

Network Terminology Applicable to RAVE

This reference document discusses some common acronyms and terminology in use by the network and data communications industries. The definitions that follow each term are in the context of their application in a RAVE or CobraNet network environment. Additional nomenclature can be found in the RAVE User's Manual and on the Peak Audio website.

ATM Asynchronous Transfer Mode (ATM) is a network protocol that uses a fixed packet (cell) length. ATM networks are popular for delivery of audio and video due to predictable latency. Although protocol bridges providing Ethernet to ATM conversion have been used in RAVE network designs, QSC Audio does not include this support with the purchase of RAVE products.

References: ATM Forum Standards, Peak Audio website (disclaimer).

Backbone This term is most often applied to the aggregate bandwidth available to an entire switch domain, LAN or WAN.

Back plane Back plane is often used interchangeably with backbone. However, back plane usually refers to the aggregate bandwidth available amongst all ports within a switch.

Blocking/Non-Blocking Blocking refers to the inability of a network switch back plane to handle all of its port activity under full load. Consider a switch that has 10 ports at 100 Mbps each. In order to support full duplex operation under full load, the switch back plane must provide at least 2 Gigabit of activity (10 ports x 100Mbps x 2) to support a non-blocking architecture. A non-blocking architecture is not required by RAVE devices. However, modern switches are generally shipping with more than enough bandwidth to support all ports under full load conditions.

Bundle Bundle refers to the grouping of audio channels for delivery over the RAVE or CobraNet network. A bundle can be thought of as a continuous virtual connection between two or more CobraNet devices on a network. Each bundle is given a value, which associates an origin to a destination(s) on the network. The complexity of user intervention is reduced by assigning bundle values rather than the physical address of each RAVE or other CobraNet device. The bundle value also determines the method of

delivery. Delivery methods support one-to-one and one-to-many audio communications. Each bundle carries from 0 to 8 audio channels, depending on the user's configuration.

References: CobraNet Technology datasheet.

Channel Channel refers to the discrete audio channels that are being routed or processed on a RAVE or CobraNet network. The channel term is sometimes referred to as sub-channel. Sub-channel is seen in earlier documentation prior to the adoption of the term "bundle" for network routing group.

References: CobraNet Technology Datasheet.

Core Switch A core switch is found at the center of a network and generally links to other switches via high bandwidth uplinks. A core switch can efficiently redistribute Ethernet frames due to reducing switch hops and its faster wire speed switch links. Core switches also provide a logical point for system management.

Edge Switch Edge switch has many definitions, which are dependent on the technology and context. With RAVE networks, we refer to an edge switch as a desktop or local switch, which links directly to the RAVE products. Edge switches generally support 10/100 Mbps ports with a larger copper or fiber uplink. The ATM world refers to edge switches as Ethernet to ATM bridges, usually as NICs in a PC or blades in a ATM switch.

LAN A Local Area Network (LAN) is a group of two or more devices communicating with each other within a localized geographic area. Could we get any more vague? A practical definition is that a LAN implies a group of communications devices utilizing a homogeneous network protocol. *Distribution* of data communications is typically at layer 1 and 2 (repeaters and switches). CobraNet audio is a LAN technology, though control and monitoring may be managed over a WAN. A small corporate intranet may also use a LAN architecture.

Layer 1 Refers to the lowest layer of the Open Systems Interconnection (OSI) model, also known as the physical layer. Layer 1 defines the physical and electrical aspects of an Ethernet or CobraNet device connection. This includes the wire speed (such as 10Mbps, 100Mbps or 1Gbps) as well as the media type (such as twisted pair copper or multi-mode fiber optic cable). The CobraNet interface in RAVE products directly supports 100BaseTX (100 Mbps over unshielded twisted pair copper) only. Faster wire speed and additional media types are available through inter-switch links and media conversion. Network repeaters operate at the physical layer. Repeaters blindly redistribute Ethernet frames to all nodes except the point of origin.

References: IEEE 802.3u, IEEE 802.3z...CobraNet Technology Datasheet.

Layer 2 Refers to the OSI model's data link layer, which is just above the physical layer. Layer 2 defines the Ethernet protocol and is where Ethernet frame assembly and disassembly takes place. The data link layer consists of the logical link and media access control (MAC) sub layers. CobraNet *audio* distribution takes place at the data link layer

using MAC addressing (not IP). Conventional network switches also operate at the data link layer. This allows a network switch to read the MAC address of an Ethernet frame and forward it only to its intended destination.

References: IEEE 802.2, IEEE 802.3, CobraNet Technology Datasheet, switch product manuals.

Layer 3 Refers to the network layer of the OSI model. This is where packet fragmenting and reassembling occurs. Layer 3 is the equivalent of the Internet Protocol layer of the TCP/IP suite of protocols. RAVE products use IP for firmware upgrades and control and monitoring activity. *IP is not used for audio distribution.* Network switches are becoming increasingly capable at layer 3. Complex switches may offer IP filtering, some true routing capabilities and additional system management features. Some of the larger RAVE networks use layer 3 devices for remote system monitoring and configuration over a WAN connection.

References: RIP, IGRP, NAT etc., TCP/IP suite, switch and router product manuals.

MI The management interface (MI) is the means of accessing control and monitoring functions in the RAVE products. The MI on RAVE is accessible through the front panel rotary encoding switches and through common software that supports Simple Network Management Protocol (SNMP). Software access provides the greatest configuration and monitoring control of the RAVE devices.

