RACOL

Rural Advanced Community of Learners

CODEC Evaluation Final Report

1.1 Introduction:

Several points of investigation were undertaken as part of the CODEC evaluation process. The evaluator began with a general review of several commercially available video conferencing platforms (both hardware and software-based) in order to survey specifications and features for comparative analysis. Secondly, a survey was developed and issued to a user group of one specific platform as a means for assessing methods for acquiring user feedback, as well as collecting feedback on this specific platform. Thirdly, a visit to the Fort Vermillion School District provided first-hand observation of the RACOL CODEC, in addition to insights into user dynamics and the application of the CODEC to a classroom environment.

1.2 Market survey of video conferencing systems:

Five video conferencing systems were examined in the first phase of the evaluation: ISABEL, Tanberg Polycom, AMNIS MPEG 2, Vbrick, and Apple iChat.

1.2.1 ISABEL videoconferencing software

ISABEL is inexpensive Video/audio/data conferencing software providing up to 20-point connections over ATM, ISDN, Internet, Mbone, and satellite. ISABEL allows for selectable events (tele-conference or tele-meeting), and 3 modes (coordinator, client or participant). Slides, screen captures, scanner presentations, whiteboards, shared displays and a shared editor can all be incorporated into an ISABEL conference. ISABEL is available for Sun Solaris, SGI O2, and Linux.

ISABEL handles all the required multimedia streaming by software, and therefore requires a powerful PC to operate in high quality mode. For example, a 2.8 gig dual processor-equipped Dell (minimum recommendation: Pentium IV 1.4 GHz with 266Mhz system bus and 256 Mbytes of RAM for good quality multimedia and response time) running the latest version of Linux Redhat is recommended. Good quality video capture cards such as WinTV products are also

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recommended (configuration optimized for a 1024x768 monitor resolution, with all session terminals recommended at 1024x768 resolution. The recommended video capture device should be based on BT848 or BT878). Isabel sessions, especially when configured to work at speeds of 2Mbps or 1Mbps, may need a large amount of PC power to code and decode large video streams or the high number of videos used in some interaction modes. Up to 5Mbps required per session depending on number of points.

ISABEL's network interface will operate with any 10/100 LAN interface supported in SuSE 8.1. Other network interfaces, such as ATM, Frame relay, ISDN require a more complex installation procedure not supported by the developer's CD-ROM.

Advantages:

ISABEL's biggest advantage is its PC-based desktop environment, providing a multi-point capability with adaptable window configurations, requiring a sustainable bit rate between the terminal and flow server with a range from 128Kb/s to 2 Mb/s. As a software-based application it requires commonly-used hardware extensions such as WinTV cards, any off-the-shelf full duplex audio card, plus USB cameras. Its friendly menu interface with point-and-click operations is relatively easy to learn. ISABEL is very affordable, and the downloadable demo version provides near-full functionality.

Drawbacks:

Principally, a steep learning curve requiring expertise in Linux, to both install and configure the ISABEL software, means the software is far from plug-and-play capable. Further to this, an external camera and microphone required to be set up in Linux can occasionally clutter up the configuration process with incompatibilities. Video/audio quality occasionally suffers due to the heavy processor and network load required for high-quality service. ISABEL does not provide for any cross-platform interoperability. General drawbacks of software systems are those universally related to PC usage, such as reboot times, incompatibilities and support for peripherals, etc.

N.B. a user survey of ISABEL in operation between Ottawa and St.

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John's on CA*net4 was conducted, with some results included in the next section of this report.

1.2.2 Tandberg Polycom H.323 Viewstation

Polycom products are widely used and highly respected as an off-the-shelf solution for business/office video conferencing requirements. The product range from this manufacturer is wide, ranging from small, medium, to large video conferencing solutions with a comparable price range. These products can be enhanced with adaptable modular options. Certain models, such as the ViewStation MP provides multipoint capability with high-quality video at up to 30 frames per second in point-to-point calls. Excellent duplex digital audio quality is enhanced with noise suppression and echo cancellation. A voice-activated tracking camera system places the focus on the speaker, and includes track-to-preset functions allows for push-button settings that automatically return the camera to a pre-determined aim point, such as a main speaker. An address book dialing option also records numbers that are frequently dialed. A very simple interface makes these products very friendly to use. Upgrades and diagnostics can be handled by means of an embedded web server.

