ACOUSTICAL DESIGN IN POWEREDGE SERVERS

Technical Note by:

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SUMMARY

Acoustic Design is a key part of PowerEdge server development.

PowerEdge Acoustical Engineering works cross-domain with numerous allied teams to ensure that sound quality, transient, and sound power level targets are achieved.

International standards are results of customers response studies are incorporated into the targets.

The acoustical output of each server model is designed to respond to configuration, operating environment and intended use.

The Sound of Servers

Sound is one of several byproducts of power utilization in a computer, along with heat, vibration, electromagnetic radiation, etc. Fans or blowers are usually the main sources of sound. They spin (some up to 20,000 revolutions per minute) to move air that removes heat generated when processors, solid state drives, rotational drives, memory, etc., are exercised. Three components typically characterize fan noise: broadband whooshing when airflow impacts obstructions; whistles or sirens as the blades pass; and hums or buzzes when fan vibration shakes its enclosure.

Spinning media such as hard disk drives or optical disk drives might tick, ring, hum, or buzz as they spin or as their heads move to read or write data. Electrical components such as capacitors, transformers, etc., swell and contract in time with applied alternating current and can cause tapping or popping sounds. Finally, human interaction can result in sound during latching of a cover, installing a computer onto rails or components into place.

Noise Perception

The mere fact that a word such as “noise” is used means that someone hears and responds to something. In Dell EMC server acoustical design, the focus is on features that would cause distractions from a person’s job at hand. Three elements are fundamental: amplitude, frequency content, and changes with time. Values for two different amplitude metrics are provided in the table below with respect to familiar noise experiences.

Value measured at your ears		**Equivalent familiar noise experience**
LpA, dBA, re 20 µPa	**Loudness, sones**	
90	80	Loud concert
75	40	Data center, vacuum cleaner, voice must be elevated to be heard
60	10	Conversation levels
45	4	Whispering, open office layout, normal living room
35	2	Quiet office
30	1	Quiet library
20	0	Recording studio

Dell EMC Specifications

Dell EMC customers work with servers in a wide array of environments and under a range of workloads. Dell EMC acoustical specifications and design have been derived accordingly. Where industry standards exist and are appropriate, such as ISO 7779, they are applied. Complementary to these standards are studies in which usage, deployment, and/or configuration scenarios have been provided to customers, to garner their responses to accompanying controlled sounds. Specifications for transients, sound quality, and other features are analyzed and updated from these customer response studies. For these studies, the acoustical team works with usability experts, and in this way, Dell EMC acoustical design focuses on the types of noises that affect actual users.

Dell EMC Design

Early in a new server's development cycle, when it still resides as a concept on paper or in CAD software, the types of workloads, deployment environments, and customer desires for the new server are evaluated for the appropriate acoustical targets, i.e., in what type of environment and how will the server be operated. To plan to meet customer requirements, acoustical engineers propose a server layout and technology strategy to their chief allies in thermal engineering and thermal controls, in order to identify the most efficient means of cooling. This may entail iterating on fan types and locations, locations of key server components, isolation schemes, mechanical damping, how the fans ramp or fall with server events, etc. Acoustical models are used to refine the approaches, and collaborative work with mechanical, industrial design, power, reliability, and other teams yields designs that may accomplish several teams' objectives simultaneously or present reasonable compromises among tradeoffs. As a server progresses from prototype to ready-to-ship, its sound quality, transient, and amplitudes are validated to specifications.

In Conclusion

Dell EMC server acoustical engineering takes a comprehensive view of computer sound, how it relates to users, their environments and workloads, and formulates specifications and designs to control it. Acoustics is a byproduct primarily of fans and blowers that move air to cool the many heat-generating components in a computer. Other sources of computer sound include spinning media, electrical components, and human interactions. Although sound is often described one-dimensionally in terms of its amplitude, several other attributes describe human experience of sound, such as frequency content and changes in time. Specifications at Dell EMC reflect the wide tapestry of sonic features and moreover relate to users' environments and workloads. The engagement for acoustical specification and design begins in the infancy of a new server, well before even the first hardware prototype. After negotiations with various teams but primarily thermal and thermal controls teams, an acoustical strategy is set and carried out through development and shipment

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To learn more about the acoustical design of PowerEdge Servers see the white paper here

For acoustical metrics of each model of PowerEdge server, refer to the white paper here

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