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Application Note

069

AN 069 Dell M1000e Chassis Air Flow

Summary

This application note describes a scenario that can occur where an air flow issue has a negative effect on the cooling design of a Dell M1000e enclosure. The application note describes when the issue can occur and the dynamics behind the issue.

Symptoms

Under normal operations, the temperature of the Amulet Hotkey host card GPU runs either at a higher than normal temperature during idle periods or at close to the thermal shutdown maximum threshold (116 °C). During either minor or extensive use, the host card GPU can either experience a slow level of thermal climb reaching the maximum threshold or may already be close to the threshold. When the maximum thermal threshold is reached, the Windows desktop is commanded to carry out an immediate shutdown.

Cause

The issue is caused by unbalanced air flow through the Dell M1000e enclosure, preventing effective cooling of the host card's GPU. As described in the *Dell PowerEdge M1000e Technical Guide*:

> *"The cooling strategy for the M1000e supports a low-impedance, high-efficiency design philosophy. Driving lower airflow impedance allows the M1000e to draw air through the system at a lower operating pressure and reduces the system fan power consumed to meet the airflow requirements of the system."* (Dell, 2013)

Under a highly pressurised environment such as a chimney rack, the air flow can be impeded and in some cases reversed where the external pressure on the inlet to the Dell M1000e enclosure is high, particularly in the case of chimney racks. As stated in the *Dell Technical White Paper:*

> *"For front-to-back cooled equipment, there should be a negative pressure (relative to the room) in the front cavity and a positive pressure at the back."* (David L. Moss, Robert B. Curtis, 2009)

To understand the issue further, Dell has produced a document describing the effects on Air Containment:

> *"A downside to a tightly coupled containment solution exists especially as it applies to the IT equipment. Any form of external pressure added to a server, storage, or networking product elicits one of two responses—the airflow slows and component temperatures climb, or the IT fans respond with additional fan energy to boost the flow rate back to its intended design point."* (David L. Moss, 2009)

To further clarify the position Dell has quoted:

> *"Care should be used when deploying passive chimney systems. A good design should impart little to no external pressure on the IT systems within the racks. While in some cases the air handlers may facilitate the flow through the racks and chimneys by creating a significant negative pressure in the ceiling return, a test should always be carried out to determine the presence of negative pressure in the chimneys and rack rears. If the air handlers do not improve the flow through the chimney, an increase*

of IT fan energy may occur. In addition, you may risk a pressure build-up at the back of the rack because the IT equipment is pushing the air up the chimney, which will cause a larger recirculation between the IT systems." (David L. Moss, 2009)

The overall resultant effect on the enclosure fans of having positive pressure at the front of the enclosure is to either cause a 'stall' in air flow (David L. Moss, Robert B. Curtis, 2009) or to reverse the flow of air as previously stated. The path of heat dissipation is described in *the Dell PowerEdge M1000e Technical Guide* (Dell, 2013), which demonstrates that a stall in airflow will cause a lack of passive air cooling within the enclosure as required by the Amulet Hotkey host card. The issue can also result in the recirculation of already reheated air.

Solution

There are two possible solutions to this issue. The first is to ensure the correct airflow and pressure is maintained within the rack; this solution is outside the scope of this document.

The second resolution is to change the thermal profile by accessing the Dell Chassis Management Console (CMC) command line SSH console, also known as RACADM. To raise the minimum fan speed, use the following command:

```
racadm config –g cfgThermal –o cfgThermalMFSPercent <percentage>
```

Where `<percentage>` is a value between 30 (the default fan speed) and 100. Enter 0 to switch back to the default setting.

To confirm the setting, enter the following command:

```
racadm getconfig –g cfgThermal
```

The `<percentage>` value that you specify will persist across CMC firmware updates but will need to be reset if the CMC is replaced.

More Information

For more information on how the path of air flow occurs in a Dell M1000e enclosure, review the section 'Heat Dissipation' (Dell, 2013) in the *Dell PowerEdge M1000e Technical Guide* which describes further the air flow within the Dell enclosure.

For more information on the concepts of air containment, read the technical white paper *'Universal Application and Benefits of Air Containment: A Practical Guide'* (David L. Moss, 2009), which provides an in depth discussion on the fluid dynamics within an environment. This should also be read along with the more in-depth article '*IT Equipment Response to External Pressure*' (David L. Moss, Robert B. Curtis, 2009) which describes the effect on IT equipment.

Bibliography

David L. Moss (2009). *Universal Application and Benefits of Air Containment: A Practical Guide*. Retrieved March 21, 2014, from Dell.com: http://i.dell.com/sites/content/business/solutions/whitepapers/fr/Documents/containment-systems-considerations-12182009_fr.pdf

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