Waves SoundGrid
Audio-over-Ethernet Networking & Processing Platform

Overview
SoundGrid is an Audio-over-Ethernet networking and processing technology developed by Waves. SoundGrid provides extremely low latency, high channel-count Waves audio processing using standard Intel CPUs and 1Gbps Ethernet networks for live sound and other real-time professional audio applications. Real-time audio processing is performed on standard Intel-based plug-in servers, running a Waves-customized real-time version of Linux.

Audio Transport and System Control
SoundGrid is a proprietary Ethernet Layer 2 protocol and EtherType.
Audio is transported and routed between networked I/O devices and is processed on Plug-in Servers connected to the same network. The I/O device converts SoundGrid packets to standard and proprietary audio protocol schemes.

Audio Processing
Taking advantage of today's extraordinary CPU power and the memory capabilities of Native processing, SoundGrid runs on standard CPUs under custom optimized Linux OS, resulting in predictability, stability, and low latency that was previously exclusive to dedicated DSP-based systems. Consequently, SoundGrid can run large numbers of Waves plug-ins, as well as extremely CPU-intensive plug-ins that are beyond the capabilities of DSP-based systems.

Separate computers form the basis of the SoundGrid processing ability:
- SoundGrid Server(s), CPUs dedicated exclusively to audio processing running a customized Linux OS that is optimized for audio processing.
- SoundGrid Host, a standard Windows or Mac computer that runs the SoundGrid host application and GUI functions.

This division of labor between the audio processing CPUs and the host application CPUs is the key to the high performance, stability, and low latency achieved by SoundGrid.

Audio Interfacing
Audio is interfaced with SoundGrid by integrating a SoundGrid-programmed FPGA (Xilinx Spartan 3) into a mixing console's I/O ports. The FPGA receives I^2S or other audio signal formats and converts them to the SoundGrid format. The FPGA is also used to transfer control messages between control nodes external to the SoundGrid network and the SoundGrid control application.

Control Software
SoundGrid audio processing, connections, system configuration and monitoring are controlled by the MultiRack SoundGrid control application, which runs on standard Windows and Mac computers, including embedded systems. MultiRack SoundGrid displays rows of virtual plug-in chains, named Racks, each of which chains up to eight Waves plug-ins. A Rack processes audio coming from a user-selected input and sends the processed output to a user-selected output. MultiRack SoundGrid offers remote parameter control and navigation over MIDI, or over an inter-application API by integration with the console's host application.

System Configuration

System configuration data is part of the SoundGrid protocol, allowing the user to:

1. Connect and route audio between system components
2. Configure I/O devices
3. Configure Plug-in Servers
4. Set system sample rate, block size, and latency
5. Monitor and control system and component status
6. Set redundancy and recovery modes

Scalability

SoundGrid systems can be easily configured for optimal effectiveness per channel-count, processing capabilities, routing, and sample rate, and are easily scaled and expanded by adding I/O or processing devices as required.

SoundGrid Integration Options
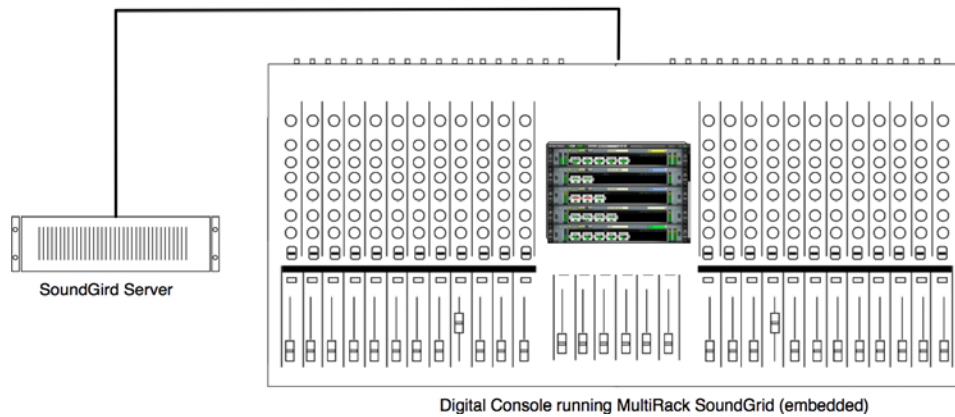
Figure 1, *SoundGrid Full Integration*

Digital Console running MultiRack SoundGrid (embedded)
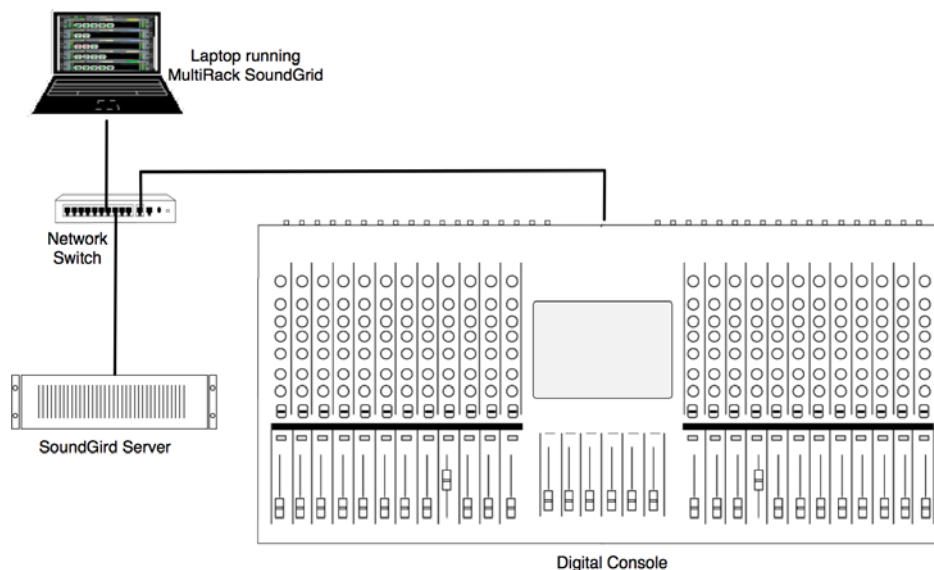
Figure 2, *SoundGrid Semi-Integration*

Digital Console

Figure 3, *SoundGrid Extended Network*

SoundGrid Network

FOH Console

SoundGrid Servers

Control Computer

Live Broadcast OB Van

Stage Box

Personal Monitoring

Recording/Playback

Monitoring Console