power monitoring is not possible for the FM120x4 sleds. It is intended that a chassis containing FM120x4 servers be monitored at the chassis level.

The FM120x4 also has some power control behaviors that differ from traditional modular servers. Since there is common power handling infrastructure, the Virtual Reseat operation can be performed simultaneously only on all the servers on the sled, and not individually.
At individual iDRACs, various voltages and temperature readings, history, and server power control are available. In the FC430 and FC630, an individual server power cap can be configured and power monitoring with history and statistics is given.
PSU Compatibility

FX2 chassis power management depends on unique features present on the new power supplies. The new features cannot be mixed with PSUs which depend on the legacy allocation method. More importantly, the new servers require these new PSUs to ensure operation within the expected power envelope. The CMC verifies each of these compatibilities and alerts if or when it finds an issue.

PSU compatibility check for chassis start-up scenario:

The PowerEdge FX2 supports 1 or 2 PSUs of same wattage (both 1600W or 1100W). Mixing 1100 and 1600 W PSUs is not supported. If mixed then only one out of the two PSUs will be "online". The other PSU is turned off (LED off) and the status is reported as "Failed". The CMC log displays a critical message.

The form factor of the FX2 PSUs is the same as many other Dell PSUs, however only the two PSU models mentioned earlier are supported. If a supported PSU is mixed with an
unsupported PSU (for example, 1600W and 750W or 1100W and 495W) then only the supported PSU is brought online. The unsupported PSU is turned off and the status is reported as "Failed". The CMC then displays a critical message. If all PSUs are unsupported (for example: 750W or 495W PSUs) then all PSUs remain off. The CMC log displays a critical message. The chassis is not turned on.

PSU compatibility check for PSU hot plug scenario:

If there is a single 1600W PSU available in the chassis, and an 1100W or an unsupported PSU is inserted, the inserted PSU remains off. The CMC log displays a critical message. The chassis uses the latest power management mode available from the 1600W PSU.

If there is a single 1100W PSU available in the chassis and a 1600W or an unsupported PSU is inserted, the newly inserted PSU remains off. The CMC log displays a critical message. The chassis power is managed with the legacy power management mode.

When there is a single unsupported PSU available in the chassis and a supported 1600W or 1100W PSU is inserted, the newly installed PSU is turned ON. The CMC log displays a critical message for the unsupported PSU.

Server Compatibility

The FC430 and FC630 servers require the latest power management capability of the 1600W PSUs. Inserting these servers into a chassis powered by 1100W PSUs causes a critical chassis health alert, although the CMC attempts to apply power to the server if requested to do so by a user. This operation is not supported or recommended.

The FM120x4 is a relatively low-power server module that the 1600W PSU can support (these servers are normally paired with the legacy-mode 1100W PSUs).