



Lab Testing Summary Report

September 2010

Report 100716

Product Category:

Web Conferencing

Vendors Tested:

Adobe
Cisco
Citrix
Microsoft
Netviewer

Products Tested:

Adobe Connect Pro
Cisco WebEx Meeting Center
Citrix GoToMeeting
Microsoft Live Meeting
Netviewer Meet



Key findings and conclusions:

- Of the products tested, WebEx was overall the most advanced and best solution for handling web conferencing
- Cisco WebEx Meeting Center users experienced:
 - Lowest latency for both sharing desktop and preloaded presentations
 - One of the quickest join times for presenters and attendees
 - Best presentation quality via desktop sharing

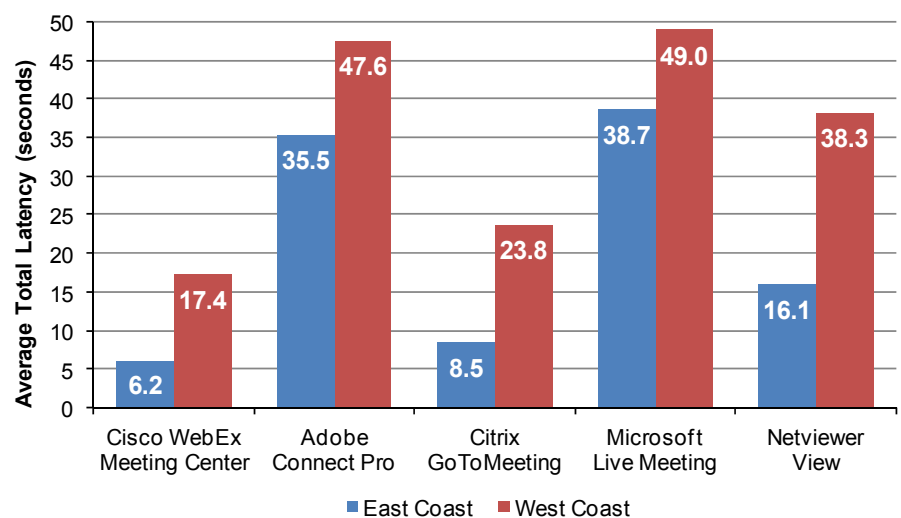
Cisco WebEx Meeting Center was evaluated by Miercom in an assessment of Web Conferencing solutions. We tested Adobe Connect Pro, Cisco WebEx Meeting Center, Citrix GoToMeeting, Microsoft Live Meeting and Netviewer Meet. These products enable live meetings, trainings and presentations through the Internet.

The objective was to evaluate the performance and overall quality of the end user experience when using Web-based meeting solutions.

After hands-on testing, Miercom determined that WebEx Meeting Center users experienced the lowest latency when sharing desktop and pre-loaded presentations and showed the best presentation quality during desktop sharing. WebEx Meeting Center had some of the lowest join times for presenters and attendees.

Figure 1: Latency via Desktop Sharing

Time taken for an action on the presenter side to display at the attendee side



Source: Miercom, August 2010

Latency was measured for static slide transitions, slide transitions to an animated slide and animations within a slide. Cisco WebEx Meeting Center had the lowest latency on both the East and West Coasts. See the Latency section on page 3 for more information.

With its ability to balance efficient bandwidth utilization while providing good Quality of Experience (QoE), WebEx Meeting Center is most advanced among the products in this comparison in handling live Web conferencing scenarios in real time.

On both US East and West coasts, we measured:

- Join times for first time and returning presenters and attendees
- Latency and quality of desktop sharing and pre-loaded presentation sharing
- Network bandwidth usage in different usage scenarios