Specifications require a minimum 2-port 10 MB LAN hub. Ports include capabilities for an alternative S-video document camera and VCR record and playback options, as well as audio inputs via desktop microphone pod and line level inputs.

Advantages:

An appliance-based system such as the Polycom hold the advantage of not requiring a PC with peripherals, as it is a self-contained device with proprietary software. Another big advantage is the ease of installation; as these units are designed from business applications and conference rooms, desktops, work spaces etc. Boot times are rapid, and an intuitive, highly graphical menu system with accompanying remote control means initiating or connecting to a session is very easily accomplished. Finally, H.323 is a very common platform in office environments.

Drawbacks:

As with any self-contained appliance, a failure of any component will result in the entire unit requiring a visit to an authorized service provider. Quality varies with pricing of product (i.e. plastic vs. glass lens).

1.2.3 Vbrick 6000

The CODEC evaluator recently acquired a VBrick MPEG-2 encoder/decoder, which was tested on the classroom subnet of the University of Victoria. While never evaluated on a commodity IP connection, or on CA*net4, a few comments regarding the Vbrick feature set have been included here about this product. The Vbrick is a broadcast-quality network appliance that let you both transmit and receive DVD-quality video over both IP and ATM networks, and display it on TV monitors and PCs. It claims to be "TV over IP" QoS. The Vbrick includes an IR remote control port for easy set-up, and a picture-in-picture feature. An optional hard drive allows for full documentation and storage of an incoming stream.

Advantages:

VBricks are designed to seamlessly interoperate with Windows Media Player, and other software MPEG players and servers. The product also claims to broadcast to platforms such as H.323; this claim has never been tested. Finally, set-up is plug-and-play, and conferencing is configured and addressed via a browser. LAN tests clearly exhibited superb video and audio quality.

Disadvantages:

The Vbrick is a CODEC module only, and requires all audio and video capture and playback devices to be served as peripherals. Audio is of excellent 48k stereo sampling quality, but ports are miniplug mono pairs, meaning quality of the I/O hardware does not live up to the sampling quality.

1.2.4 Apple iChat

The CODEC evaluator has also recently acquired Apple's iChat AV

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desktop videoconferencing package, which claims to be the first video conferencing solution that allows for natural conversations over the Internet. The product has been tested on a number of LANS as well over commodity Internet with high-speed service. In one instance, it was used next to an H.323 session as an intercom device.

iChat AV features high-quality, full-screen video, full-duplex audio; and an easy-to-use GUI typical of Mac Panther OS 10.3, that makes setup easy in several steps.

Ichat is based on an optimized H.263 CODEC with full-duplex audio with an effective echo cancellation solution built in. As it is based entirely in Mac OS, no other drivers are required at the time of installation. H.263 dovetails with QuickTime technology to compress the video and audio while maintaining very acceptable QoS over any 100-Kbps or faster Internet. 56k connections will allow for audio chat only. iChat AV works with Apple's iSight camera, other FireWire-based cameras, including DV camcorders. A large default size of 352 by 288 pixels can be scaled to full screen. Windows can be resized during a conference session, and images are dynamically adjusted without compromising video and audio quality.

Ichat requires either a .Mac or AOL AIM account to establish a conferencing session. Something known as a Rendezvous chat automatically displays colleagues online on your local network, and a presence technology lets you know if colleagues are available for text, audio, or video chats, as the software will detect the presence of a video camera at another site is active. A one-click of a status button initiates a video or audio conference, with settings automatically optimized based for available bandwidth and processing power.

Advantages:

Seamless one-click operation to connect desktop to desktop. IChat is an excellent option for enabling videoconferencing in an Apple-equipped classroom with high-speed internet service. Apple's OS is extremely intuitive, and iChat is now a fully installed feature of the OS X environment. Apple's usual plug-and-play facility with peripheral

device makes hardware setup simple and quick.

