

AT&T Connect[®] Video Conferencing Functional and Architectural Overview

**Enterprise Edition
Version 8.8 SP1
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Introduction

AT&T Connect[®] incorporates powerful multi-point desktop video conferencing capabilities that can help employees, customers and partners, collaborate more effectively and intimately—no matter where they are located.

Solution Highlights

- Fully integrated multipoint voice, data and video conferencing solution
- H.264 video codec for superior image quality
- Existing AT&T Connect customers can activate new video capabilities quickly and easily
- Delivers professional interactive video collaboration experience from a desktop or laptop—in the office, at home, or in a conference room
- Simple and intuitive control of video transmission and image layout
- No special firewall configurations required: uses standard outbound port (:80 or :443)—same as a regular web browser
- Robust distributed server architecture routes real-time communication streams in a highly scalable, fault-tolerant, bandwidth-efficient manner
- Special techniques and algorithms for optimizing bandwidth usage and avoiding network congestion
- Administrative control over video bandwidth amount, and over which hosts are allowed to initiate video in their meetings
- Doesn't require IT personnel for setup (if used as a hosted-only service)
- "Software-only" implementation that runs on low-cost commodity server hardware, avoiding expensive proprietary video conference bridge ("MCU") hardware
- Optional AT&T transport services available to ensure video QoS.

Video capabilities

When can video conferencing be activated?

Video conferencing is fully integrated with AT&T Connect. No special scheduling or IT preparations are required to activate video during web conferences.

The System Administrator or Teleconferencing Manager can grant "video privileges" to all, or just some, Hosts in the organization. Video is automatically activated at meeting start if the meeting's Host has video privileges. (The Host can disable use of video if desired.)

Who can transmit video during the conference?

During web conferences, if video is allowed, a specified number of participants with a USB webcam can start transmitting their live video to all other participants at any time. If all available video windows are already in use by other participants, a "busy" message will be displayed.

In "moderated" conferences, only the Moderators can transmit video at will. Other participants may transmit video only when the Moderator has granted them permission to speak in the conference.

Video Layouts

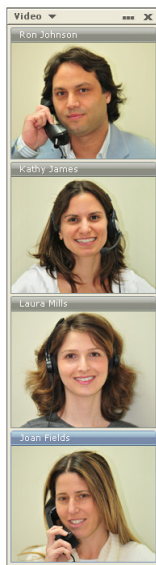
Since web conferences may be conducted in a variety of ways, AT&T Connect offers various video layouts designed to complement the conference requirements. The Host or Presenter can change the video layout on the fly during the conference.

All Same Size—in this layout, all conference participants view live-stream video of multiple participants, while all video windows are displayed at the same size. This layout is recommended for use in interactive meetings, when most participants are expected to share information.

Each standard definition video stream can be displayed in small (176w x 144h) or medium (352w x 288h) windows. If sharing Whiteboard data and video, it is recommended to select the small windows to leave adequate Whiteboard space.

When several video windows are displayed, the user can arrange these windows horizontally, vertically, or in grid formation.





Control Management

The functions of the System Administrator, Host and End-User are described below:

System Administrator

- Defines the maximum video bandwidth (bit rate) that each user can transmit
- Defines the maximum number of simultaneous video windows in a conference (which directly affects the overall transmitted bit rate)
- Defines which Hosts are allowed to utilize video in their meetings
- Defines which Hosts are allowed to use the layouts with large bandwidth consumption, and change the output bit rate of a user's video during the conference

Host

- Enables/Disables video usage during a meeting
- Defines the video layout seen by all participants in the meeting. The options are:
 - **All Same Size**
 - **Picture-in-Picture**
 - **One Video Only** (includes an option to follow the current Presenter)
- Defines the video resolution used for all video windows in the meeting. The options are:
 - Small: 176w x 144h (QCIF)
 - Medium: 352w x 288h (CIF)
 - Large: 640w x 480h (VGA)
- Stops video transmission of a specific user (optional)
- Adjusts the maximum transmitted bit rate of a user's video during a conference (optional)

End-User Control

- Starts/Stops transmitting his/her video
- Pauses his/her video
- Changes the video pane position—floating or docked
- Changes the video pane view—horizontal view, vertical view or grid (relevant to **All Same Size** layout only)
- Full screen—selects to view a specific user's video stream at full screen size

Picture-in-Picture—in this layout, two video streams are combined in a single window, with a smaller video frame set within a larger video frame. By default, the smaller frame shows the local video stream while the larger frame shows the remote stream. A toggle button switches video streams between the two frames. This layout is recommended for one-on-one meetings.