Join Time

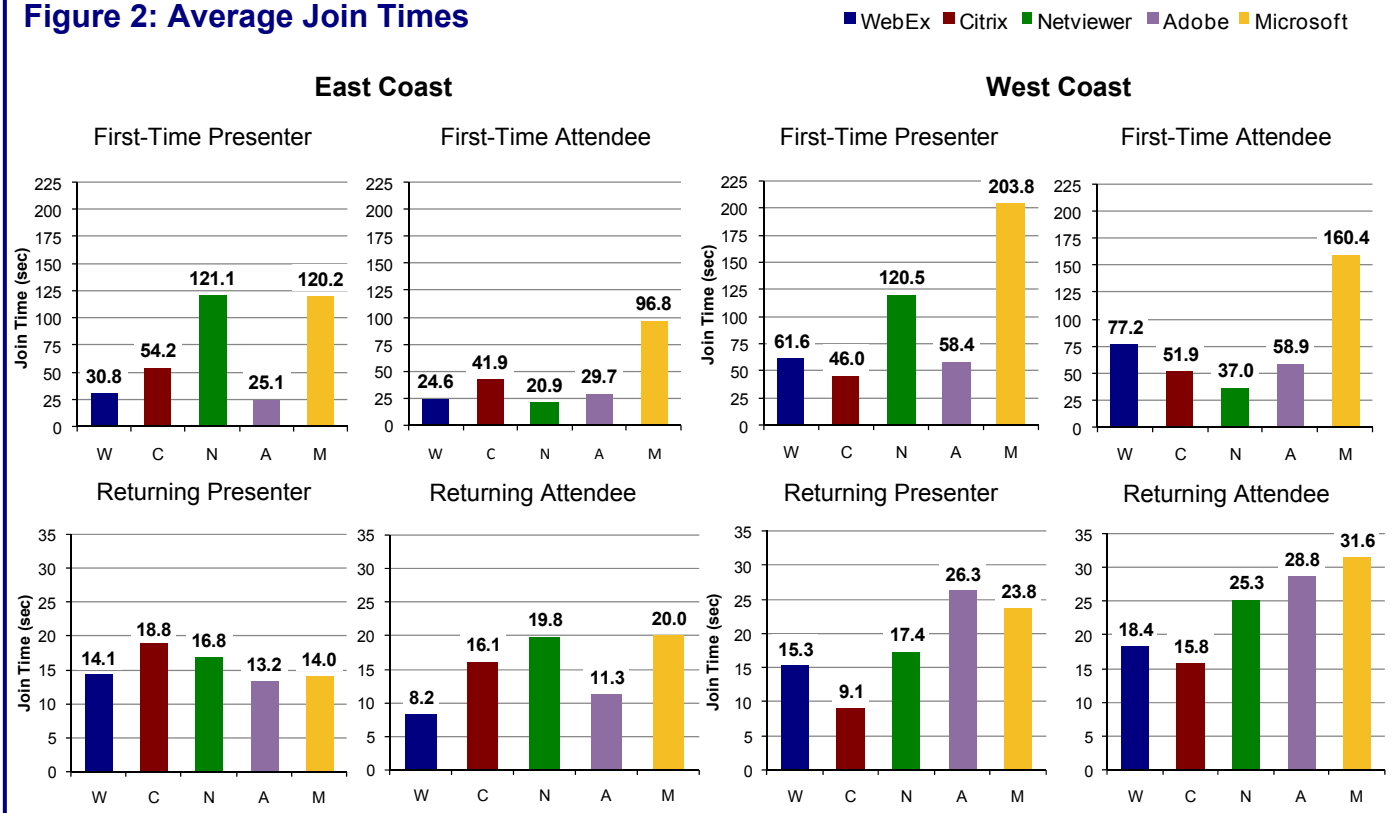
Join time is the time required to start the meeting and includes download and installation of client software. To provide meaningful data, times were recorded for four scenarios: first time presenter and attendee and returning presenter and attendee.

As expected, the join times for first time presenters and attendees were longer, due to software downloads and installs before the meeting could start.

With returning presenters and attendees, join times were shorter since the application was already resident. Only Netviewer repeated the download and installation process for attendees returning to the conference. All measurements were taken during three different times of day on the East and West coasts. There was an increase in the times on the West Coast due to network conditions of the office used.

The time for first time presenters ranged from 25.1 to 203.8 seconds. Returning presenters took from 9.1 to 26.3 seconds. For returning presenters, Adobe had the best join time on the East Coast while Citrix was the fastest on the West Coast. WebEx was second for the East Coast and on the West coast. The first time attendee had times ranging from 20.8 to 160.4 seconds. Netviewer had the best first time attendee time for both coasts. Returning attendees had times ranging from 8.2 to

Figure 2: Average Join Times



Source: Miercom, August 2010

Comparison of join times for first time and returning presenters and/or attendees.

31.6 seconds. WebEx had the best time on the East Coast while Citrix was the best for the West Coast. Microsoft had a significantly longer join time for first time presenters and attendees compared to the other solutions because it required a large client download and install.

