MPEG PowerStream and Networking FAQ

Q. **What is MPEG PowerStream?**
A. MPEG PowerStream is a high quality video streaming application that supports the Vitec MPEG Profiler MPEG1/2 encoder. Built on DirectShow Architecture it's main function is to broadcast live or pre-recorded content over IP Networks including LAN, ATM, Satellite and ASDL networks.

Q. **So what can I use MPEG PowerStream for?**
A. MPEG PowerStream is ideal for applications that involve distance learning, business TV, corporate communication, e-commerce, Broadband Internet broadcast, video servers upload related applications, computer based training, surveillance systems, manufacturing process monitoring, high-quality value added videoconferencing systems, transportation surveillance, archiving and retrieval of video source and video library.

Q. **I'm a system integrator. I don't want a stand-alone application, what can I do?**
A. Since MPEG PowerStream is based on the Microsoft standard DirectShow Architecture, bespoke applications can be easily built using the underlying DirectShow Filters.

Q. **What is DirectShow?**
A. Microsoft DirectShow is an architecture for streaming media on the Microsoft Windows platform. DirectShow provides for high-quality capture and playback of multimedia streams. It supports a wide variety of formats, including Advanced Streaming Format (ASF), Moving Picture Experts Group (MPEG), Audio-Video Interleaved (AVI), MPEG Audio Layer-3 (MP3), and WAV files. It supports capture using Windows Driver Model (WDM) devices or older Video for Windows devices. DirectShow is integrated with other DirectX technologies. It automatically detects and uses video and audio acceleration hardware when available, but also supports systems without acceleration hardware.
DirectShow simplifies media playback, format conversion, and capture tasks. At the same time, it provides access to the underlying stream control architecture for applications that require custom solutions. You can also create your own DirectShow components to support new formats or custom effects. DirectShow Filters are provided automatically through installation of DirectX 8.0.

Q. **What is a LAN?**
A. A LAN or Local Aread Network is defined as a collection of two or more computers that have some communication path between them. Devices known as routers allow the ability to conect multiple LAN together. A router can also connect to a WAN (Wide Area Network). Ethernet is the most popular LAN architecture in use today.

Q. **What is Ethernet?**
Ethernet is probably the most common type of LAN on the Internet. Chances are, unless you are particularly lucky and can afford a Token Ring connection, your office will be interconnected using a Ethernet network.
The Ethernet standard was developed by IBM, DEC, and Xerox, and was published in 1982. It can reach speeds up to 100 Mb/s, and revolves around a protocol known as Carrier Sense, Multiple Access with Collision Detection (CSMA/CD). In the basic design principle of Ethernet, the wire is considered one large pipe, to which every host has access at the same time and on the same level. When a network card has a packet to send, it waits until the pipe is available and then tries to send its own data. If another network card tries to do the same thing concurrently, a collision occurs; both cards abort the transmission and retry after a random amount of time. The randomization of the retry interval ensures that if two packets collide, they will not be resent at the same time again. Needless to say, collisions are bad for your LAN. When they occur, the network stops working– even if for a short amount of time– and its efficiency decreases. Collisions can be caused by many factors, including the number of hosts on the network and the quality of the cabling, and they can affect throughput performance even with minimal amounts of bandwidth usage.
As the Ethernet implementation considers the wire to be one shared data pipe, data has to be divided in chunks of an appropriate size to guarantee an even bandwidth usage to all hosts on the network. This way, each host will only send packets of up to a predefined number of bits, allowing every other network card to participate in the transmission of data. The maximum size that a packet can assume is characteristic to each specific network implementation, and is called Maximum Transmission Unit (MTU). For Ethernet, this value is 1,500 bytes. The division of information in packets makes it also possible to implement an efficient error control system. When a network card sends a packet, a Cyclic Redundancy Check (CRC) value is attached to it. Once the destination host has received the packet, it recalculates the CRC and checks it against the one attached to the packet. If they do not match, the packet is discarded.

Q. **What is an IP Network?**
A. An IP Network is based on TCP/IP, an industry-standard suite of protocols designed for large internetworks spanning wide area network (WAN) links. TCP/IP was developed in 1969 by the U.S. Department of Defence Advanced Research Projects Agency (DARPA), the result of a resource-sharing experiment called Advanced Research Projects Agency Network (ARPANET). The purpose of TCP/IP was to provide high-speed communication network links. Since 1969, ARPANET has grown into a worldwide community of networks known as the Internet.

