PowerEdge MX7000 Acoustical Options

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SUMMARY

For the majority of PowerEdge MX7000 deployments, the acoustical experience meets customer expectations.

For customers deploying MX7000 in noise-sensitive areas, a three-pillar strategy can help reduce the acoustical noise output.

These pillars are: Configuration selection; Software settings; and Acoustical hardware.

Today's server market is a challenging place to build quieter servers. Virtually every new generation of components require more power to drive incredible new features. Increased power means increased heat generation, stimulating increased airflow to achieve required cooling. For technology-dense data center products like the Dell EMC PowerEdge MX7000, increasing fan speed is the prescribed approach to deliver new features, though it comes with some acoustical output tradeoffs.

Leveraging the new efficient thermal design of the MX7000[1], the acoustical design of MX7000 fits well within the Dell EMC metrics for standard unattended modular data center products. However, Dell EMC acoustical engineers are aware of unique permanent or temporary applications where customers show increased acoustical noise sensitivity. For these applications, Dell EMC recommends a three-pillar strategy to achieve the desired level of noise for your application:

- Configuration selection;

- Software settings

- Acoustical hardware

Note: The MX7000 is not appropriate for office or general-use space deployments with or without the following pillars.

Image 1: The PowerEdge MX7000 modular platform

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Configuration Recommendations

The most effective strategy for reducing acoustical output starts at the point of purchase. Though specific configuration recommendations are difficult to provide due to the wide range of workloads and applications that the MX7000 system supports, the following guidelines can be used to understand tradeoffs and optimize a system for a specific application space.

- Typically sled fans (rear fan modules) are the loudest component in the system, therefore reducing the total power consumption on individual sleds is the most successful approach to reducing acoustics. Choose lower wattage components, especially CPUs, and optimize DIMM counts to reduce sled power consumption.

- For compute sled configurations (MX740c & MX840c), CPU thermal design power (TDP) drives cooling requirements of the sled for most workloads. Choose the lowest TDP required achieve workload requirements. Where possible choose general purpose processors over low core-count or frequency optimized models to achieve lower acoustical output.

- For IOM-A/B options, 10 GbT and 25 GbE pass through, fabric expander (MX7116n) module and the switching module (MX5108n) provide better acoustical experience. Fabric switching engine (MX9116n) requires higher fan speeds to cool, which may compromise efforts to reduce acoustics.

- For IOM-C options, SAS storage IOM (MX5000s) requires lower fan speeds than the fibre channel module (MXG610s).

- When sled or module slots are empty, blanks must be installed to achieve efficient cooling and keep fan speeds from increasing.

The following table lists three configurations designed for specific workloads and deployment in attended data center applications.

Table 1: Select configurations that are designed for deployment in attended data center spaces.

Component	Computational	Transactional	Virtualization
MX740c	8^1	8^2	6^3
MX840c	0	0	0
MX5016s	0	0	2^3
IOM A1	10GBT PTM	25gbe PTM	10GBT PTM
IOM A2	10GBT PTM	25gbe PTM	10GBT PTM
IOM B1	10GBT PTM	Blank	Blank
IOM B2	10GBT PTM	Blank	Blank
IOM C1	Blank	MXG610s	MX5000s
IOM C2	Blank	MXG610s	MX5000s

1. Computational MX740c sled configured with 2 145W CPUs, 12 32GB DIMMs, 4 1.6TB NVME SSD drives, 2 25Gb Mezzanine cards, and an H740 PERC.
2. Transactional MX740c sled configured with 2 135W CPUs, 12 32GB DIMMS, 6 1.6TB 12Gb/s SAS SSD drives, 2 25Gb Mezzanine cards, 1 Fiber Channel MMZ, 2 M.2 Drives
3. Virtualization MX740c configured with 2 135W CPUs, 12 32GB DIMMS, 6 1.6TB NVME SSD drives, 2 25Gb Mezzanine cards, 1 H745P PERC. MX5016s configured with 16 1.6TB SAS SSD drives.

Sound Cap

For some MX7000 deployments, noise sensitivity may be situational and/or temporary. For these applications Dell EMC developed a software-based solution that can be enabled on demand. Sound cap is a custom thermal profile available in the BIOS and iDRAC GUI on MX740c and MX840c sleds. The sound cap feature limits acoustical output by applying a percentage-based power cap to the CPU. Therefore, acoustical output reduction comes at some cost to system performance.