Disadvantages:

Requires a minimum G4 or G5 processor to take full advantage of the service. There is no interoperability with other platforms.

1.2.5 AMNIS MPEG 2

AMMIS claims to be the industry's first compact and portable, independent-channel, live streaming video system, and is the CODEC of choice currently for the RACOL classrooms. This being the case, the classroom observations at the end of this report will cover detailed observations of the system in action, with comments relating to all observed advantages, disadvantages, as well as issues arising as they relate to installation design.

Classroom observations:

The first classroom observation by the CODEC evaluator took place on November 18, 2003 from the Communications Research Centre Virtual Classroom in Ottawa to the Grade 10 math class at High Level School via H.323, 384 kbs.
1st impressions:

There was about a 1 sec. delay experienced for my image to return to the CRC. T1 service was only available to the school district from Edmonton, so the university cyberport served to bridge the CA*net4 connection from Ottawa to the RACOL schools.

There is a real surveillance attitude in the camera placement. Teachers and students view one another from a perch situated just below the ceiling. There is a visual sensation created of a superior/inferior juxtaposition when experiencing the classroom network.

Using a monitor in the Virtual Classroom that was comparable in size to those in the RACOL classroom, very few details were visible to me

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from the classroom. It was not possible for me to determine what activities were taking place on the desks, given the size of the monitors and the placement of the cameras. Colour quality rendered the burgundy-coloured shirt I was wearing as brown/green. This kind of distortion could hinder certain presentations involving objects or science presentations made using the visualizer device. Also, the smartboard was not visible from the perspective of the camera that was in use.

Regarding audio, student questions from other locations were clearer and more present than the teacher's response. There were very occasional amounts of distortion, and generally a great deal of room ambience and echo.

Observation then took place in the Ft. Vermilion School District itself during a three-day visit.

24 November a.m. Math class in High Level.

Amnis Mpeg2 system @ 3 mbs. 3002 low latency encoder, 4001 decoder. About .5 sec latency detected from classroom to the hub and back.

First impression of the classroom involved lighting (bright, florescent lighting in H.L. classroom) with the lighting appearing to be out of balance at other locations. The split screen depicting all of the locations on the monitor appeared to produce subtle horizontal lines and flicker. The questions raised relates to the quality of the CODEC versus the lighting conditions in the classroom spaces. Camera reaction to light levels and quality, as well as surface glare on the monitor glass, cannot be separated from the experience of the CODEC itself.

24 November p.m. Gerry Lawlor's class from Fort Vermilion
Audio distorted when spoken words were accented. The effect was not distracting in any way. A number of questions were raised:
To what degree does video quality contribute to the experience? Does a higher quality of video matter when there is poor light at the source and destination, and glare on the monitor?

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25 November a.m. at the RACOL Hub.
3 mbs low latency session with 2 minutes recorded to tape from all locations. Occasional shimmer effect in video.
NB audio was overloading off phone jack, lowered imput level and improved towards last sample.

25 November p.m. La Crete with Lawler Aboriginal Studies
Took 2 films off Panasonic monitors, 2 still clips samples of classroom lighting and glare.

Attempted high quality high latency session with Pam's class. Delay affected use of smartboards, images appear to follow from explanations after 4-second delay. Observed excellent video quality comparable to broadcast. MPeg2 at 704x480, 323 at 352x288, service at 1024 kbs.

H.323 QoS virtually the same quality as low latency Mpeg but 323 displays slight artifacts video around edges and line. Hi quality mode excellent for visualizer especially for displaying artifacts or science examples. Recommend low latency for smartboard activity. Overall impressions of AMNIS: beautiful seamless, reliable quality AV.

Aboriginal studies students avoid instructions and assignments by the remote teachers, spend time on the Web with their backs to the camera. How to encourage his or her participation when nobody watches the instructor?
Relate tele-presence to presentation. Only example I saw of a student interpreting the medium as an extension of him was one who was playing with the delay of his own image in HiQ mode.

Have the teachers ever sat in on a remote session to compare participation issues and explore engagement ideas?