Q. **What is an IP address?**

A. Every host interface, or node, on a TCP/IP network is identified by a unique IP Address. This address is used to identify a host on a network; it also specifies routing information in an internetwork. The IP address identifies a computer as a 32-bit address that is unique across a TCP/IP network. An address is usually represented in dotted-decimal notation, which depicts each octet (eight bits, or one byte) of an IP Address as its decimal value and separates each octet with a dot.

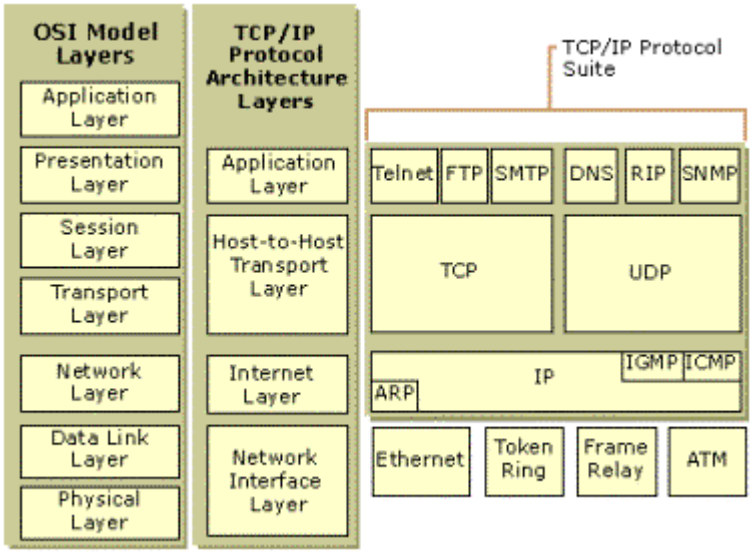
e.g 169.254.217.247

The use of IP addresses allows you to establish a Unicast, Multicast or Broadcast session. The port and IP Address must match on the receiver if you are using Multicast. If you are using Unicast then the IP Address must be set to the IP address of the receiver and the port number must then match on the transmitter and receiver.

Q. **What is TCP/IP?**

A. TCP/IP protocols map to a four-layer conceptual model known as the DARPA model, named after the U.S. government agency that initially developed TCP/IP. The four layers of the DARPA model are: Application, Transport, Internet, and Network Interface. Each layer in the DARPA model corresponds to one or more layers of the seven-layer Open Systems Interconnection (OSI) model.

The figure below shows the TCP/IP protocol architecture. MPEG PowerStream operates using the UDP protocol which is in Layer 4.



The TCP/IP protocol architecture

Q. **What is UDP?**

A. UDP provides a one-to-one or one-to-many, connectionless, communications service. UDP is used when the amount of data to be transferred is small (such as the data that would fit into a single packet), when the overhead of establishing a TCP connection is not desired, or when the applications or upper-layer protocols provide reliable delivery. However, UDP provides no error correction, and so if data packets are lost in transmission, they cannot be recovered.

Q. **What is ATM?**

A. The Asynchronous Transfer Mode (ATM) protocol is a connection-oriented protocol that is ideal for voice, video and data communications. ATM is a high-speed networking technology that transmits data in cells of a fixed length. ATM is a native connection-oriented transport protocol. It is composed of a number of related technologies including software, hardware, and connection-oriented media. A cell is a fixed-length packet containing 53 bytes of information. Since the number of bytes – and consequently the transit time – of the cell is constant, the cells can be switched at a constant interval.

An ATM endpoint establishes a connection or virtual circuit prior to sending any data on the network. It then sends cells along this path toward the destination. This virtual circuit is a direct path from one endpoint to another. While establishing the connection, the endpoint also negotiates a Quality of Service contract for the transmission. This contract spells out the bandwidth, maximum delay, acceptable variance, and other parameters the virtual circuit (VC) provides, and this contract extends from one endpoint to the other. Since the virtual circuit is connection-oriented, the data arrives at the receiving end in proper order and with the specified service levels. ATM is an excellent compromise for the transmission of both voice and data on a network. ATM provides a guaranteed Quality of Service on a LAN, a WAN, and a public internetwork.

ATM is analogous to making a telephone call. To run MPEG PowerStream on an ATM network you must use LAN Emulation.