Currently, sound cap must be enabled manually in each compute sled installed in an MX7000 chassis to be most effective. Sled reboot is required to enable or disable sound cap. Currently, sound cap can only be enabled in a sled iDRAC interface or in the BIOS options during sled boot up, sound cap cannot be enabled through MSM.

Table 2: Sound power[1] impact for typical and feature rich configurations of PowerEdge MX7000 chassis when all CPUs are stressed to maximum power.

Configuration	Sound Power with All CPUs @ Max Stress, Sound Cap Off, (bels)	Sound Power with All CPUs @ Max Stress, Sound Cap On, (bels)
Typical A[2]	9.3	6.9
Typical B[3]	9.3	6.8
Feature Rich[4]	9.3	7.6

1. Sound power reported in this table represent engineering measurements collected during the course of development and are not official declared sound power measurements for MX7000. For official MX7000 sound power output data, refer to the MX7000 environmental data sheet.
2. Typical A configuration includes 4 MX740c sleds, 2 MX840c sleds, 4 MX5108n IOMs and 2 MXG610 IOMS. MX740c sleds configured with 2 140 W TDP CPUs, 12 32 GB DIMMS, 6 1.6 TB SAS SSD Drives, 2 25 Gb Mezzanine Cards, 1 Fibre Channel MMZ. H740+ PERC. MX840c sleds configured with 4 165 W TDP CPUs, 48 16 GB DIMMS, 6 1.6 TB NVME Drives, 2 25 Gb Mezzanine Cards, 1 Fibre Channel MMZ.
3. Typical B configuration includes 6 MX740c sleds, 4 MX5108n IOMs and 2 MXG610 IOMs. MX740c sleds configured with 2 140 W TDP CPUs, 12 32 GB DIMMS, 6 1.6 TB SAS SSD Drives, 2 25 Gb Mezzanine Cards, 1 Fibre Channel MMZ. H740+ PERC.
4. Feature Rich configuration includes 6 MX740c sleds, 2 MX5016s sleds, 2 MX9116n IOMs, 2 MX7116n IOMs, and 2 MX5000s SAS Switches. MX740c sleds configured with 2 165W TDP CPUs, 24 32 GB DIMMs, 6 1.6 TB NVME Drives, 2 25 Gb Mezzanine Cards, H745p PERC. MX5016s sleds configured with 16 1.6 TB SAS SSD,

Acoustical Baffle

Finally, for persistent acoustically-sensitive deployments, Dell EMC has developed a hardware baffle solution, available as an optional add-on package to the MX7000 chassis. The baffle fits behind the MX7000 chassis and is designed to reduce the acoustical contribution of the rear fan modules. The baffle features a tool-less install; and fits within a standard rack depth without impacting cable management or rack door operation.

For more information about the MX7000 Acoustical baffle, see the *Direct from Development* tech note, "PowerEdge MX7000 Acoustical Baffle".

Customer-driven design

During product development, the MX7000 acoustical baffle and sound cap were tested under iterative usability studies. 26 IT professionals provided their experiential insights and acceptable performance tradeoffs for the MX7000 acoustical baffle and sound cap under simulated MX7000 workloads. The baffle alone was reportedly effective in reducing some shrill tones, even at 100% CPU utilization. Usability testing resulted in resoundingly positive testing scores, as the baffle scored the highest grade averaging an 'A'. IT Professionals reported the acoustical benefit of shrill tones being blocked, making the MX7000 an acceptably quiet chassis to work around. Thus, the sound cap coupled with the acoustical baffle was worth the acoustic-to-performance trade-off in certain work environments. In these unique work scenarios, peer communication and employee discomfort-to-noise can be managed where employees may be mandated to work around exceptionally loud blade servers.

Conclusion

The new PowerEdge MX7000 chassis is a versatile and dense modular infrastructure that comes with acoustical noise tradeoffs. For the majority of MX7000 deployments in unattended data centers, the acoustical experience will meet customer expectations. For customers deploying MX7000 in noise sensitive areas, these three pillars can help reduce the acoustical noise output of the PowerEdge MX7000.

Notes:
1. See the Direct from Development tech note, "*PowerEdge MX7000 Chassis Thermal Airflow Architecture*"

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