Over-subscription Over-subscription refers to the ability of a single path to handle all of the ports connected to it at full load. Over-subscription is expressed as a ratio of all possible traffic referenced to the available bandwidth. Values less than 1 are desirable. Consider an uplink path on a given switch. If the switch has 10 full-duplex 100 Mbps ports, then a 2 Gigabit uplink would be required to handle all of the possible traffic under full load. However, a small non-managed switch is more likely to have only a single Gigabit uplink port. The over-subscription ratio would then be 2:1. Typically, over-subscription values are calculated on estimated full load conditions. This because maximum bandwidth consumption per port is usually much less than the wire speed.

Partition Partition simply refers to segmenting a network into LAN, VLANs or via various packet or frame filters.

Port Trunk Port Trunks refers to a pair of Ethernet switches or routers that have two or more port connections between them (inter-switch links). The trunk consists of multiple connections between the two switches such that they behave like a single virtual port. The trunk provides greater bandwidth capacity and fault tolerance. A trunk with 4 100 Mbps connections operating at full-duplex provides 800 Mbps bandwidth. If one connection should fail the remaining 3-port trunk assumes the full workload.

References: IEEE 802.1Q, Cisco's ISL, switch and router product manuals.

QoS Quality of Service. This pertains primarily to the ability to prioritize network traffic. With QoS it's possible to give CobraNet audio the highest throughput priority on

an Ethernet switch. In so doing, other forms of traffic may be dropped from the network first when saturation occurs (bandwidth exhaustion).

References: IEEE 802.3p, IEEE 802.3Q, switch product manuals

Repeater Ethernet repeaters are most commonly referred to as hubs. Repeaters are half-duplex devices that blindly redistribute Ethernet frames to all ports except the origin. Since all ports receive each transmission, delivery of frames is limited to one node at a time. Unlike network switches, all ports on a repeater occupy the same collision domain. Multiple transmissions simultaneously will cause a collision event. In the event of a collision, frames are discarded and each failed transmitter must try again. It should be noted that collisions are avoided with CobraNet audio on network repeaters due to delivery control embedded within the protocol. However, RAVEs should exist on a dedicated network when connected to repeaters, as data communications can disrupt audio delivery.

SNMP Simple Network management Protocol (SNMP) is the network industry's common protocol for management of network devices. SNMP allows the designer to define a group of objects for a particular piece of hardware. The objects may be intended for configuration of device parameters or for reporting operating events and statistics. CobraNet supports SNMP for viewing and manipulating MI variables. RAVE products support MI access through SNMP. The SNMP interface allows configuration of bundle assignments, channel resolution and a wealth of other parameters.

References: RFC 1157, RFC 1213, CobraNet Technology Datasheet.

Spanning Tree Protocol Refers to the IEEE 802.1D standard for redundant links between network devices. Spanning Tree Protocol (STP) allows a network to be wired in a ring topology without the problems of undesirable loops or broadcast storms. STP ensures that only one link between nodes is enabled at any given time. In the event of a severed connection, a redundant link can then be activated. STP is available on many managed switches and can be used with RAVE networks where mission critical communications are required.

References: IEEE 802.1D, RFC 1493, CobraNet Technology Datasheet.

Switch Ethernet switch refers to a layer 2 device that can read an Ethernet frame, determine the intended destination of the frame and then forward/regenerate the frame to the recipient. The ability to read the destination address of each Ethernet frame allows a switch to efficiently redistribute frames to only the intended recipients. Ethernet switches provide isolated collision domains at wire speed for each port. The broadcast domain may be global or partitioned with the use of VLANs on a managed switch. Managed switches are user-configurable and may offer numerous advanced features. Non-managed switches operate like older Ethernet port bridges except that frame distribution is performed with dedicated hardware. The term switch refers to a dedicated connection (analogous to a closed switch contact) between the frame origin and destination point(s).

Switch Meshing Meshing refers to load balancing between switches. Meshing is similar to port trunks in that there are multiple connections between switches. However, meshing can span multiple switches and the wire speed of each link can be dissimilar. Unlike STP, meshing keeps all connections active and switch intelligence assures that only one path is available for a given Ethernet frame. Meshing allows a switch to quickly choose the fastest path available. This tends to balance the workload among the mesh domain (switches participating with multiple inter-switch meshed ports). Complex RAVE networks may use switch meshing to reduce hardware, through load balancing, and provide an additional measure of fault tolerance.

References: Hewlett Packard product manuals.

Uplink Uplink ports are available on network switches and repeaters. Uplink ports allow connection between switches or repeaters without the use of cross-over cables. Additionally, uplink ports may have faster wire speeds or consist of multiple ports that provide a greater overall bandwidth capacity. Some uplink ports provide media conversion or protocol translation, such as with an Ethernet to ATM uplink.

VLAN Virtual Local Area Network refers to logical isolated LAN segments that share the same switch hardware. With a managed switch, network traffic can be segmented into multiple VLANs, effectively isolating traffic between domains or communication types. A RAVE network can make use of VLANs to isolate CobraNet audio from data communications. The audio VLAN can then be assigned the highest priority for data throughput.

References: IEEE 802.1p, IEEE 802.Q, ISL, switch product manuals.

WAN A Wide Area Network (WAN) is a group of two or more devices communicating with each other over a wide geographic area. A practical definition is that a WAN implies a group of communications devices that may be utilizing dissimilar network protocols. This means that routers and gateways may be included in the WAN design. *Distribution* of data communications is typically at layer 3 (IP). A corporate network that is accessible from offices in Chicago and New York is an example of a WAN. The Internet is an example of a huge WAN.