Summit

to Create a Cyber-Community to Advance

Deaf and Hard-of-Hearing Individuals in STEM

White Papers +
Recommendations

2008

Summit to Create a Cyber-Community to Advance Deaf
and Hard-of-Hearing Individuals in STEM (DHH Cyber-Community)

Summit Organizers:

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http://www.ntid.rit.edu/cat/summit

September 2008

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Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing
Individuals in STEM (DHH Cyber-Community)

June 25-27, 2008

The Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing Individuals in STEM (DHH Cyber-Community) will occur on June 25-27, 2008 on the campus of the Rochester Institute of Technology (RIT) in Rochester, New York. This Summit, led by RIT and the University of Washington (UW), will occur immediately after the National Technical Institute for the Deaf (NTID)-sponsored *2008 International Symposium on Educational Technology and Education of the Deaf* (June 23-25, 2008, http://www.rit.edu/~techsym). The Summit is supported by the National Science Foundation under Award No. OCI-0749253.

The goal of the Summit is to conduct a three day conference with 50 leaders (35 national, 15 regional) in the field of support service provision for postsecondary deaf students in science, technology, engineering, and mathematics (STEM) programs. The primary outcome will be to report on the current state of on-line remote interpreting and captioning. In addition, a recommendation report will be prepared that outlines the characteristics of a multimedia cyberinfrastructure that provides remote communication support for deaf and hard-of-hearing students in STEM mainstreamed classrooms.

The need for this Summit transpired as a result of an increase in the number of deaf and hard-of-hearing students mainstreamed in STEM programs in the United States, and the growing need for skilled interpreters and captioners who are competent in these specific areas of study.

Approximately 28 million individuals, 10 percent of the U.S. population, have significant hearing loss that interferes with their ability to carry out routine tasks or access information (Hitchen & Davis, 2002; Mitchell, 2006). Of these 28 million, it is estimated that 1 to 2 million use American Sign Language (Harrington, 2004). More than 300 of these men and women, who are mainstreamed in STEM programs at the baccalaureate level or higher, are enrolled at the National Technical Institute for the Deaf (NTID) at the Rochester Institute of Technology (RIT). The remaining STEM students who are deaf or hard of hearing, estimated at 400 (*College and Career Programs for Deaf Students*, 2001), are mainstreamed in over 100 different colleges and universities throughout the country.

As deaf and hard-of-hearing students seek to prepare for careers in STEM fields through tertiary education, there is a growing need for skilled interpreters and captioners who are well versed to interpret and caption at all course levels (beginner, intermediate, and advanced) in these fields (NTID Annual Report, 2006). Deaf and hard-of-hearing students seeking degrees in STEM fields of study often do not have easy access to interpreters and captioners who are knowledgeable with the scientific terms and technical language used and needed in order for them to be successful.

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A multimedia cyberinfrastructure that supports deaf and hard-of-hearing students with appropriate remote interpretation and captioning has the potential of addressing this need. These services are referred to as **on-line remote interpreting and captioning in improved educational environments**.

At the Summit, the 50 selected leaders will be divided into 6 constituency groups based on area of expertise, involvement, and experience. There will be no more than 8 persons in each group. Each group will be responsible for discussing the benefits and challenges associated with creating an on-line remote interpreting and captioning infrastructure specific to the stakeholder population in which they represent. The six stakeholder populations include:

< **Students**
  Those studying in mainstreamed STEM programs at the undergraduate and graduate levels;

< **STEM Faculty**
  Those who teach deaf and hard-of-hearing students while utilizing the new on-line remote interpreting and captioning systems;

< **Coordinators of Support Services**
  Those representing the needs of undergraduate and graduate STEM universities who are knowledgeable regarding the challenges associated with providing effective and efficient delivery of services on a continuing basis;

< **Educational Captioners and Interpreters**
  Those with sufficient experience to represent issues of quality of service and technical challenges associated with offering their services remotely;

< **Educational, Linguistic, and Sign Language Researchers/Developers**
  Those with sufficient experience in deaf postsecondary education, and have a proven history of conducting meaningful research and evaluation efforts in the field of classroom communication and support; and

< **Cyberinfrastructure Specialists**
  Those representing cyberinfrastructure, networking, user interface, and video technologies. These individuals will offer a perspective on the state of cyberinfrasturcture as it applies to the delivery of remote interpreting and captioning systems within a postsecondary environment.

In addition, two funding source representatives will observe the discussions and offer perspectives related to potential work products.

Plan of Execution

• Co-facilitators will be recruited, at least nine months prior to the Summit, for each of the six working teams representing the constituency groups identified above. The co-facilitators will be responsible for preparing an outline/talking points or a brief state-of-the-art working paper to set the context for the activities and outcomes expected from the Summit for his/her constituency group. These outlines and/or working papers will provide a definition of needs of each group, the current situation with regards to remote services, potential benefits of cyberinfrastructure system, and associated challenges.

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- In addition to the co-facilitators, six other leaders/members will be recruited for each of the six constituency groups. These selected leaders/members will receive copies of the outlines and/or working papers prior to the Summit.

- All logical planning will be completed at least two months prior to the Summit. The Summit team (Clymer, Diaz-Herrera, DeCaro and Ladner) will:

    < Create conference narrative and information;
    < Develop overall calendar for speakers and participants;
    < Specify presentation and communication technology support (interpreters, assistive listening technology, real-time captioning services, etc.);
    < Develop management databases and establish travel and budgetary systems;
    < Create Summit web page (Wiki); and
    < Arrange housing and venue space.

- The Summit will be three working days in duration:

    < **Facilitators Pre-Summit Meeting – Wednesday, June 25, 2008 from 4:00 - 7:00 PM in Golisano Building 70, Room 1400**

    Summit plans, logistics, and unresolved issues will be addressed in preparation for the two full day working team meetings.

    < **Group Meetings to Present White Papers – Thursday, June 26, 2008 from 8:00 AM – 9:00 PM in Golisano Building 70, Room 1400**

    After a brief welcome, each of the working groups will meet as a panel in the presence of all other Summit participants. The co-facilitators will lead discussions among the panel members using their outlines/talking points or white paper for that team as a catalyst for articulating the potential benefits and challenges of creating an on-line remote interpreting and captioning infrastructure for that constituency group. At the conclusion of each group session, other participants will be invited to comment (8:00 AM – 5:00 PM – lunch will be brought in.)

    Participants will then be asked to breakout into their working groups (closed sessions) to draft recommendations of the major issues and challenges associated with the development of the new on-line remote system from their respective constituency group (5:00 – 9:00 PM until completion – dinner will be brought in).

    < **Group Meetings to Present Recommendations – Friday, June 27, 2008 from 8:00 AM – 3:00 PM in Golisano Building 70, Room 1400**

    The co-facilitators of each team will present their group's recommendations, in sequence, to the entire Summit gathering, with all members participating in discussions (8:00 AM – 3:00 PM – lunch will be brought in).

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> < **Facilitators Post-Summit Meeting – Friday, June 27, 2008 from 3:00 – 6:30 PM in Golisano Building 70, Room 1400**
>
> Facilitators to meet to discuss key points that should be included in the summary report.

• Within 90 days of the conclusion of the Summit, a first draft of the proceedings will be shared with all participants for review and feedback.

• An evaluation report regarding the Summit will be submitted to funding agency within 120 days of the conclusion of the Summit.

Attached please find a time line of the tasks leading up to, during, and following the Summit.

Date	Task
June 25-27, 2008	Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing Individuals in STEM (DHH Cyber-Community) 2008 June 25 Facilitators Pre-Summit Meeting from 4:00 – 7:00 PM 2008 June 26 Group Meetings to Present White Papers from 8:00 AM – 9:00 PM 2008 June 27 Group Meetings to Present Recommendations 8:00 AM – 3:00 PM 2008 June 27 Facilitators Post-Summit Meeting 3:00 – 6:30 PM
August 25, 2008	Draft of Summary Report/Recommendations
September 15, 2008	Final Summary Report/Recommendations

If you have any questions about the Summit, please do not hesitate to contact one of the Summit Organizers listed below. Thank you for your consideration.