Recommendations:

Any human activity that is meant to inform and influence others can be interpreted as a form of performance. Performance typically occupies some kind of consensual space within which norms of behavior are established, and in which the meaning of physical space

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is described with specificity. The classroom is an example of this consensual space. Once cameras and videoconferencing are introduced into a classroom, two things are altered. From the point of view of delivery, the camera acts to extend physical space to and from satellite locations. Secondly, the medium acts as a magnifying glass on the one hand, and as a compression of physical space on the other. In other words, the classroom now exhibits many of the same attributes as television.

Successful teachers[1] understand the camera as being a spatial extension of their classroom. Teachers who move about their own room, for example, naturally seem to move about the network in a way that puts everybody on an equal spatial footing. Those who sit in the front have an exaggerated lack of spatial/physical presence at the remote locations.

Physical space design cannot be separated from the experience or quality of the CODEC as a depiction of that physical space. As mentioned above, glare on a monitor or quality of light in a capture space cannot be separated from the experience of the CODEC as a rendering of space. A diminished quality of any of these attributes diminishes the overall quality of the service. Camera placement, for example, conveys a subtextual message, as is evident in the art of the cinematographer. Pointing a camera down from the height of the ceiling depicts an inferior subject. Wide-angle images diminish the physical presence of the students as subjects relative to their physical surroundings. While not wishing to theorize too extensively on the meaning of the medium, it is important to stress that the CODEC is the heart of the experience for all students at the satellite locations, and therefore every aspect of the CODEC service must be considered when assessing the success of its implementation.

Regarding further activities relating to CODEC evaluation, there are two or three areas on which I would like to focus:

[1] Success in this instance being evidence of student engagement in all classrooms.

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1) Low latency versus high quality service. We discovered that certain tasks simply do not operate well under the high quality setting of the CODEC. The very obvious time delay from point to point caused distraction and disruption. For example, teacher's questions delivered in hi-quality mode would result in an unfair advantage to the "local" versus "satellite" classrooms. Increased quality of video service was also not a particularly strong enhancement to general Q&A sessions, nor did it enhance smartboard activities. The visible delay ended up provoking class clown-ism. However, items utilizing the visualizer were tremendously enhanced by the increased video quality, particularly in science demonstration. Increased video quality also has the potentially positive effect of clarifying facial features and eye contact, which could serve a more personal presentation content format, such as creative projects.

2) Classroom design and engagement mechanisms. A number of issues regarding the integration of the technology into the architectural design of the classrooms became apparent. For example, backs to cameras seated at computers were often engaged in some very non-academic activities at satellite locations. Camera placements are reminiscent of surveillance systems. Teachers who treated their own classrooms 3-dimentially tended to successfully extend that spatial sense to the satellite locations. Further to this, students tended to appear on-camera as respondents.

Proposals:

1) Engage students in a creative content project, in which they have to convey in a one-minute presentation something of meaning about their particular community. A show-and-tell story with a script that also involves some kind of image or artifact (photos, objects etc.). This is an opportunity for everybody to experience the presence of the camera in the classroom, and field questions. We could do 2 sets of sessions operating at both low latency and hi-quality mode. Ideally, these would be small group sessions with the content developed and presented from 2 or more locations.

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2) I have an excellent little exercise in cinematography in which a set of still images from a film are presented, and students are required to "read" the shot and match it with a set of descriptive texts. For example, a still from a Hitchcock film where the subject is set in the distance surrounded by huge trees would be matched with a reading that tells us that the subject is overwhelmed and rendered insignificant. Once they complete this exercise, I would ask them to comment on the view of their own classroom from the camera's point of view. They could be as imaginative as they like here.

1.3 Evaluation Form for Student Participants

Title: **Date:**

Length.

Instructor(s):

Sites:

Information for Participants:

As a participant in this project, your feedback is vital to its success. The evaluator assigned to assess the benefits of the technology needs to know its effectiveness and how the experience has impacted your learning/performance. We invite you to read and sign the consent form below and to take the time to complete this questionnaire during and following the videoconference.

Consent Form:

1. I understand that all information collected will be strictly confidential with regard to my identity and that, under no

circumstances, will comments from individual participants be identified.