Latency

We measured the latency for a PowerPoint presentation on the attendee side when shared by the presenter. Latency is the time delay for an action performed by the presenter to display at the attendee side. The delay was measured for static PowerPoint slide transitions, slide transitions to an animated slide, and animations within a slide. Latency was measured for two user case scenarios: sharing a previously uploaded/cached PowerPoint presentation from a server, and sharing a PowerPoint presentation using desktop screen sharing. All tests were performed during three different times of the day: in the morning, afternoon and evening. Times were then averaged.

Uploaded/Cached PowerPoint: In this test scenario, a presenter shares an uploaded or cached file with the attendee. Typically this type of sharing involves minimal delay and better quality of experience for the attendees. Citrix and Netviewer do not offer this capability. Testing revealed that Cisco WebEx Meeting Center and Microsoft Live Meeting attendees did not experience any latency for both East and West Coast test locations. Adobe Connect Pro attendees experienced a 7+ second delay for both coasts.

Desktop Screen Sharing: This test measured latency when a screen sharing session from the presenter with the attendee using desktop sharing mode is used. This method is more bandwidth intensive, resulting in more delays and a poorer quality of experience for the attendees than sharing via uploaded files. *See Figure 1 on page 1 and Table 2 on this page.*

Quality of Desktop Sharing

A 13-slide PowerPoint presentation was used to evaluate the quality of PowerPoint slides shared with the attendees. Quality for each slide was scored on a 1 to 5 scale, with 5 being best, and based on the following criteria compared to the original PowerPoint presentation: (1) Presence of all objects and animation in the uploaded PowerPoint share; (2) Detail and clarity of picture;

smooth color transitions; (3) No pixilation or grainy colors and maintaining same shades of colors; (4) Clarity of small and rotated text; (5) Preservation of smooth transitions to pixilated, fade out, and animated slide and; (6) Preservation and fluid movement of complex animation within a slide. Individual slide scores were then averaged to obtain the total quality score for each product.

This quality evaluation was conducted for a PowerPoint presentation with uploaded or cached slides from a server and for slides viewed from desktop screen sharing. *See Figures 3 and 4 for results.*

Network Bandwidth Usage

Network bandwidth was measured in terms of average upload and download rates, for different user case scenarios on the presenter and attendee sides.

The bandwidth usage was recorded during 1) desktop sharing with PowerPoint, 2) desktop sharing with PowerPoint and 1:1 webcam and 3) desktop sharing with PowerPoint, 1:1 webcam and VoIP.

During the testing, we observed that increased bandwidth numbers did not necessarily mean better video quality. When presentations were shared via desktop sharing, attendees consumed from 50 to 230 kbps of network bandwidth. Microsoft and

Table 2: Product Ranking for Desktop Sharing Latency

| East Coast | | | West Coast | | |
|------------|-----------|------------|------------|-----------|------------|
| Rank | Product | Time (sec) | Rank | Product | Time (sec) |
| 1 | Cisco | 6.2 | 1 | Cisco | 17.4 |
| 2 | Citrix | 8.5 | 2 | Citrix | 23.8 |
| 3 | Netviewer | 16.1 | 3 | Netviewer | 38.3 |
| 4 | Adobe | 35.5 | 4 | Adobe | 47.6 |
| 5 | Microsoft | 38.7 | 5 | Microsoft | 49.0 |

Ranking of each product for latency delay between presenter action and attendee display. Cisco WebEx Meeting Center had the lowest latency times on both coasts.

Adobe used the least amount of bandwidth when desktop sharing. However, there was a tradeoff, as the user experienced poor image quality, jumpy animation, and choppy slide transitions, as well as loss of color fidelity with Microsoft LiveMeeting. Despite utilizing the least amount of bandwidth, Adobe had similar issues and also suffered from lack of clarity and detail.

Netviewer used the most bandwidth, and its slide quality was good with a presentation using desktop sharing. The desktop sharing quality from Citrix was also good and had high bandwidth usage.