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As of May 20, 2008

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I am a doctorate candidate in Computer Science at
DePaul University and I am scheduled for my defense
on May 22nd. I received my BA degree in Psychology
at Gallaudet and MS degree in Information System at
DePaul University. I was a co-founder of DePaul ASL
project and works with the research team there. I also
had been a traditional full-time employee including as
Technical Analyst and Technical consultant for 15
years.

My main research interest is in using technology to
create simulations of ASL linguistics that will help in
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I'm a third year Deaf undergraduate student majoring
in Psychology at University of Washington. I've been
working with Richard Ladner for three years on various
projects such as MobileASL, Deaf/HH Cyber
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Ron Painter

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I am a deaf graduate student in chemistry at Stanford University. I obtained my bachelor's degree in chemical engineering at the University of Washington before moving to sunny California for graduate school. I'm in my fourth year of graduate school, and hope to get my doctorate in two more years.

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I am a deaf doctoral candidate in Computer Science at University of Houston. My dissertation is on biomedical image analysis, specifically brain scans. I obtained my bachelor's degree in applied physics at Angelo State University, and my Masters in Computer Science at Rochester Institute of Technology. I also recently graduated from law school and am focused on disability and intellectual property law.

David Fourney

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I am a Ph.D. student in Industrial Engineering at Ryerson University. I have a Masters degree in Computer Science from the University of Saskatchewan as well as a B.A. in Psychology and a B.Sc. in Computer Science. I am hard of hearing.

My research interests are primarily in usability engineering and human factors. Currently, my team and I are developing ways to improve captioning so that emotional and other auditory information can be better represented.

Minoru Yoshida

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Minoru Yoshida is a graduate student, graduating in 2008 with a Master's degree in Public Policy from the Rochester Institute of technology. He also works full time as Software/Hardware Specialist at PEN-International, NTID/RIT.

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STEM Student Perspective on Benefits/Challenges Associated with On-line Remote Interpreting and Captioning

Prepared by Joshua R. Beal

Awareness of the challenges that face disabled students pursuing STEM education at the post-secondary level has resulted in commitments of funding and research efforts from the National Science Foundation (NSF), IBM and a number of higher education institutions such as RIT/NTID and three other alliances supported by NSF: the MIDWEST, EAST and RASEM2.

While each of these alliances vary in focus on K-16 STEM education access, much of those efforts are targeted at improving educational technology accessibility for student populations with visual, mobility, health and learning barriers. There is a plethora of literature available on mitigating these barriers, however obstacles continue to exist for deaf and hard of hearing students in STEM programs across the country.

For the purpose of this whitepaper, the discussion is focused on exploring educational access technology options for deaf and hard of hearing STEM students attending mainstream post-secondary education settings as opposed to those attending traditional post-secondary education settings for the deaf and hard of hearing such as NTID/RIT, Gallaudet University or CSUN. The distinction is vital since traditional post-secondary education settings for the deaf and hard of hearing have accumulated a body of knowledge and resources that are very difficult, if not impossible, to replicate and transfer to other institutions.

An important distinction should be made between deaf and hard of hearing students due to the communication methods that are primarily used by each group. Deaf students, whose first language is American Sign Language (ASL), rely on ASL as their primary means of communication. While some students may have lip-reading and speech capabilities, the capability for oral communication widely varies from individual to individual. Another factor to consider is that deaf students throughout K-12 trained to practice self-identification methods in respect to requesting their communication access needs. Consequently, at the post-secondary level, these students are well aware of their right to communication access services such as ASL interpretation, CART, or note-taking services.

In contrast, hard of hearing students, may not be used to exercising self-identification methods in order to obtain communication access services. This is a challenge for post-secondary institutions that are eager to provide communication access services to their students, but are unable to identify the students who would benefit from those services. As a result, a knowledge gap exists within the mainstream institution, which is not adequately differentiating between the needs and preferences of individual deaf or hard-of-hearing student in respect to communication access in the classroom.

There are several new tools available today for addressing varying deaf and hard of hearing student communication needs. They include Video Relay Service (VRS), Video Relay Interpreting (VRI), Real-time Remote Online Captioning (RROC), and Automatic Speech

Recognition (ASR). These tools have wide implications in respect to providing communication access to deaf and hard of hearing individuals as their uses in the educational setting continues to be refined and developed.

VRS allows for personal direct communication, from outside the classroom, between the deaf and hard of hearing student and the classroom peers, tutors, professors and support staff. VRI enables the capture of information inside the classroom through an ASL interpreter who is connected through a direct internet connection and conveys the classroom lectures to the student using ASL communication. RROC operates using the same premise as VRI, except the information conveyed is in English. ASR is a software application that requires personalized training by the speaker to capture their spoken language and effectively convert it to proper text. All these communication access tools, with the exception of ASR, require a third party to convey the information between the student and the transmitter of information – student, support staff or teacher.

Of these three tools, only VRS is subsidized by the Federal government, therefore there are no cost constraints or limitations to continued use. VRI and RROC have relatively high costs, typically $35-$120 per classroom session, subjective availability due to marketplace supply/demand and varying credential requirements for interpreters/operators by providers make it difficult to ensure consistent quality provision of services. These factors make it difficult for

mainstream settings to consistently obtain the high level of service needed to convey STEM educational content to the student.

VRI and RROC have been adapted from in-person service provision to internet-based services, thus increasing availability of services over dispersed geographic areas and ensuring that the student's communication needs are met. While the increasing use of VRI and RROC in the class-room setting provides more communication access options to students at post-secondary institution, barriers remain. These barriers appear throughout the classroom environment:

- Field Trips – Controlled environment requirement due to Internet/Audio capability
- Lab/Study Groups – Inability to capture audio from numerous speakers, lack of visual indicators
- Multiple Information Sources – Transcription is not aligned with other content (Notes, PowerPoint slides, classroom handouts)

Integration of VRI, RROC into the classroom, for the purpose of resolving the communication access barrier for deaf and hard of hearing students continues to be an effective, but costly solution.

Today, the greatest opportunity for developing full communication access in the classroom comes through the concept of a digital classroom environment. A good example of this is an online course which provides in advance, accessible content to students including readable text for blind, captioning for any video content provided and ease of communication through email

between students and faculty. While online courses are an emerging option for creating an

accessible digital classroom environment, post-secondary institutions are attempting capture the

benefits of online learning while providing personal instruction through blended courses, which

are a combination of online and classroom instruction.

Blended courses, with proper preparation, can enable full communication access by using third

party services such as VRI and RROC or it can incorporate ASR technology as a means of

transmitting the speaker's verbal content. The use of ASR technology, while requiring user-

intensive training to correctly align the speaker's voice with text, can allow for self-contained

classroom communication access. While time-consuming and relatively untested, use of ASR

technology is promising due to the removal of the third-party service provider, thus saving time

and money.

All these advances in development of communication access tools and digital classroom

environments lead to the examination of a Internet-based Cyber-Infrastructure system that not

only provides accessible options to deaf and hard of hearing students, but also post-secondary

institutions who seek to use these tools.

These tools would include:

- Online Databases
    - o Technical Vocabulary Guides
    - o Classroom Content/Material

- Teaching Tools for Educators

    o Accessible Content for Instruction

    o Guides to effective VRI, RROC, ASR use

- Accessibility Guidelines for Content Development

    o Guidelines for Deaf and Hard of Hearing content development

- Best practices for STEM relating to RROC and VRI Personnel

    o Technical Vocabulary for third party service providers

For these purposes, the primary benefit of such as system would allow for use of accessible content that is focused at deaf and hard of hearing STEM students, the respective faculty and support staff at those institutions. Furthermore, providing an open database to STEM students/faculty would promote standards and more easily compel a greater number post-secondary institutions to implement effective and affordable communication access solutions that meets the needs of those deaf and hard of hearing students.