One Video Only—in this layout, one participant broadcasts a single video stream to all other participants in the web conference. The Presenter can select the **Follow Presenter** option, to always display the "current Presenter" as presenting rights are passed from participant to participant during the conference.

This layout is ideal for classroom training and instructional meetings where there is one primary speaker at a time with limited interaction from the other participants.

Usage Scenarios

AT&T Connect Video Conferencing will typically be used in any of the following applications:

One-on-One Mentoring/Interviewing/Consultation

Video-based job interviews or professional mentoring sessions are intimate exchanges with a powerful emotional element. Interviews benefit greatly from live video's ability to transmit body language and emotional reactions. In short, the use of video yields a more natural interaction and intuitive, effective communication.

Picture-in-Picture (PIP) layout is most beneficial for one-on-one video meetings. A local user can view his or her image in the small window, while viewing a remote user's image in the large window.

Team Meeting/Business Meetings

Most meetings fall into this category, which can include:

- Project kickoffs, steering, and updates
- Ad-hoc brainstorming and troubleshooting
- Business meetings with customers, partners or vendors

These meetings can bring together just a handful of coworkers, or involve dozens of participants from related teams. Because these meetings involve the active participation of several users, widespread video coverage is crucial.

All Same Size layout is most beneficial for multiple-user meetings, since all users can view live-stream video of multiple key participants.

Conference Rooms

Often, several people gather in a conference room to participate in a video conference with another group of people who are seated in a different conference room, or with other individuals located in different offices.

Typically, the shared conference-room video stream is sent at VGA resolution at 30 frames per second. When network conditions do not allow this, the conference room video can be transmitted at a smaller CIF frame size.

One Video Only layout is useful for transmitting video between a conference room to one or many long distance participants, and the **Picture-in-Picture** layout is useful for transmitting video between two conference rooms.



Training Sessions and Web Seminars

These are classroom training and instructional meetings where there is one primary speaker and limited interaction from other participants. Presenters can also demonstrate physical equipment and processes in real-time, addressing questions as they arise.

Within these events, the Presenter/Moderator broadcasts a single video stream to all other endpoints in the event. During the event, when participants have permission to speak, they can also broadcast their video.

The **All Same Size** layout is most effective for moderated events.

Dual Monitors

If a Presenter enables the dual monitor mode on his computer, the AT&T Connect Participant Application can be displayed on one monitor and the video pane can be displayed on the other. In this way, the video pane doesn't cover up important information on the conferencing application's Whiteboard.

Architecture

Each AT&T Connect client application connects to an AT&T Connect real-time conferencing server, which is part of a globally distributed network of interconnected communications servers hosted by AT&T. The AT&T

Connect client application transmits an end-user's video from an attached USB desktop web camera. This client application encodes and transmits one outbound H.264 video stream to its connected server. The client application receives multiple H.264 streams from that server, decodes them, and presents them on the client computer's screen, along with any whiteboard data or shared applications being presented during the web conference.

The AT&T Connect communications server distributes incoming H.264 video streams to other servers, and to other connected clients in the conference. If network congestion causes a server's outgoing video streams for specific user(s) to overflow its sending-queue, the server automatically thins or suppresses the outgoing video stream for this user(s) until the congestion clears or more bandwidth becomes available.

Deployment Options

Customers have several options for deploying the AT&T Connect video conferencing solution, depending on the needs of their organization, the types of online Events they wish to conduct, the locations of the users who will attend the Events, and their video quality requirements.

Hosted Service Offering

AT&T Connect video conferencing can be employed as a purely "hosted" service in which the end-users' PC applications connect to the AT&T Connect conferencing servers over public Internet connections (All conferencing traffic is encrypted end-to-end for secure transmission.)