WebEx was in the middle for bandwidth consumption and had very good presentation quality. WebEx is able to efficiently utilize the bandwidth needed to provide high quality desktop

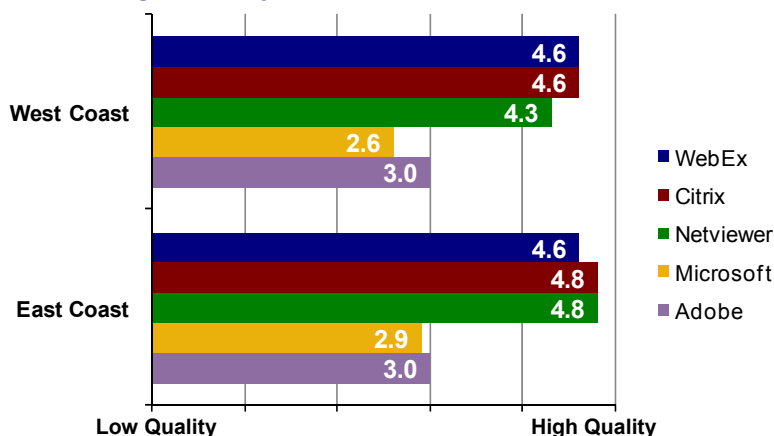
sharing and sharing of a pre-cached presentation. This combination provides the users with a good Quality of Experience (QoE).

Strengths and Weaknesses

Cisco WebEx Meeting Center

Strengths: Had low join times, especially for returning presenters and attendees. Attendees did not experience any latency and could access an uploaded presentation in the least amount of time. WebEx efficiently utilized bandwidth to provide users with good Quality of Experience for desktop sharing. WebEx presentation quality was good for desktop sharing and for uploaded/cached presentations.

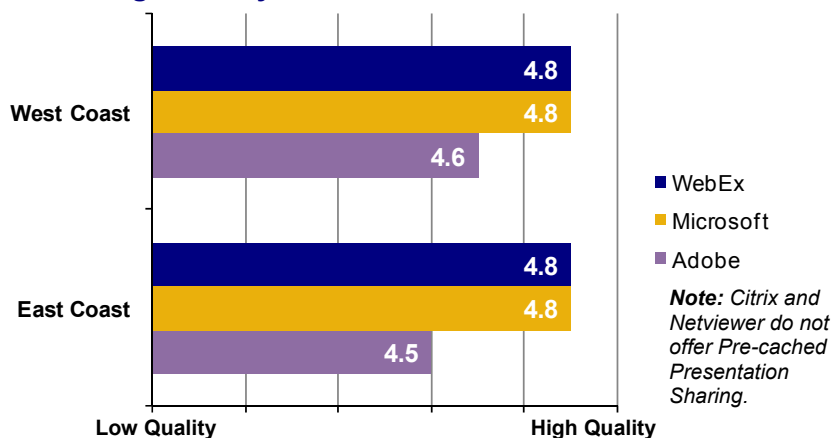
**Figure 3: Presentation via Desktop Sharing
Average Quality Score**



Source: Miercom, August 2010

Desktop screen sharing quality was evaluated using a PowerPoint presentation with 13 slides. The slides contained a variety of slide text of various sizes and orientations, animations and colors. A higher score indicates better quality of experience. Note that results for pre-cached presentations are only available for WebEx, Adobe and Microsoft. Desktop sharing is the only option for sharing presentations with Citrix and Netviewer.

**Figure 4: Presentation via Pre-cached Presentation
Average Quality Score**



Source: Miercom, August 2010

Note: Citrix and Netviewer do not offer Pre-cached Presentation Sharing.

Weaknesses: There was one minor caching error in uploaded presentations.

Adobe Connect Pro

Strengths: Had no loss of webcam video quality for 1:1 video. Like WebEx, it also recorded very low join times for presenters and attendees. In network load observations, Adobe had the lowest download and upload rate for desktop sharing and PowerPoint.

Weaknesses: Recorded high latency when attendees shared an uploaded presentation. Users experienced a consistent latency/delay in all slides. Low bandwidth consumption caused presentation transitions and in-slide animations to be choppy or completely missed at the attendee side. At times, the presentation was distorted from a high number of upload/caching errors.

Citrix GoToMeeting

Strengths: Had the fastest join time on the West Coast for first-time and returning presenters and returning attendees. Audio settings are retained for returning presenters and attendees. Desktop sharing presentation quality was tied for first on both East and West coasts.

Weaknesses: Citrix only offers presentation sharing via the desktop sharing method, which tends to experience more latency than the uploaded/pre-cached presentation option.

Microsoft Live Meeting

Strengths: Showed low join times for returning presenters at both test locations. Users did not experience latency with uploaded files. Live Meeting had the least number of upload/caching errors in uploaded files. Presentation quality for pre-cached presentations was one of the best. Bandwidth usage was among the lowest for desktop sharing.