In conclusion, an increasing number of non-traditional post-secondary institutions are educating deaf and hard of hearing students in the STEM disciplines with limited resources and knowledge of communication access issues and tools. With the advent of technological tools such as VRS, VRI, RROC and ASR, there continues to be progress in addressing the communication access needs of deaf and hard of hearing students, but it has yet to be done in a complete fashion that ensures full 100% communication access. A Cyberinfrastructure System would provide an opportunity to implement full communication access for deaf and

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hard of hearing students in the STEM disciplines, at geographically dispersed locations, through the shared dissemination of best practices, tools and guidelines for students and educators alike.

Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing Individuals in STEM (DHH Cyber-Community)

June 25-27, 2008

Students

Group Members

- ❖ Ellie Rosenfeld, Facilitator
- ❖ Alan Hurwitz, Facilitator
- ❖ Joshua Beal, Support
- ❖ Raja Kushalnagar
- ❖ Karen Alkoby
- ❖ Ron Painter
- ❖ Jessica DeWitt
- ❖ David Fourney
- ❖ Minoru Yoshida

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Student Recommendations

1. Empower STEM students

   o Enhance ease and timeliness for securing support services

   o Legal and advocacy issue as priorities

2. Develop social networking opportunities for both live and virtual contact

   o annual STEM workshop/retreat for both faculty and students

Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing Individuals in STEM (DHH Cyber-Community)

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Student recommendations con't.

3. Focus on STEM vocabulary and discourse

  o Support ASL-STEM forum development

  o Interpreter training & STEM certification

5. Shared access to deaf-friendly STEM instructors across various universities

6. Create a way to provide virtual tutoring support

Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing Individuals in STEM
(DHH Cyber-Community)
June 25-27, 2008

http://www.ntid.rit.edu/cat/summit

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As of June 24, 2008

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Outline of Talking Points for STEM Faculty Group

As of June 2, 2008

DHH Cyber Community Summit June 25-27, 2008

5/20/2008

Please note: this is a **preliminary** *list in progress. Feedback and contributions are greatly appreciated.*

The following points focus on mainstream classrooms where majority of students are hearing. The goal of accommodation should to encourage a 2-way (or many-way) interaction between students and instructor. Many of the same issues arise for accommodating deaf and hard of hearing students and a hearing instructor or accommodating hearing students and a deaf or hard of hearing instructor.

- Problems faced by deaf students in mainstream classrooms
  - Visual dispersion
    - Students must divide their visual attention between instructor, overhead slides, handouts, interpreter/captioner, other students, and notes.
  - Access to appropriate accommodation
    - The best interpreter/captioner may not be co-located.
  - Barriers to classroom participation
    - Language barriers, interpreter delay, feeling excluded
  - Barriers to after-class activities
    - Examples include group work, study sessions, etc.
- Accessible teaching styles for d/hh students
  - Pausing for the interpreter/captioner
    - Example: Ensuring hearing students don't answer questions before interpreter is finished
  - Teaching to the "top of the class" versus more inclusive teaching for all.
  - Turn-taking and discussion
  - Identifying yourself / standing before speaking
  - Likely will have positive affect other hearing students as well
  - Universal design in teaching
    - Example: Having each student take a turn with public class notes)
  - Large lecture style vs. small group discussion
    - The importance of 2-way, N-way communication
  - Accessible use of classroom technology
    - Captioned videos
    - "Talking while doing" increases potential for missed content
      - Students must "follow along" with displayed technology
  - Changes in teaching style due to remote accommodation
    - Increased delay in feedback loop

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- - Technology setup (cameras, microphones, laptops). Who is responsible?
    - Technology failures and recovery
  - Communication outside the classroom
    - Encourage/facilitate/moderate group work
    - Email, wiki, pre- and post-class discussion
    - "Blended learning" – hybrid distance learning and in-class learning
  - What to expect from deaf or hard of hearing students
    - Deaf students are typically good at self-advocation, whereas hard of hearing students may not have experience with this. For example, the accommodation that has worked well for a student in high school may not work well in large lecture classroom or multi-student group discussions. How to encourage and recognize when students need help.
    - Educational background of students, and how to deal with mixed backgrounds

Faculty Group Recommendations

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Main Recommendation

- There is recognition that the faculty member does have to adjust his/her teaching style to accommodate deaf and hard of hearing students, but any added technology should try to minimize what adjustments must be made.
  - A mechanism for checking if the adjustments are happening or going well

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Web Page for Faculty Recommendation

- Faculty Web Page for DHH accessibility hosted by PEPNet
  - Advisement materials for deaf students
  - Best practices examples
  - Examples of universal teaching design
  - On-line class or tutorial
  - Responsibilities (legal and policy)
    - Framework for policies on a local level
  - Faculty forum for learning about accessibility

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Continued Web Page

- Web Resources Example
  - http://www.pepnet.org/
  - ClassAct II
  - http://biology.queensu.ca/%7Equdai/index.html Queens University
  - http://www.students.ubc.ca/facultystaff/ disability.cfm?page=students UBC
  - DO-IT

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Technology Use Recommendation

- Agreement on who is responsible for what concerning the technology provided for accessibility.
    - Setup
    - Failures
    - May vary depending on educational setting
        - Classroom
        - Lab
        - Field

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Part Time Faculty Recommendation

- Part time, temporary faculty, and TAs need condensed training.
  - Have less time and commitment

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Intellectual Property Recommendation

- There must be an agreement between the university and faculty members concerning the captured materials (caption scripts, video) for accessibility.
  - Who has access to it.
  - How long will be saved.
  - When will be destroyed.
  - Legal issue concerning captured materials should be studied.

Educational Research

- Evidence based research on effectiveness of various teaching adjustment.
  - Data on number of faculty encountering deaf and hard of hearing students.
  - Cyber-infrastructure should be designed to collect data automatically.

Mobility Recommendation

- Cyber-infrastructure should support mobile use cases
  - Field trips
  - Conferences
  - Labs
  - Demonstration Classrooms
  - Office hours
  - Team meetings
  - Tutoring

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National Interpreter/Captioner Database

- A national interpreter/captioner database to be able to fine the best qualified for a particular STEM subject.
  - The DHH Cyber-community needs it

Certification

- Interpreter certification in STEM (RID)
- Captioner certification in STEM (NCRA)

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As of June 24, 2008

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Coordinators of Support Services
Draft of White Paper

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DRAFT
May 8, 2008

Introduction

Postsecondary education institutions are faced with the challenge of serving an increasing number of individuals who represent more diverse backgrounds and interests. As the student population changes and more students who are deaf or hard of hearing enroll in a wide variety of courses and majors, the challenge further expands to provide quality access services from a relatively small pool of resources. One possible solution is to provide access services from remote locations using internet access to connect the service provider with the learning environment. These may include sign language interpreting, speech-to-text transcription, or notetaking services. This paper will briefly review the available services, provide information about the current use of these services in various learning environments, discuss issues that need to be considered when implementing remote access services, and list resources that may be helpful to coordinators of support services.

Overview of Remote Access Services for Students who are Deaf and Hard of Hearing

Interpreting

Sign language interpreting services have traditionally been provided in educational settings as onsite classroom access services. Sign language interpreters translate spoken comments into sign language and signed comments into spoken English. In recent years, access to technology has had an impact on how these services might be offered. Through the use of web cameras, microphones, computers and monitors, and an internet connection, interpreting services may be provided from a remote location. This is commonly referred to as video remote interpreting, or VRI (Berke, 2008). Although the deaf and hearing participants are often in the same location, the interpreting services are provided from a remote site (Lightfoot, 2005), such as by staff from the institution or from an interpreting services agency with VRI capability. The student views the interpreter on a computer monitor or laptop computer, and the web camera in the classroom enables the interpreter to voice any comments or questions the deaf student may have.