The standard "hosted" video conferencing feature allows using the **Small** and **Medium** video layouts (as specified above). Customers need not deploy any special hardware on their premises, other than the standard USB desktop webcams used by participants. Enabling AT&T Connect on a hosted basis requires no additional networking infrastructure at the customer premises.

However, the customer's premises LAN must provide sufficient bandwidth to support the desired video conferencing traffic, and the customer must have sufficient internet WAN access available from those premises (users who are working remotely from home must have a sufficiently capable broadband connection through their residential ISP). Each inbound or outbound CIF-sized video ('Medium') stream at 15 fps requires approximately 264k bps (including all frame packing, IP header, and Ethernet overhead bytes). Each inbound or outbound QCIF-sized (Small) video stream at 15 fps requires approximately 1044k bps (including all frame packing, IP header, and Ethernet overhead bytes).

By default, the hosted service does not utilize any QoS measures: video streams are delivered on a "Best Efforts" basis. With suitable internet WAN bandwidth, this usually provides acceptable image quality for 96 kbps with 15 fps CIF-sized images, but there is no SLA in this arrangement and video quality can be negatively impacted by Internet traffic congestion beyond AT&T's control. If a given user's network connection has insufficient bandwidth, the AT&T Connect software will automatically attempt to reduce that user's video transmission bit rate (yielding a lower-quality video image). If available bandwidth is still insufficient, the system will automatically suspend video transmission from

the particular end-user, without disturbing video transmission from other users equipped with better network connections.

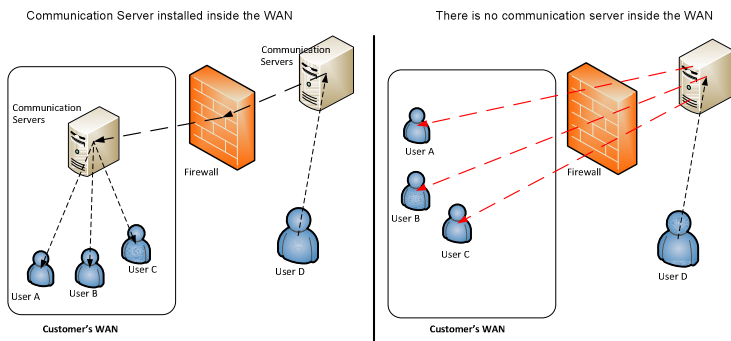
Service Enhancement for Improved QoS

Various options are available to minimize WAN bandwidth requirements, improve video performance and ensure QoS. For example, AT&T MPLS IP VPN transport can be ordered and provisioned (at additional cost) to enable Class-of-Service (COS) prioritization of video packets to/from specific endpoints at designated customer premise locations.

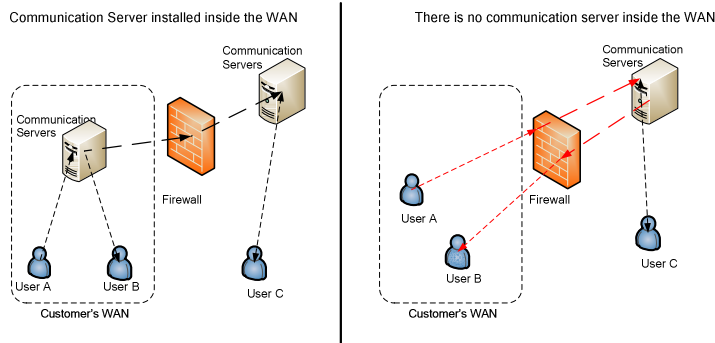
AT&T Connect also offers a unique option to place real-time communication servers on-premises at customer locations with heavy video conferencing needs. End-users located at those premises can connect their computers to the on-site server(s) via the corporate LAN, and the on-site server(s) in turn connect to the hosted AT&T Connect conferencing servers via WAN link. The on-premises servers and the remote hosted servers work together to form a seamless extended, "hybrid" conferencing network: local users connect to the local on-site servers, while external (off-premises) users can connect to the hosted servers, and all participants are joined in the same web/video conference.

