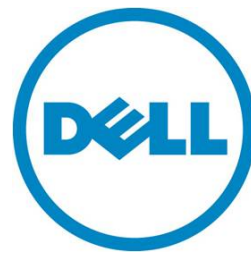# PSU Mismatch System Behavior for Dell PowerEdge Servers

System behavior for unsupported power supply unit (PSU) configurations in Dell PowerEdge 12th generation servers

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Executive summary

The Dell™ PowerEdge™ 12th generation server portfolio is complemented with a new lineup of high-efficiency power supply units (PSUs). PSUs can be changed for a variety of reasons after the point-of-sale, which creates the opportunity for adding non-matching PSUs. A PSU mismatch will not occur if all of the PSUs in a system are the same model, which is the factory default configuration. Supporting all PSU combinations adds unnecessary cost and complexity to the design. Therefore, there is a limited set of supported PSU configurations.

Introduction

The Dell PowerEdge 12th generation power supply unit (PSU) portfolio enables features such as PSU redundancy, and right-sized PSU optimization by incorporating a number of different PSU maximum output capacities and form factors. For many enterprise-class server applications, server systems are configured with redundant PSUs, and a PSU mismatch condition is defined as an unsupported PSU configuration. Table 1 lists the 12th generation PSU portfolio and Figure 1 illustrates a subset of the Dell PowerEdge 12th generation 86mm PSUs.

Table 1.   Dell PowerEdge 12th generation PSU portfolio

Model	Form factor	Watts	80-PLUS rating	Hot-pluggable	Cabled	Redundant configuration option
L1100E-S0 E1100E-S0	1U 86mm	1100	Platinum 94%	✔		✔
E750E-S0 D750E-S1 F750E-S0	1U 86mm	750	Platinum 94%	✔		✔
D495E-S0 F495E-S0	1U 86mm	495	Platinum 94%	✔		✔
E1100D-S0 (DC-Input)	1U 86mm	1100	N/A	✔		✔
D550E-S0 L550E-S0	1U 51.3mm	550	Platinum 94%	✔		✔
D350E-S1 L350E-S1	1U 51.3mm	350	Platinum 94%	✔		✔
DH550E-S0 FSB001-240G2	1U 106mm	550	Silver 88%		✔	
DH550E-S1 2G4WR	2U 86mm	550	Silver 88%		✔	
DH350E-S0 8M7N4	2U 86mm	350	Silver 88%		✔	

Figure 1.   Dell PowerEdge 12th generation 1U 86mm platinum PSUs 495W, 750W, 1100W

PSU mismatch definition

The Dell PowerEdge 12th generation PSU portfolio delivers a rich set of options for optimizing servers for power efficiency, cost, and features. Supporting all PSU combinations adds unnecessary cost and complexity to the design, and impacts power efficiency, redundancy, and feature support. Therefore, there is a limited set of supported PSU configurations. "PSU Mismatch" is the system design, and behavior, for handling unsupported PSU configurations.

A PSU mismatch will not occur if all of the PSUs in a system are the same model, which is the factory default configuration. After the point-of-sale, the PSUs can be changed for a variety of reasons, and there is the opportunity for a PSU mismatch when mixing PSU models in a given system configuration. A system with a PSU mismatch is defined to be in a failure condition, and the PSU mismatch should be resolved.

The system will identify the primary PSU model, and check for a PSU mismatch, following an AC power cycle. An AC power cycle occurs when all the input power sources to the system are removed, and then input power is restored to at least one PSU. The system will also check for a PSU mismatch when a PSU is hot-plugged. A PSU is defined to be hot-plugged when a PSU and input power are added to a system after an AC power cycle, and is independent of the system being in the on or off state. An AC power cycle is required to change the primary PSU model that is used to determine a PSU mismatch for hot-plugged PSUs.

PSU mismatch classes

The flexibility of the 12G PSU portfolio creates a wide variety of potential PSU mismatch scenarios. Not all mismatch scenarios are as critical as others, thus behavioral classes are defined to allow different behaviors based on criticality. Table 2 defines the PSU mismatch behavioral classes.

Table 2.   PSU mismatch classes

Class	Description
Ignore	All PSUs are enabled; the defined mismatch condition is ignored. Log entries are not generated.
Disable feature	All PSUs are enabled; non-common features are not supported, and the feature is disabled. Log entries are not generated.
Disable PSU	Mismatched PSU(s) are disabled. Log entries are generated. PSU LED flashes green.

If a PSU is disabled due to a PSU mismatch, that means the PSU is in a failed condition, it is not actively providing power to the system, and it can be safely removed from the system.

PSU mismatch conditions

PSU mismatches occur when two or more PSUs do not share the same feature sets. Each parameter that can cause a PSU mismatch condition is mapped to a PSU mismatch class, and is defined in Table 3.