Captioning

The term "captioning services" can encompass several types of services that portray the spoken word in print format. The most common ways of providing captioning for a classroom lecture or

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discussion are communication access realtime translation (CART), non-verbatim meaning-based speech-to-text systems, and voice recognition technologies.

Communication Access Realtime Translation (CART)

CART is described as a "word-for-word text interpreting service" (National Court Reporters Association, 2001). It is the instant translation of the spoken word into text which is displayed on a computer monitor or other device. The service is performed by a CART provider who uses a stenotype machine, notebook computer and specialized software. The CART provider may be in the classroom or at a remote location. For remote access, the CART provider listens to the lecture through a telephone or microphone for a Voice over Internet Protocol (VoIP) connection. Internet access is essential for this service; both the student and the CART provider are logged into a realtime account on a website (National Court Reporters Association, 2002). There are several ways in which the lecture material can be transmitted and shared, including the use of shared applications, such as WebEx or NetMeeting, or through the use of streaming text. Standard dial-up telephone lines are not recommended because there may be a delay in the transmission.

Non-verbatim meaning-based speech-to-text systems

In recent years, there has been growth in the use of meaning-for-meaning speech-to-text applications, such as TypeWell and C-Print, which are also referred to as text interpreting services. Service providers may be referred to as captionists or transcribers, and they use a laptop computer and specialized software to provide a condensed version of the spoken information (Aylesworth, 2005). Remote access can be provided in a manner similar to what is used for CART.

Voice recognition technologies

Known also as automatic speech recognition (ASR), this technology blends the capabilities of speech recognition software and a voice captioner who "echoes" what is presented orally (Eilers-crandall, Gustina, & Campbell, 2004). In some systems, the voice captioner can also make corrections in the text, as needed. Resources that are currently available include Caption Mic and C-Print with Automatic Speech Recognition. Commands are included to help format the text. The result is a realtime display of the lecture or discussion on a computer screen or other display device. Voice captioners typically participate in short training activities to enable the software to recognize the speaker's voice. Remote access can be provided in a manner similar to what is used for CART.

Notetaking

Computer assisted notetaking services may be provided onsite or through a remote interface. While not specifically designed to facilitate communication among hearing and deaf participants in a classroom, it may provide support to students in this setting (Gallaudet University, 2007). Remote access can be provided in a manner similar to what is used for CART.

Coordinating Services

Traditionally, access services for students who are deaf or hard of hearing are coordinated through the campus office of disability services (DS) (Association on Higher Education and Disability, 2004). Depending on the number of students to whom services are provided, the campus may have staff interpreters and speech-to-text providers, or they may contract with external agencies or individuals to provide services. One of the DS staff members may be responsible for only coordinating services for

students who are deaf or hard of hearing, or that service coordination may be part of a larger, more varied set of responsibilities (Hochgesang, Dunning, Benaissa, DeCaro, & Karchmer, 2007).

When considering the use of remote services, it may be necessary to involve additional members in the coordinating team. Because on-campus interpreters or speech-to-text providers may provide services to remote or satellite sites within the same campus system, working closely with campus personnel, such as information technology (IT) or audio-visual (A-V) personnel, is advised. Ensuring that the equipment is working properly in both the classroom and the service studio is critical, and other campus personnel may share their expertise to support these endeavors. Other campus staff members, such as those who schedule classroom space, may also be involved when considering various classroom features, such as access to internet services or phone lines, adequate lighting, etc.; it may be necessary to relocate a class to ensure that the technology and setting will be sufficient to provide good access for the student.

When working with an outside agency to provide remote access services, the campus office of disability services must also coordinate services with the agency and related personnel. Because ensuring good communication access is essential, the DS office must also work with the agency to arrange appropriate interpreting or speech-to-text services. The on-campus technology team may also work closely with the technology support that may be available through the outside agency.

No matter how the services are provided, it is essential that feedback from the student be gathered on a regular basis. As remote access services continue to expand, the experiences shared by the consumer can help improve the quality and shape the scope of future developments.

Using Remote Services in Various Learning Environments

Due to the rapidly changing technology and the growing use of what is currently available, specific information about remote technology use for classroom access may not be described in the available literature. Consequently, the work group conducted a survey of coordinators of support services during Spring 2008 to better understand how remote services are currently being utilized. Thirty professionals responded to the survey. Fourteen respondents used remote CART services; seven respondents used remote C-Print or TypeWell services; three respondents used remote voice-writing services; and five respondents used remote sign language interpreting services. One respondent was a nationally Certified Realtime Reporter who provides remote CART.

There is much overlapping in regard to successful practices, barriers and issues, and solutions identified in all the various learning environments of Traditional Classroom Instruction, E-Learning, Laboratory Settings, Field Trips/ Off-Campus Learning Settings, and Student Practicum/Internships.

Traditional Classroom Instruction

In the traditional classroom setting, the instructor shares course content through lecture and demonstration. Course enrollment may range from a small group of students in a classroom to several hundred students in an auditorium. The environment is usually controlled. In this setting, students typically remain in their seats and are able to watch the instructor and any audio-visual materials included as part of the lecture.

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Successful practices identified (13 responses):

- Training (prior to the start of each term) on the use of technology (laptop computer, web camera, microphones, internet connection);
- Develop troubleshooting skills for students, disability services staff, faculty, and IT/AV staff;
- Work closely with IT/AV staff to troubleshoot issues with campus security or firewalls;
- "Test runs" to introduce students and faculty to the technology;
- Work with disability services and the registrar's office for priority registration to ensure early notification about classroom use, internet access, and access services;
- Once the term has started, share preparatory materials with service providers;
- When using video remote interpreting, use a web camera to send visual information (e.g., PowerPoint slides; blackboard information) to the service provider;
- Importance of a back-up plan in case of technical failure or ineffectiveness.

Barriers/issues identified (15 responses):

 - Quality of sound transmitted from the classroom to the remote location. The quality of some microphones/ sound systems often is not sufficient;
 - Reluctance of faculty to use a microphone appropriately;
 - Classroom discussions difficult to hear due to lack of additional microphones in the classroom;
- The service provider, in a remote location, is unable to see what occurs in the classroom, what is on the blackboard, or facial expressions/ body language;
- Not all captioning software programs are able to portray scientific notation or mathematical equations;
- Bandwidth may not be sufficient to provide smooth transmission of video relay interpreting;
- Wireless connections may not have the strength of a hard-wired connection;
- Equipment (e.g. web cameras and laptops) may not be compatible;
- Using cell phones or internet-based phone communication systems not always dependable;
- Campus security, firewalls, ongoing internet maintenance and system upgrades can affect services;
- Logistics and collaboration with various offices can pose a challenge;
- Students may be reluctant to use remote technology;
- Faculty may be reluctant to relocate from a regularly-assigned classroom to one that offers the access needed.

Solutions identified (12 responses):

- Need for good communication, good preparation, and ongoing training;
- Essence of good working relationship with provider agency and their technology support;
- One respondent indicated desire for a nationwide database of available remote captionists/ interpreters;
- Maintenance/ care for equipment purchased to ensure high quality/ dependability;
- Use an FM system and in-class notetaker as back-up strategies if the remote connection fails. Service coordinators should look for portability when considering how remote services can be provided.

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E-Learning (online learning/web-based classes/distance education):

Under the generic title of "e-learning" there are a variety of approaches that may be used in the college environment. Students may be in a traditional class that is supplemented by online activities; or they may be enrolled in a course that has no scheduled time or day to meet but the course information, including lectures and discussions, is posted on a website and discussion board. Some of these materials may be video or audio materials that may not be captioned prior to posting. The learning environment may be more flexible than in a traditional classroom; students may choose to participate in class at any time that suits their schedule.