Q. **What is LAN Emulation?**
A. LAN emulation (LANE) is a group of software components that allows LANE to work with legacy networks and applications. With LAN emulation, you can run your traditional LAN-aware applications and protocols on an ATM network without modification. LAN emulation makes the ATM protocol layers appear to be an Ethernet or Token Ring LAN to overlying protocols and applications. LANE can increase the speed of data transmission for current applications and protocols when ATM is used over high speed media; unfortunately, LANE does not take advantage of native ATM features such as QoS. However, LANE does allow your current system and software to run on ATM, and it facilitates communication with nodes attached to legacy networks. LANE is configured in the ATM adaptor Windows settings.

Q. **What is ADSL?**
A. Asymmetric Digital Subscriber Line (ADSL), is a protocol than can operate over existing telephone wires or through cable modems that operate over coaxial cable television wiring.

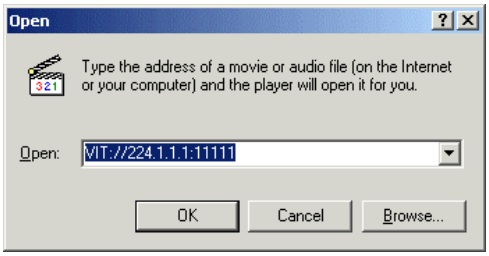
Q. **What is IGMP?**
A. Internet Group Management Protocol (IGMP) is a protocol in the TCP/IP protocol suite that is responsible for the management of IP multicast group membership. IGMP allows the forwarding of Multicast streams and prevents unnecessary network traffic by either routing the IP data to a listening client or blocking IP data if not required at the client at the router.

Q. **How can I improve the performance of my network?**
A. For MPEG PowerStream to work on a LAN it is important to make sure you configure the LAN suitable for Multicasting. The simplest method is to make sure you use a switch rather than a hub. A "switched LAN" reduces the amount of collisions on your network. A hub can be simply viewed as a looped cable that goes from on connector to another. A hub therefore should be avoided at all costs in planning a network topology. Intelligent Routers and Switches that support IGMP should be implemented within the network to make it Multicast-enabled.

Q. **What do I need on my computer before I can load MPEG PowerStream?**
A. For MPEG PowerStream to work you need either Windows 2000 or Windows NT with service pack 5. The MPEG Profiler hardware needs to be installed and working correctly. A network adaptor (10 or 100 base-T) needs to be installed. This network interface must be connected to a network. The minimum configuration is one with the Transmitter and Receiver installed on the same PC and the PC connected to a hub or switch.

The Receiver requires a suitable MPEG decoder which supports DirectShow. Windows Media Player includes an MPEG1 decoder as standard but for MPEG-2 you must install your own decoder.

Q. **How do I receive the Stream?**
A. MPEG PowerStream supports standard IP and ATM networks for delivering the video. These MPEG streams can be received by a standard PC, for in-window viewing, or on regular TV monitor when using a hardware decoder. Any DirectShow compatible MPEG-1 or MPEG-2 decoder can be used. The receiver is started through Window Media Player.



To receive a Multicast stream type in the Multicast IP address and port number using the VITEC Protocol 'VIT'.
i.e VIT://224.1.1.1:11111
To receive a Unicast stream type in the port number only. i.e VIT://:5050

Q. **What is a unicast?**
A. Unicast routing is the process of forwarding unicasted traffic from a source to a destination on an internetwork. Unicasted traffic is destined for a unique address.

Q. **What is a broadcast?**
Broadcast traffic is received and processed by all computers on the network.

Q. **What is a multicast?**
A. In addition to unicast and broadcast support, IP also provides a mechanism to send and receive IP multicast traffic. IP multicast traffic is sent to a single destination IP address but is received and processed by multiple IP hosts, regardless of their location on an IP internetwork. A host listens for a specific IP multicast address and receives all packets to that IP address. IP multicast is more efficient than IP unicast or broadcast for one-to-many delivery of data. Unlike unicast, only one copy of the data is sent. Unlike broadcast, the traffic is only received and processed by computers that are listening for it.
The additional elements of IP multicast include the following:

- The set of hosts listening on a specific IP multicast address is called a host group.
- Host group membership is dynamic, and hosts can join and leave the group at any time.
- There are no limitations to the size of a host group.
- A host group can span IP routers across multiple network segments. This configuration requires IP multicast support on IP routers and the ability for hosts to register themselves with the router. Host registration is accomplished using the Internet Group Management Protocol (IGMP).
- A host can send traffic to an IP multicast address without belonging to the corresponding host group.