Weaknesses: Requires a download and installation of a large client program, which increased setup time for first-time presenters. For both coasts, join times were significantly longer than most products evaluated for both first time presenters and attendees. When video

was enabled, Live Meeting had high network load usage. Users also experienced high latency during desktop sharing of presentation. Microsoft had the worst presentation quality for desktop sharing.

Netviewer Meet

Strengths: Had low join times for returning presenters on both coasts. Quality of presentation for desktop sharing was good but with intensive bandwidth usage.

Weaknesses: Netviewer consumed the most bandwidth out of all the products tested. Returning attendees must reinstall the client software before each session. Like Citrix, Netviewer only has desktop sharing available for sharing presentations within a web conference, which tends to experience more latency than the uploaded/pre-cached presentation option.

How We Tested

All testing was conducted in two geographical locations: New Jersey on the East Coast and Northern California on the West Coast. We measured the join times for the downloading and installing of software to enter a meeting for first time and returning presenters and attendees. Join times were compiled for all user case scenarios which included first time presenter, returning presenter, first time attendee and returning attendee. Measurements were taken for each task the user has to perform to join a Web meeting. These measurements took into account the time taken for downloads and installation of any client components. Once the session had been joined, audio and video setup times and ease of setup were recorded.

There were three iterations performed for each test case. In order to ensure that time of day was not a factor in any one test or product, all tests were rotated. There was a morning, mid-day and evening session. Results were recorded only after ascertaining the products were optimized.

We noted latency and quality of a shared application containing static and animated slides when uploaded to a central server, or shared via desktop sharing. Latency and quality of 1:1 webcam video was calculated. Network load/bandwidth utilization was measured for

scenarios including desktop sharing of a PowerPoint presentation, and with additional webcam video and VoIP audio.

Additionally we used a 13-slide presentation test to evaluate the quality of shared PowerPoint slides. The slide displayed on the attendee side was compared to the original. Attention was focused on:

- 1) Presence of all objects and animations in the uploaded PowerPoint;
- (2) Detail and clarity of picture; smooth color transitions;
- (3) No pixilation or grainy colors and maintaining color fidelity;
- (4) Clarity of small and rotated text;
- (5) Preservation and smoothness of transitions to pixilated, fade out, and animated slide, and;
- (6) Preservation and fluid movement of complex animation within a slide.

Bottom Line

Miercom's testing evaluated the network utilization and its effect on Quality of Experience in two geographic locations: Miercom's East Coast offices, and offices in downtown San Francisco. Performance differences observed between the products mainly revolved around network bandwidth utilization and latency. Any performance issues seen in East Coast testing tended to be exacerbated by the reduced bandwidth available at the West Coast location. The reduced bandwidth caused increases of up to 50% in join times and increased latency during desktop sharing. It also caused some PowerPoint slides to be skipped, and audio and video dropouts for some products during load testing.

Products with very low network load often compromised performance, while products with high load did not necessarily provide an improved user experience. Overall, Quality of Experience was consistently good for WebEx in both test locations. Microsoft LiveMeeting performed noticeably poorly in both locations, showing high latency and poor desktop sharing quality which impacted Quality of Experience

(QoE). Microsoft consumed the most bandwidth. The ability of WebEx to balance relatively efficient bandwidth utilization without impacting QoE in this real-world environment stood out among the products tested. We were impressed with its overall performance.



Cisco WebEx Meeting Center is awarded the Performance Verified certification for being an advanced Web conferencing solution.

After hands-on testing, Miercom confirmed:

- WebEx Meeting Center users experience the lowest latency when sharing desktop and pre-loaded presentations
- Cisco WebEx Meeting Center displays the best presentation quality during desktop sharing
- Meeting Center has some of the lowest join times for presenters and attendees

Cisco WebEx is advanced among its competitors with its ability to balance efficient bandwidth utilization and provide good Quality of Experience (QoE).

Miercom Performance Verified

Based on our assessment of Web conferencing products, Cisco WebEx Meeting Center is awarded the Performance Verified certification for being an advanced web conferencing solution.

After hands-on testing, Miercom confirmed that WebEx Meeting Center users experienced the lowest latency when sharing desktop and pre-loaded presentations and showed the best presentation quality during desktop sharing. WebEx Meeting Center had some of the lowest join times for presenters and attendees.

With its ability to balance efficient bandwidth utilization while providing good Quality of Experience (QoE), Cisco WebEx Meeting Center is advanced among its competitors in handling live Web conferencing scenarios in real time.



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