Successful practices identified (8 responses):

 - Working closely with technology support staff;
 - Developing strategies for troubleshooting;
 - Training opportunities for students and faculty;
 - Working closely with remote services providers and conducting pre-term equipment testing.

Barriers /issues identified (5 responses:

- Two main issues highlighted are audio components and software compatibility;
- Web content, such as streaming videos, podcasts, or other audio components, often is not captioned;
- Software incompatibility may occur when technology for one purpose, such as classroom speech-to-text services, is used in a different manner, such as providing captions for a web conference. Service providers need to ensure that captions can be included as part of a live broadcast, and not added in a postproduction process that would delay access.

Solutions (6 responses):
- Need for good communication, preparation, and ongoing training for all people involved;
- Importance of working closely with distance education technology staff through all phases- preparation, implementation and follow-up. Involving them creates a better understanding of universal design, thus broadening the potential audience beyond that of students with disabilities.

Laboratory Settings

Laboratory settings offer students the opportunity to apply what they've learned in the traditional classroom setting in a hands-on manner. Although students may be assigned to lab stations, the setting may be much less structured than a traditional classroom. The instructor may gather students for a demonstration, or comment on what some of the students may be doing. Labs may be held in conjunction with a traditional class, or scheduled for a regular, separate time.

Successful practices identified (4 responses):

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- Only one indicated that remote captioning services were offered for a laboratory setting. Another respondent indicated that while on-site captioning services were provided, remote services had not yet been implemented;
- Two respondents indicated that students only used in-class notetaking services or one-to-one communication with the instructor through written communication in the lab setting instead of using remote services.

Barriers/issues identified (4 responses):

- Room set-up can be a barrier to providing effective services. While instructor and students may move around the room, the microphones may not be able to pick up a clear message;
- The laptop needs to be located where it's easy to see the captions without interfering with the lab exercises;
- Lab sections are frequently taught by teaching assistants, so there is ongoing need to provide training to a larger group of professionals.

Solutions identified (3 responses):

- Asking the professor for handouts, books, or other materials to share with the service provider is helpful in preparing
- Providing an in-class notetaker when remote services were unavailable.

Field Trips / Off-Campus Learning Settings

Participating in field trips or other off-campus learning activities offers students an opportunity to learn from sources that cannot be experienced in the classroom. Field trips may be short, lasting a portion of a day, or they may extend over several days or weeks. They may include a wide variety of settings, ranging from urban indoor areas to remote outdoor locations.

Successful practices identified (1 response):

- Although outdoor settings may pose a challenge to providing remote access services, one institution purchased a sub-notebook computer that could be carried anywhere;
- Using battery power and a wireless connection enables captions to be transmitted.

Barriers /issues identified (3 responses):

- Bandwidth cited as a critical issue, especially when other users tap into the internet with large applications;
- Sound transmission issues - group settings may have competing sounds, such as more than one speaker or background noise.
- Scheduling issues, e.g. field trips may include extended class periods or unusual hours; utilizing campus staff to provide remote services may result in scheduling problems for on-campus courses.

Solutions identified (2 responses)

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- As technology continues to change, equipment may be available in smaller sizes. Eventually, an institution may be able to choose equipment the size of a pager to provide remote captioning services;
- When available bandwidth is an ongoing issue, negotiate a higher priority for using available bandwidth for access services.

Student Practicum / Internships

As students approach the end of their formal education, some programs of study include a student practicum or internship experience in a work setting as one of the graduation requirements. These experiences give students the opportunity to apply their classroom knowledge to a real-world experience. The student intern may shadow a professional or assume limited job responsibilities. The setting may vary a great deal, depending on the role of the intern and job situation.

Successful practices identified (4 responses):

- Working closely with staff at the internship site, including clarifying communication strategies and policies;
- An unexpected benefit to providing remote access services was that students reported a more positive experience without an additional person (the service provider) onsite.

Barriers /issues identified (3 responses):

- Difficulty managing the flow of conversation so the service provider could hear the information being shared, access to high quality microphones, and access to dependable internet service. In addition, because the service provider was not onsite, one respondent indicated that the student intern's co-workers often forgot about the need for access and did not follow appropriate communication protocol.

Solutions identified (1 response):

- Students need to assume responsibility to manage the flow of conversation and be a self-advocate;
- DS staff may provide printed explanations about the technology and discussion management protocol.

Setting up a Cyberinfrastructure System

Potential Benefits

- Benefit to remote schools where there is a lack of available interpreters and captionists;
- More flexibility and being able to draw from a larger pool of local and national resources for providing such services.

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- No central location to get information about remote services. Current information is scattered about. Coordinators often don't know where or how to go about gathering and sorting through information and options;
- Not being able to identify and locate remote service providers;
- Challenges retaining service providers;
- Challenges with terminology, diagrams and graphs for STEM students;
-Concerns regarding ability to evaluate quality of such interpreting or captioning services;
- Gaining support of technical support staff at the college/ university who may be resistant to the idea of remote services;
- Possibility of over-accommodating- determining reasonable accommodations;
- Money issues- paying for such services, or unjustified fear of the high cost of such services;
- Gaining support of administration who may be reluctant to try services out of fear of financial cost, firewalls, or simply lack of knowledge;
- Difference in resources between small and large programs (rural versus uban);
- Determining eligibility for such services, writing policy to determine priority requests;
- Lack of awareness among students regarding remote services;
- Dealing with last-minute requests and prioritizing requests;
- Copyrights regarding captioning of materials, ownership of captioning notes.

Future trends and issues

1. Growing number of d/hh students with diverse needs (oral, signing, cochlear implants)

Resources (to be expanded)

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Coordinators of Support Services

Recommendations

DRAFT

June 27, 2008

Cyberinfrastructure Summit

http://www.ntid.rit.edu/cat/summit

Establishment of Service Hubs

- Seek federal/ state funding to support establishment of regional programs or 'service hubs' who can provide remote services within their areas

- Utilize established programs for deaf/hh students as service hubs

- Service hubs may encourage standardization of pay and practices

Websites/ Databases

- Central website that provides overview of remote access services including current technologies (e.g. Pepnet.org, stsn.org)
- Central database of remote service providers, including video models of interpreters signing ASL, PSE, etc.
- Interactive database showing which service hub has availability at what time (e.g. which interpreters are free with backgrounds suited to the specific need)
- Online library STEM terminology, phrases, diagrams, etc. for service providers

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Materials Development

- One-page tipsheet on remote services
- Guidelines on establishing and providing remote access services at the postsecondary level with information for DSS providers, IT/AV staff, administrators, faculty and staff, and students
- Policies and procedures for DSS staff (e.g. prioritizing services, etc.)
- Technical information (e.g. bandwidth, i2, recommendations, etc.)

Equipment

- Use service hubs as equipment-loan centers for pilot/ testing purposes

- List of funding resources for purchase of equipment

- Set up group of technical support staff to serve as technical advisors (e.g. research new technologies on an ongoing basis, do demonstrations, etc.)

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Training

- Online training for faculty and staff on remote services

- Online training for STEM students orienting them to remote access services

- Virtual forums with organizations such as AHEAD, RID, STSN, PEPNet, etc.

Other

- Recommendation to RID regarding certification of interpreters with STEM backgrounds
- Study on cost-effectiveness of remote vs on-site access services
- Special interest groups at conferences

http://www.ntid.rit.edu/cat/summit

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As of June 27, 2008

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Notes on Possible solutions/directions for the future

DRAFT
June 27, 2008

Cyberinfrastructure Summit
http://www.ntid.rit.edu/cat/summit

- On-demand national agency/clearinghouse for providing captioning/interpreting (and information about same). Details to be determined.
    o Supporting documents can be posted, etc.

- Possibility of approaching government and private agencies to seek funding for certificate training in STEM interpreting/captioning
    o Formal training necessary to assure quality and skills

- Need for various display options for wide-ranging learning venues
    o Same functionality across platforms—PC, Mac, PDA, etc.