IP multicast addresses, also known as group addresses, are in the class D range of 224.0.0.0 to 239.255.255.255 as defined by setting the first four high order bits to 1110. Multicast addresses in the range 224.0.0.0 to 224.0.0.255 are reserved for the local subnet and are not forwarded by IP routers regardless of the Time to Live (TTL) in the IP header.
The IP multicast addresses from 224.0.1.0 to 238.255.255.255 are either reserved or assigned to a multicasting application. The addresses from 239.0.0.0 to 239.255.255.255 are reserved for applications such as MPEG PowerStream. For more information about these addresses, see Boundary settings.

The following are examples of reserved IP multicast addresses:
224.0.0.1 - all hosts on this subnet.
224.0.0.2 - all routers on this subnet.
224.0.0.5 - Open Shortest Path First (OSPF) Version 2, designed to reach all OSPF routers on a network.
224.0.0.6 - OSPF Version 2, designed to reach all OSPF designated routers on a network.
224.0.0.9 - Routing Information Protocol (RIP) Version 2.
224.0.1.1 - Network Time Protocol.

Q. **What is meant by push or pull modes?**
A. Push mode is when the transmitter pushes data to the receivers, pull mode is when the receiver pulls the data from the transmitter (server) . This would appear to achieve the same aim, but there are advantages of each approach. Push can be defined as distribution by demand in that a central server sends information to clients on its own schedule, and the clients have to receive it. Pull is distribution on demand because each client determines what information it will receive and on what schedule. Push is therefore valuable when a lot of data must be widely and quickly distributed. Pull can be more efficient for distributing a great variety of information to recipients with different needs.
PowerStream can be configured so that the sender pushes data, or that the receiver pulls data, thus allowing maximum flexibility in an application.

Q. **What is a UDP port?**
A. To use UDP, an application must supply the IP address and UDP port number of the destination application. A port provides a location for sending messages. A port functions as a multiplexed message queue, meaning that it can receive multiple messages at a time. A unique number identifies each port. It's important to note that UDP ports are distinct and separate from TCP ports even though some of them use the same number. The port and IP Address must match on the receiver if you are using Multicast. If you are using Unicast then the IP Address must be set to the IP address of the receiver and the port number must then match on the transmitter and receiver.

Q. **What are Boundary settings?**

A. Boundary settings are based on TTL (Time To Live) values that prevent the forwarding of IP multicast traffic as illustrated in the table below. TTL-based boundaries apply to all multicast packets regardless of the multicast group.

TTL Threshold	Boundary	Scope
0	Host	Restricted to the same host.
1	Subnet	Restricted to the same subnet.
32	Intranet	Restricted to the same site.
64	Region	Restricted to the same region.
128	Internet	Worldwide.
255	Unrestricted	Unrestricted in scope.

TTL Thresholds and Their Scope

Therefore, setting a Boundary to Intranet on the Boundary interface prevents the forwarding of IP multicast traffic that is intended to be restricted to the site. Only regional or beyond traffic is forwarded.

Q. **How do I set up MPEG PowerStream to work with more than one encoder in a PC?**

A. MPEG PowerStream is configured to work with multiple encoders. You must first install multiple MPEG Profiler Encoders (up to 4) in a single system. By running multiple instances of PowerStream (i.e run the same application more than once), then each instance of PowerStream will use an encoder.

Q. **Can I use set top boxes as receivers?**

A. Yes, as long as the STB is IP-enabled. There are two main types of set top box, those which are really a PC in another guise and those which are dedicated STBs. The dedicated STBs, such as the Pace DSL4000, will only receive streams that are pushed from the server. The PC-type of STB, such as VBox and the Fujitsu-Siemens Activy, will also receive pushed streams and in some cases may also pull streams from the server. It may be necessary to load a PowerStream receiver filter in order to fully exploit the pull features if available. Please refer to the STB specifications for further details.

Q. **I'm not receiving anything what am I doing wrong?**

1. Make sure you can receive on the same computer as you are transmitting. This is the minimum network requirement. The PC you are using must be connected to a switch and it must have a valid TCP/IP Address. Use the default settings of MPEG PowerStream. If you are still unable to receive anything double check your IP settings in the Windows Network configuration. Check that you can 'ping' your network card. 'Ping' is a utility provided in Windows to check your PC is connected to the network.

2. Check your Vitec MPEG Profiler Encoder by performing a 'Write to Disk'. Check you can playback the stream in Windows Media Player. If you are encoding MPEG-2 make sure you have a suitable MPEG-2 decoder in the PC either software or hardware and it is installed correctly.

3. Check you have a valid Multicast address. If you are using Unicast – this will only be received on the PC with the unique IP Address you have specified in the Net Settings of MPEG PowerStream.