A key aspect of the AT&T Connect distributed server architecture is that only a single real-time data stream per sender per conference is sent between any two adjacent servers on the extended network. Thus, no matter how many end-user clients are connected to a given AT&T Connect communications server, only limited bandwidth is used between that server and the rest of the AT&T Connect infrastructure.

Thus, placing an AT&T Connect communication server on-site ensures that when multiple users within that site (users A, B and C) view the video of another remote user (D), only a single copy of D's video stream is sent over WAN through the organization's firewall to the on-site AT&T Connect server, which then replicates the stream to the local on-site users' computers (A, B and C) over the corporate LAN. This replication is accomplished without relying on IP Multicast-enabled routers or IP Multicast "group" administration, and does not require opening multiple UDP ports or using special firewall traversal or NAT-ing solutions. This "local stream replication" capability is especially compelling when conducting large-scale seminars or Town Hall-style meetings in which a Presenter's video stream is being "broadcast" to many viewers grouped at one or more corporate sites. Without the on-premises conferencing server, WAN bandwidth or MPLS bandwidth requirements could be prohibitive.



Using on-site AT&T Connect communication servers can thus reduce WAN bandwidth requirements, and can also ensure better video quality *between users within the same site*, since the video stream between those users travels only through the local on-site AT&T Connect server, without traveling out through the firewall to an external server (unless necessary to serve external (off-site) participants). *For those conferences that involve exclusively on-site participants, the video streams never leave the corporate LAN at all*, thus conserving valuable WAN bandwidth, reducing firewall CPU utilization, and adding an extra measure of transmission security.



COS prioritization can be applied to video streams traveling between the on-premises servers and the remote hosted servers by ordering optional AT&T MPLS transport service. Since AT&T Connect conserves inter-server bandwidth (as described above), it is often possible to achieve good video QoS using a smaller amount of constant data rate MPLS bandwidth, thus lowering operating costs while still delivering a reliable, high-quality video conferencing experience.

Security

Real-time conferencing streams are protected with 128-bit end-to-end SSL encryption. Specifically, all streams (audio, video, whiteboard data, application sharing screen images, etc.) pass from the AT&T client software (on the end-user's desktop) through the AT&T Connect conferencing servers, and on to other end-user PC clients. The streams are never decrypted during this transit.

Even before encryption is applied, the real-time data streams passing between AT&T Connect servers, and between servers and connected clients, are compressed and encoded for bandwidth efficiency and added security.

The architecture of the AT&T Connect solution allows participants who are located behind different firewalls to share their live video without the need for a dedicated ISDN connection. The AT&T Connect client application and on-site servers require only a *single outbound port* (usually port 80 or port 443) to be opened on the corporate firewall. (These are the same requirements typically required for Web navigation using a conventional Web browser.)

System Requirements

Client Computer Requirements

Operating Systems

- Windows 2000
- Windows XP
- Windows 2003
- Windows Vista

Office/Mail Applications

- Office XP
- Office 2003
- Office 2007
- IBM Lotus Notes 6.5 and above

Supported Browsers

- MS Internet Explorer 6.
- MS IE 7.0, MS IE 8.0
- Firefox 2.0
- Firefox 3.0

Hardware and Bandwidth (when using AT&T Connect Video feature)

Hardware:

- Pentium 4 – 2.4 MHz CPU – 32 or 64 bit
- 512 MB or higher
- Monitor with High Color (24 bit) display and at least 800x600 resolution (recommended 1024x768)

Disk Space:

- 12 MB for Participant application installation
- 50 MB to store event materials (Recommended: 100 MB). This setting is configurable

Internet access:

Average, per stream, bandwidth required (client-server connection):

- Small size video-104Kbps
- Medium size video-264Kbps

Please note that the required bandwidth is for the video stream with 15 frames per second. Additional bandwidth is required for other event actions (such as application sharing). More information can be found in the AT&T Connect System Requirements End User v8.8 pdf document.

Supported Video Cameras

- Camera should support CIF resolution or higher (VGA-enabled camera recommended)
- 15 frames per second (fps) or higher (30 fps recommended)
- Video Frame Size: QCIF (176 × 144), CIF (352 × 288)
- IYUV / RGB raw video stream to computer driver