- Multiple audio and video inputs for service providers in the classroom—wide angle perspectives instead of single, fixed angle
    o Enhanced audio in classrooms—multiple mics allowing for best possible capture of classroom audio
    o Need to define sound engineering re:classrooms

- Possibility of wedding captions AND interpreting, allowing remote interpreters greater access to information, thereby improving their output

- Availability of the various kinds of support (CART, C-Print, etc) being fitted into the different platforms, e.g., Connect, NetMeeting, Wimba, Elluminate Live!

- Technologies for students with multiple disabilities—adapting technology to fit individual student needs/preferences

- Evaluation must be a part of any provision of service

Notes on Possible solutions/directions for the future

- Cross-disciplinary (STEM) Software that facilitates the use of math equations, symbols, etc.

- All-way communication access between student, teacher, and service provider
    - Interface (Bluetooth?) between service provider and teacher
    - Interface between student and provider in backup format
    - Backup alternative technology for communication (IM)

Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing
Individuals in STEM (DHH Cyber-Community)
June 25-27, 2008

http://www.ntid.rit.edu/cat/summit

Educational Captioners and Interpreters:

Section of Working Paper on Captioning

As of June 2, 2008

Overview of Remote Captioning Services

In remote captioning, an intermediary operator in an office in a remote location produces text with (a) a stenographic machine, (b) a QWERTY keyboard, or (c) automatic speech recognition while listening to the information via an audio source as it is being spoken by a teacher. Often when a speech-to-text service is used, interpreting and/or notetaking services have *not* been provided to deaf/hard-of-hearing (d/hh) students unless there are several of these students who have diverse needs in a class (Marschark, et al.; Stinson & Antia, 1999). Generally the goal of *steno-based services*, which employs a 24-key steno-machine and is also called Communication Access Real-Time Translation (CART), is to produce a verbatim display of the spoken message (Preminger & Levitt, 1998; Steinfeld, 1998; Smith, 2003; Stinson, Stuckless, Henderson & Miller, 1988).

Keyboard-based approaches often use computer-enhanced high-speed typing to provide access to the spoken information. The C-Print and Typewell abbreviation approaches uses word abbreviations to enable the service provider to, as closely as possible, capture the spoken information (Harkins & Bakke, 2003; O'Neill & Laidler, 2004; Stinson, Elliot, McKee & Francis, 2000; Stinson & Stuckless, 1998). In the last few years, *automatic speech recognition-based* (ASR) services have begun to be used as a support for communication access and learning for students who are d/hh or who have other disabilities (Aylesworth, 2006; Viable Technologies, 2005).

Needs

«GreetingLine» Page 1 6/2/08
penteam$:Current Projects:Access Center on Technology:Summit - June 25-28 2008:Groups:Interperters - Captioners:Captioner-InterpreterWorking Paper.doc
This material is based upon work supported by the National Science Foundation under Award No.OCI-0749253

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Captioning service providers typically provide a real-time text display on a laptop computers for the student or other client to view in class, meeting, etc. However, support service needs still go unanswered in a variety of education, work, and extracurricular settings. Following are needs that have been identified for remote captioning services.

- If the speaker at the remote location, such as the teacher, wears a microphone, then s/he needs to repeat what others are saying so that the provider hears the discussion.

- The provider typically does not see the figures, charts, etc. that the teacher uses in the classroom (or other speaker in the remote setting, and this may affect the provider's comprehension of information, as well as the resultant display.

- If the material is technical, the speaker may use jargon. If the provider is not aware of these technical words it may affect the production of accurate text.

- Students, teachers and other users need to be trained to set up and use technology and equipment with which they may be unfamiliar.

- Remote services need to have sufficient flexibility to effectively support individuals in many educational, work, and community settings. For example, community colleges in isolated settings that occasionally have d/hh students who need captioning services will benefit from services that are easy to install and use, work on a variety of display devices, and are inexpensive. Other settings, such as co-op experiences, often require meetings and professional development for which communication access is obviously crucial, but for which such access is often not available.

- Easy access by students or other users to the captioned material after the class or other event has been completed. It is desirable to have an electronic record of the transcript that the student can access after the visit. This transcript will help students recall what happened at the visit and further understand course material.

- Provision of captioning support services in nontraditional learning settings, such as field visits where traditional delivery systems may be impractical. The absence of these supports can preclude d/hh students

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from taking courses and participating in other activities with field visit components. Improvement of remote captioning would help overcoming this barrier.

- Disconnection and re-establishing of connections may be an issue. Disconnection may be more likely to occur if the connection is a wireless Internet connection, or through a cell phone.

- The lag time between the time a person, such as a teacher, speaks at a remote site and the display of text on the client's device may increase if cell phone lines are used.

- If speakers change and a polycom microphone is not feasible, the microphone may need to be changed from one speaker to another. This could contribute delay.

- It may be desirable to have two-way communication between the speaker and the service provider, to obtain clarification, etc.

- If there is significant background noise in the setting, such as at a factory, this can affect the ability of the provider to hear the spoken message.

- D/hh students need a way to ask questions or make comments to the teacher or others at the remote site.

- Comprehensive clearinghouse, coordinating, or scheduling systems that allows d/hh users to easily arrange for their preferred service are desirable. Currently, a user contacts an individual company or agency ahead of time and that organization then arranges services. Thus, on demand, on-the-spot service is not available.

- Captioning for Online or distance learning.

Current Services

Remote CART, automatic speech recognition (ASR), and keyboard-based captioning services are currently available (Aylesworth, 2004; Preminger & Levitt, 1998; Rapidtext, 2006; Ultech, 2003). Features of current services can be subdivided into four categories: (a) features common to ASR, CART, and keyboard systems; (b) features unique to ASR systems; (c) features unique to CART systems; and (c) features unique to keyboard systems.

a. Features common to ASR/CART/keyboard systems.

- Current remote systems typically require the speaker, such as a teacher, to wear a microphone that communicates with a phone that relays the speech signal to a provider at a remote location. Some systems describe the voice connection as a conference call.

- Placement of a polycom microphone in the class or meeting room is another recommended option. In addition, it is recommended that the provider use telephone headsets or a speaker phone in listening to the message from the class or meeting room (National Court Reporters Association, 2002).

- In some remote systems, the provider produces the text and sends it to the consumer's computer (usually a laptop), which has special software for viewing the text, via the Internet (Aylesworth, 2004). The consumer's computer usually connects to the provider via the Internet using a wired or wireless local area network connection.

- In other remote systems, the provider continuously uploads the text on an Internet site that the students' laptop then accesses. This requires minimal special software on the students' computer. These websites may allow simultaneous access by multiple users.

- Some providers describe the website as similar to a "meeting room" on the Internet. This room, or site, receives the feed from the provider and allows viewing of the text by the consumer (Caption First, 2008). Software packages such as NetMeeting, which is a free download, and WebEx allow this type of meeting (National Court Reporters Association, 2002).

- Some remote systems use a classroom interface device, such as the ccSatilite box in Caption Mic, to facilitate transfer of the speaker signal to the provider.

- Some systems include downloading of an applet or other small software package onto the web browser of the client's computer. This procedure allow better viewing of the caption's on the Internet site that is accessed by the client's computer (Caption First, 2008).

- The system may include a web camera so that the provider can see what is going on in the classroom. In addition, web cameras is one way that they provider and client may communicate with each other (Aylesworth, 2004).

- If the provider and client both share a software, such as C-Print Pro, the provider and client may communicate with each other on an independent channel.

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b. Features unique to ASR systems

- The provider listens to the audio and "shadows," (other terms are "echoes," and "re-speaks") the words into the ASR software, which converts the dictation into text.