Table 3.   PSU mismatch conditions

Parameter	Options	Mismatch	Class	Description
Output capacity	1100W, 750W, 550W, 495W, 350W	Yes	Disable PSU	PSUs with different output wattages are not supported, and affect the system efficiency, load sharing, and feature support.
Input voltage type	AC Input, DC Input	Yes	Disable PSU	Mixing AC input and DC input voltages are generally not supported. PSUs with AC input are prioritized over DC input.
Platform PSU support	Yes, No	Yes	Disable PSU	PSUs that are not supported by the platform are disabled. Example: Configuration restrictions may cause a high performance server to not support the smallest capacity PSU.
PSU feature capabilities	Variable	Yes	Disable feature	Non-matching features are disabled.
Efficiency	Titanium, Platinum, Gold, Silver	Yes	Ignore	PSUs with different efficiencies will continue to be enabled.
Input voltage	Low-Line (110V AC) High-Line (220V AC)	Yes	Ignore	PSUs with different input voltages will continue to be enabled. However, some of the higher output PSUs may only achieve the maximum output rating with high-line input.
PSU firmware revision	Variable	No	N/A	PSUs with different firmware revisions are not considered a PSU mismatch.

PSU mismatch system behavior

Output capacity mismatch

The most common PSU mismatch condition is when a system has two or more PSUs with different output capacities. Following an AC cycle, the PSU with the highest output capacity is the primary PSU, and the PSU with the smaller output capacity is disabled. A PSU that is hot-plugged that does not match the output capacity of the primary PSU is disabled and can be safely removed from the system.

Input voltage type

Mixing AC input and DC input voltages is generally not supported. Following an AC cycle, the PSU that has AC input is the primary PSU, and the PSU with DC input is disabled. A PSU that is hot-plugged is required to have the same input voltage type as the primary PSU in order to be enabled; otherwise, the PSU is disabled and can be safely removed from the system. There may be exceptions to this behavior, but they are considered deviations, and are outside the scope of this document.

Platform PSU support

The Dell PowerEdge 12th generation PSU portfolio is designed to work with the Dell PowerEdge 12th generation server portfolio. However, there may be some deviations from this rule. An example of this deviation is a configuration restriction, which may prevent a high-performance server from supporting the smallest capacity PSU. If a PSU is not supported by the system, the PSU is disabled, and can be safely removed from the system.

PSU feature capabilities

PSUs that share the same form factor generally support the same feature set, but there can be exceptions. If there is a PSU mismatch condition where the primary PSU supports a feature that is different than other PSUs in the configuration, the PSUs continue to be enabled, and the feature is disabled. This behavior prioritizes the capability to enable a mismatched PSU and disable non-critical feature(s).

Efficiency

There is a range of PSU efficiency ratings currently available, such as Platinum, Gold, and Silver. Solution providers like Dell continue to raise the bar by delivering more efficient PSUs. Mixing PSU efficiencies is defined as a PSU mismatch, but this mismatch is ignored by the system, and all PSUs continue to be enabled. A PSU or feature will not be disabled based only on the efficiency rating, but mixing PSUs with different efficiencies raises the potential for a PSU Feature Capabilities mismatch.

Input voltage

A system that mixes the PSU AC input voltages of low-line 110V, and high-line 220V will cause a PSU mismatch that is ignored by the system, and all PSUs continue to be enabled. A PSU will not be disabled based only on the input voltage. However, it does raise the potential for an output capacity mismatch when using the higher output capacity PSUs, because they may only achieve the maximum output rating with high-line input voltage. Example: An 1100W PSU with low-line input voltage may only achieve a 1050W maximum output, which causes an output capacity mismatch with an 1100W PSU that has high-line input voltage.

PSU firmware revision

PSUs with different firmware revisions are not considered a PSU mismatch, and all the PSUs will continue to be enabled.

PSU mismatch notification and error reporting

PSU mismatch notification and error reporting will occur only when a PSU is disabled due to a PSU mismatch condition.

PSU LED indicator

The PSU LED will flash on and off at a rate of 1 Hz to indicate that the PSU has been disabled due to a PSU mismatch, which is illustrated by the figure below.

Figure 2.   The PSU LED flashes on and off at a rate of 1Hz to indicate a PSU mismatch

Error reporting

The Integrated Dell Remote Access Controller (iDRAC) GUI contains the primary sources for PSU mismatch error reporting. There are two logs in the iDRAC GUI that are updated when a PSU is disabled due to a PSU mismatch condition: the System Events Log (SEL) and the Lifecycle Log. If there is a PSU mismatch during a system reboot or AC cycle, there will be a PSU mismatch message printed during the BIOS Power On Self Test (POST) prior to entering the operating system.

Example

A PSU mismatch occurs if the primary PSU is 495W, and then a 750W PSU is hot-plugged. PSU mismatch behavior causes the system to disable the 750W PSU due to the output capacity mismatch. Illustrations of the error reporting for this example are provided in the following figures (Figure 3, Figure 4, Figure 5, and Figure 6).