2. I understand that, by agreeing to participate in this evaluation, I am providing consent to publication of my comments in anonymous format in part or in whole in subsequent reports and papers that may be published in relation to the evaluation. In no case, will comments from individual participants be identified.
3. I understand that my participation in this evaluation may involve only completing the attached questionnaire. Interviews will be conducted on a limited basis. The purpose of the interview will be to talk in more detail about the experience. This discussion may take about 15 minutes of my time in total.
4. I understand that my participation is voluntary and that refusal to participate will not in any way affect my grades in this course. I can decide to withdraw from an interview at any time.
5. I understand that any resulting publication(s) will be made available to me upon my request.
6. I understand that the researcher (Michael Bussiere) will be available during the evaluation to answer any questions I might have.

If you agree to participate, please sign on the line below.

Signature: _____Date: _____

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Please circle the number that best represents your experience.

1. How effective was the content of the videoconference?

   Not at all effective Very effective

   1 2 3 4 5

   Comments:

_____

_____

_____

2. To what degree was the content enhanced by the opportunity to collaborate?

   Not at all enhanced Very much enhanced

   1 2 3 4 5

   Comments:

_____

_____

_____

Please provide brief answers to the following:

1. What were you hoping to get out of this videoconference? Did you get it?

   _____

_____

   _____

_____

   _____

_____

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2. How did developing your presentation/presenting in this fashion compare to in-person presentations?

_____

_____

_____

_____

_____

_____

3. How did this medium affect your comfort level as a participant?

_____

_____

4. What factors contributed to the dynamics of the interaction? What factors interfered with the dynamics of the interaction?

_____

_____

5. What were the benefits of using this technology?

_____

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6. What were the drawbacks/difficulties of using this technology?

_____

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_____

7. What suggestions do you have for your teacher(s) and co-presenters to make future events better?

_____

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1.4 Teacher Evaluation Form for Student Presentations

Please provide a brief answer.

1. What were the intended goals of the presentation?

_____

_____

_____

Please circle the number that best represents your experience.

2. How well were the intended goals of the presentation achieved?

   Not at all well Very well

   1 2 3 4 5

   Comments:

_____

_____

_____

3. How appropriate was the time allotted?

   Not at all appropriate Very appropriate

   1 2 3 4 5

   Comments:

_____

_____

_____

4. How effective was the content of the presentation when related to the medium of videoconferencing?

Not at all effective Very effective

1 2 3 4 5

Comments:

_____

_____

_____

5. How well did the content connect to the curriculum of your course?

Not at all connected Very connected

1 2 3 4 5

Comments:

_____

_____

_____

6. To what degree was the content enhanced by the opportunity to collaborate?

Not at all enhanced Very much enhanced

1 2 3 4 5

Comments:

_____

_____

_____

Please provide a brief answer to the following:

7. What were the benefits you observed by using this technology to collaborate and present?

_____

_____

_____

8. What were the drawbacks/difficulties of using this technology?

_____

_____

_____

What additional materials, handouts or visuals might have improved this videoconference?

9. What will you do to make future student presentations better?

_____

_____

_____

1.5 Evaluation Form for Videoconference Quality of Service

Please circle the number that best represents your experience.

1. Video artifacts: I was aware of blocks, color splotches, image distortions, or areas that were grossly out of focus.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

2. Sharpness: Lines in the video were sharp and smooth, not jagged or fuzzy.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

3. Contrast, brightness and color saturation: The image was dull or faded.

   Agree Disagree

   1 2 3 4 5

Comments:

_____

_____

_____

4. Color depth: I was aware of color banding in faces and/or backgrounds.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

5. Stability: The image was perfectly stable, with no motion in the background. The picture did not shimmer or deform over time.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

6. Image clarity: The image was bright, clear and rich in color and texture.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

7. Linearity: The video was abrupt and jerky.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

8. Volume: The volume was constantly delivered at an appropriate level.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

9. Sound Quality: There was no background noise and/or hiss.

   Agree Disagree

   1 2 3 4 5

   Comments:

_____

_____

_____

Please feel free to add further comments below.

Thank you for your cooperation!

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