- Dictation macros can enable the provider to insert names, or phrases into the text without requiring the provider to say the full phrase. For example, the provider may say "CLC" for "coordinated list of chemicals," because the provider has entered CLC into the system's dictionary as a macro for the expanded phrase (Caption Mic, 2008).

c. Features unique to CART systems

- Captions may be added to Webcasts. The captioning signal is added to the broadcast signal before being sent to the Web. The technology involved in this arrangement is similar to that used for regular broadcast captioning (Caption First, 2008).

- Some CART providers use text streaming. This technology regulates the flow of text so that it appears on the screen in a consistent, even manner. When the text box technology is combined with a Webcast, it enables the consumer to combine the text with other features, or pods that are part of the Webcast, such as audio, video, and chat functions (National Court Reporters Association, 2002).

Potential Benefits of a Multimedia Cyberinfrastructure

This working paper is intended to provide some initial ideas for development of a multimedia cyber infrastructure that provides remote communication support for d/hh students in STEM mainstream classrooms. The following possible benefits of a cyberinfrastructure are intended for a wide variety of class situations, from a standard class, to a laboratory, to a field trip.

- Allow a person to create on-demand service if needed.

- Allow coverage for a variety of times.

- Allow access to the service from a variety of places.

- Support access in group communication situations.

- Allow choice from among a variety of services.

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- Allow easy access to the saved text version of the captioning after the event.

- Allow the combining of captions with other forms of input.

- All ways for the d/hh client to ask questions; make comments; etc.

- Maintain consistent, reliable service.

- Provide service on a variety of display devices from smart phones to desktop computers.

Associated challenges to creation of the cyberinfrastructure are as follows:

- Creation of technology that would coordinate the various options to permit choice. and that would allow the various options to work together.

- Coordination of agencies that provide services to allow near continuous availability of services.

- Creation of a scheduling system that would make on-demand or near on-demand services feasible.

- Create storage access to allow use of the saved text produced with the captions as appropriate.

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Overview of Educational Interpreting

The presence of interpreters in mainstream classrooms began in earnest in 1975. Public Law 94-142, subsequently the Individuals with Disabilities Education Act (IDEA) promulgated the practice of educating deaf children in the "least restrictive environment", i.e., mainstream classrooms. These regulations led to a significant increase in the number of deaf children attending public schools (Moores, 1987) and a concomitant surge in the need for interpreters in those schools.

Hurwitz (1991) was one of many researchers who noted that formal training for the task of educational interpreting was lacking, a condition which persists to this day. Jones (2004) provides a useful set of terms and definitions that will clarify our topic.

K-12 Educational Sign Language Interpreter:

> "Educational Interpreter" means a person who uses sign language in the public school setting for purposes of facilitating communication between users and nonusers of sign language and who is fluent in the languages used by both deaf and nondeaf persons (CO 2002, 22-20-116 (2), in CDE 2002).
> [An educational sign language interpreter] ...is a professional, who facilitates communication and understanding among deaf and hearing persons in a mainstream environment. The interpreter is a member of the educational team and is present to serve staff as well as students, hearing as well as deaf people, by minimizing linguistic, cultural, and physical barriers. The title, "Educational Interpreter," is recommended by the National Task Force on Educational Interpreting, and is intended to imply that a person holding this title is a professional with specialized preparation in deafness, whose primary role is interpreting, but who is also qualified to provide certain other educational services (New York 1998).

Interpreting:

> "...the process of changing messages produced in one language immediately into another language. The languages in question may be spoken or signed, but the defining characteristic is the live and immediate transmission" (Frishberg 1990, 18).

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"Interpreting...refers either to the general process of changing the form of a message to another form, or to the specific process of changing an English message to American Sign Language (ASL), or vice versa" (Winston 1989, 147).

Research shows (Jones, Clark & Soltz 1997), however, the term "interpreting" in the K-12 arena refers to transliterating (between two codes of English: one spoken, one signed).

Transliterating:

"...is a specific form of sign language interpreting. It is the process of changing one form of an English message, either spoken English or signed English, into the other form. The assumption in transliteration is that both the spoken and the signed forms correspond to English, the spoken form following the rules of standard English and the signed form being a simple recoding of the spoken form into the manual code of expression" (Winston 1989, 147).

Transliteration incorporates features of American Sign Language (ASL) to enhance clarity. Ability to transliterate implies a knowledge of ASL features so that they can be incorporated into a transliteration.

While there is a small but growing body of research into the qualifications, efficacy, roles, and responsibilities of educational interpreters, there is general agreement that an alarming number of interpreters working in K-12 settings are ill-prepared for their work. In a survey from 2001, Jones reports that 50% of educational interpreters held no certification; 58% were not evaluated for interpreting skills prior to being hired; 31% had *never* been evaluated for interpreting skills; and 38% had never received in-service training. These numbers were largely corroborated by a subsequent study (Peterson and Monikowski, 2006) of educational interpreters in Ohio.

Needs

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Clearly education is chief among the needs of these interpreters. There are relatively few baccalaureate programs that specialize in the training of educational interpreters, an odd fact given that fully 20 years ago it was found that more than 50 percent of graduates from interpreter education programs (IEPs) went to work in K-12 and postsecondary settings (Stuckless et al.) . A recent survey found there to be 130 IEPs in this country. Of that number, only 30 were baccalaureate programs and of those programs, only a very few specialized in educational interpreting.

The perception of inattention to quality has also led to educational interpreters suffering something of a stigma in the interpreting community, a phenomenon little studied but much discussed, to wit the recent brouhaha when the Registry of Interpreters for the Deaf recently decided to confer full voting status on educational interpreters who met certain qualifications.

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The early results from this wide netting of data on educational interpreting confirm long held suspicions about the quality of interpreting in many venues. On the positive side, however, this broad implementation holds great hope for the eventual identification and acceptance of standards in this field.

Possible Directions for the Future

The advent of Video Relay Interpreting has, in a very short period of time, changed fundamental considerations in the field of sign language interpreting. Video Relay Interpreting can be defined as a technological innovation whereby the interpreter and the two interlocutors are all in separate locations. The signing consumer and the interpreter can see each other on videophones. The hearing consumer and the interpreter

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are linked by phone line. In this way the interpreter can serve the communication needs of both consumers without having to be physically present with either of them.

The growth of video work is unprecedented. In 2002, Video Relay Service (VRS) companies provided 530,053 minutes of interpreting service. In 2006 that number had grown exponentially to 44,326,554, and continues to grow apace. Projections for the year ending in June of 2008 are for the provision of 65,139,834 minutes of service (NECA, 2007). This explosive growth has meant that an ever-increasing number of interpreters are committing to a steadily escalating workload in the VRS environment. Given that the demand for this service far outstrips the number of qualified interpreters able to perform it, stress on the population of interpreters has already been felt. There is reason to believe that this situation will get much more serious before it improves.

The effect of fatigue on the efficacy of sign language interpreters and interpreting is little studied and poorly understood. Moreover, the work that has been done in this regard is focused on traditional (non-VRS) interpreting. While VRS interpreting has much in common with traditional interpreting, it also has some major differences (Taylor, 1995). VRS interpreters work in circumstances that are unique to video interpreting, e.g., working from a video source, working in a cubicle, working in a rapidly changing series of contexts, working in an overlapping series of roles (interpreter, customer service agent, operator, technician).

VRS interpreting needs to be differentiated from Video Remote Interpreting (VRI). Where VRS interpreting requires that the two parties being interpreted for be in different locations, VRI does not have that restriction. The absence of this stipulation means that VRI work has potential in classrooms. However, much remains to be known about such an application. While it might serve well in lecture settings, it would be largely unserviceable in other situations, like small-group discussions or any of the sundry dialogue-based interactions that happen in classrooms.