Figure 3.   iDRAC GUI system summary indicates a problem with the power supplies
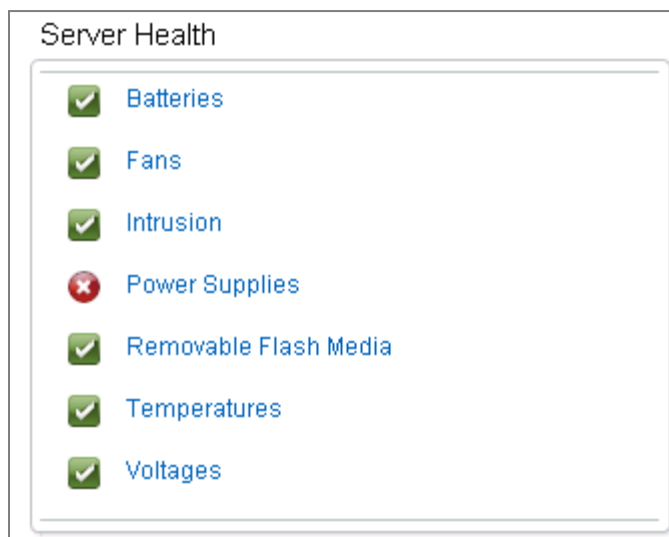
Server Health

- ☑ Batteries
- ☑ Fans
- ☑ Intrusion
- ❌ Power Supplies
- ☑ Removable Flash Media
- ☑ Temperatures
- ☑ Voltages

Figure 4.   The SEL log identifies that a PSU is not configured correctly

| ❌ | Thu Apr 12 2012 11:01:32 | Power supply 2 is incorrectly configured. |
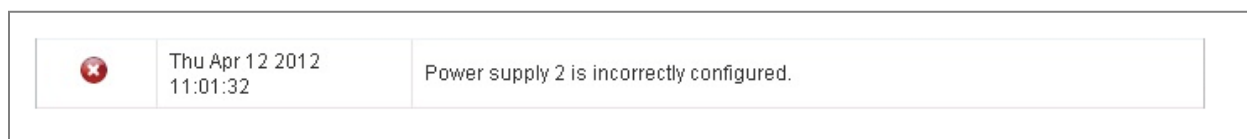
Figure 5.   The Lifecycle Log identifies that a PSU is not configured correctly

| + | ❌ | 2012-04-12T11:01:32Z | PSU0006 | Power supply 2 is incorrectly configured. |

−

PSU0006: Power supply 2 is incorrectly configured.

❌   2012-04-12T11:01:32Z

Log Sequence Number: 595

Detailed Description:
Power supplies should be of the same input type and power rating.

Recommended Action:
Install matched power supplies and review product documentation for proper configuration.
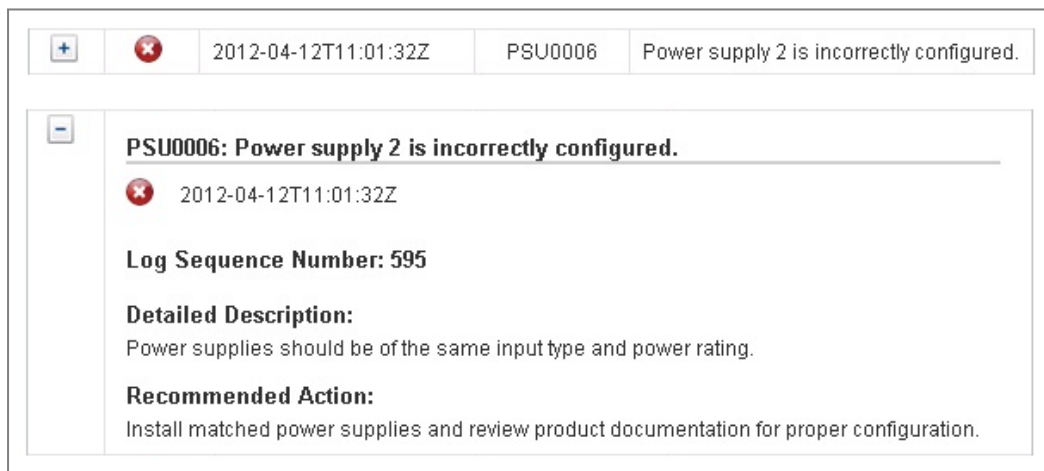
Figure 6.   BIOS message during POST following a system reboot

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Warning: PSU Mismatch.  Check PSU.
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Summary

All PSUs should be the same model when configured with more than one PSU in a Dell PowerEdge 12th generation server. If this is not the case, a PSU mismatch can occur, and the PSU output or supported feature set can be impacted. The PSU mismatch behavior minimizes the system impact, but a PSU mismatch is a failure condition, and should be resolved by installing compatible PSUs.

References

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2. Power and Cooling Innovations in Dell PowerEdge Servers: white paper
3. Right-Sized Power Systems: A Means to Improved Energy Efficiency: white paper
4. Power Consumption Reduction: High Efficiency Power Supplies: white paper
5. Power Consumption Reduction: Hot Spare: white paper
6. Power and Cooling Train the Trainer (TTT): training deck