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June 11, 2008

Educational Captioners and Interpreters:

Section of Working Paper on Captioning

(Reflects input from group members regarding captioning)

Overview of Remote Captioning Services

In remote captioning, an intermediary operator in an office in a remote location produces text with (a) a stenographic machine, (b) a QWERTY keyboard, or (c) automatic speech recognition while listening to the information via an audio source as it is being spoken by a teacher. As used here, *captioning* is the umbrella term for speech-to-text services and *remote captioning* is the umbrella term for remote speech-to-text services. Often when a speech-to-text service is used, interpreting and/or notetaking services have *not* been provided to deaf/hard-of-hearing (d/hh) students unless there are several of these students who have diverse needs in a class (Marschark, et al.; Stinson & Antia, 1999). Generally the goal of *steno-based services*, which employs a 24-key steno-machine and is also called Communication Access Real-Time Translation (CART), is to produce a verbatim display of the spoken message (Preminger & Levitt, 1998; Steinfeld, 1998; Smith, 2003; Stinson, Stuckless, Henderson & Miller, 1988). This approach is based upon theory concerning phonetics and syllables.

Keyboard-based approaches often use computer-enhanced high-speed typing to provide access to the spoken information. The two most common of these approaches, C-Print and Typewell, use word abbreviations with a QWERTY-based keyboard to enable the service provider to, as closely as possible, capture the meaning of the spoken word (Harkins & Bakke, 2003; O'Neill & Laidler, 2004; Stinson, Elliot, McKee & Francis, 2000; Stinson & Stuckless, 1998). In the last few years, *automatic speech recognition-based* (ASR) services have begun to be used as a support for communication access and learning for students who are d/hh or who have other disabilities

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(Aylesworth, 2006; Viable Technologies, 2005). Automatic speech recognition may be used to provide a word-for-word translation, in a manner similar to a stenographic-based system, or a to provide a meaning-for-meaning translation, in a manner similar to a keyboard-based system.

Needs

Captioning service providers typically provide a real-time text display on a laptop computer for the student or other client to view in class, meeting, etc. However, support service needs still go unanswered in a variety of education, work, and extracurricular settings. Following are needs that have been identified for remote captioning services:

- Software that can translate either steno or voice into text.

- Software that allows for displaying formulas with symbols, not just words

- If the speaker at the remote location, such as the teacher, wears a microphone, then s/he needs to repeat what others are saying so that the provider hears the discussion.

- Settings that involve multiple speakers can be challenging for remote providers with respect to hearing all the comments or relying on the person with the microphone to repeat the comments. Other challenges with this type of situation are in the identification of speakers. The provider is dependent on the speakers identifying themselves or relying on their judgment as to whether the speaker is a male or a female, which may be difficult to ascertain if the sound quality is poor. Another consideration is the student who is receiving the text, sees only "male speaker or female speaker", and may not be in a position at the table to visually determine who exactly is speaking.

- The provider typically does not see the figures, charts, etc. that the teacher (or other speaker in the remote setting) uses in the classroom, and this may affect the provider's comprehension of information, as well as the resultant display. There need to be improved ways for providers to prepare via textbooks, syllabus, PowerPoints, faculty and student names, etc.

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- Instructors may use media to support their teaching and if this media is not captioned, the provider would need excellent sound and visual access to accurately represent the information in text for the student. Advanced viewing of this material is always helpful.

- If a web camera is used at the remote location, the provider can usually see references such as left, right, top, bottom with regard to comments made by the speaker (this, that, there) and refer the student to a specific location on the board or on the projection screen. The picture is not generally large enough or clear enough to offer additional visual cues for the provider that can support comprehension of the material.

- If the material is technical, the speaker may use jargon. If the provider is not aware of these technical words it may affect the production of accurate text.

- Students, teachers and other users need to be trained to set up and use technology and equipment with which they may be unfamiliar.

- Online training of students, faculty and staff on the distinction between world-for-word versus meaning-for-meaning services is desirable to ensure that the chosen service is appropriate for the particular classroom situation and student needs.

- Remote services need to have sufficient flexibility to effectively support individuals in many educational, work, and community settings. For example, community colleges in isolated settings that occasionally have d/hh students who need captioning services will benefit from services that are easy to install and use, work on a variety of display devices, and are inexpensive. Other settings, such as co-op experiences, often require meetings and professional development for which communication access is obviously crucial, but for which such access is often not available.

- Easy access by students or other users to the captioned material after the class or other event has been completed is desirable. It is desirable to have an electronic record of the transcript that the student can access after the visit. This transcript will help students recall what happened at the visit and further understand course material.

- Provision of captioning support services in nontraditional learning settings, such as laboratories or field visits where traditional delivery systems may be impractical is desirable. The absence of these supports

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can preclude d/hh students from taking courses and participating in other activities with field visit components. Improvement of remote captioning would help overcoming this barrier. For example, students involved in medical or nursing field experiences will require mobility for remote captioning equipment and potentially nontraditional placement of the equipment. Pat Billies mentioned at the 2008 PEPNet conference the placement of a PDA in a cadaver next to the body part the instructor was discussing so the student could follow the lecture along with the visual information the instructors was providing within the cadaver.

- Disconnection and re-establishing of connections may be an issue. Disconnection may be more likely to occur if the connection is a wireless Internet connection, or through a cell phone.

- The student and provider must be prepared to resolve technical issues when they arise during the remote captioning process or have immediate access to a technician who can resolve the issues quickly.

- The lag time between the time a person, such as a teacher, speaks at a remote site and the display of text on the client's device may increase if cell phone lines are used.

- If speakers change and a polycom microphone is not feasible, the microphone may need to be changed from one speaker to another, such as on a field visit where the instructor gives the microphone to a guide at a place being visited. This could contribute delay and other possible difficulties.

- If a conference or USB microphone is used at the remote location, the provider can usually hear comments from several speakers. However, other sound issues can interfere with the sound quality such as chatting, coughing, rustling papers, or tapping near the placement of the microphone.

- If there is significant background noise in the setting, such as at a factory, this can affect the ability of the provider to hear the spoken message.

- Prep material is a necessary tool for supporting quality services. Experience in the topic area where services are needed or prep material is essential to support quality services with remote captioning.

- It may be desirable to have two-way communication between the speaker and the service provider, to obtain clarification, etc. This two-way communication may be with students via instant messaging or chat room

- D/hh students need a way to ask questions or make comments to the teacher or others at the remote site.

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- A comprehensive clearinghouse, coordinating, or scheduling systems that allows d/hh users to easily arrange for their preferred service is desirable. Currently, a user contacts an individual company or agency ahead of time and that organization then arranges services. Thus, on demand, on-the-spot, service is not available.

- Captioning for online or distance learning is desirable.

- Software that allows ASCII text to flow through the Internet to a secure server is desirable.

- Improved Internet connections in the classroom that allow students to access a website to receive text is desirable.

- An encoder and a phone line at the remote site to receive text and merge it with an image. Sometimes a switcher is needed to switch between cameras and computer or other images is desirable.

- Improved was for service providers to hear what is being said via phone line or VoIP is desirable.

- A way for paying service providers is desirable.

- System for recruiting and training service providers is desirable.

Current Services

Remote CART, automatic speech recognition (ASR), and keyboard-based captioning services are currently available (Aylesworth, 2004; Preminger & Levitt, 1998; Rapidtext, 2006; Ultech, 2003). Features of current services can be subdivided into four categories: (a) features common to ASR, CART, and keyboard systems; (b) features unique to ASR systems; (c) features unique to CART systems; and (c) features unique to keyboard systems.

a. Features common to ASR/CART/keyboard systems.

- Current remote systems typically require the speaker, such as a teacher, to wear a microphone that communicates with a phone that relays the speech signal to a provider at a remote location. Some systems describe the voice connection as a conference call.

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- Placement of a polycom microphone in the class or meeting room is another option. In addition, it is recommended that the provider use telephone headsets or a speaker phone in listening to the message from the class or meeting room (National Court Reporters Association, 2002).

- In some remote systems, the provider produces the text and sends it to the consumer's computer (usually a laptop), which has special software for viewing the text, via the Internet (Aylesworth, 2004). The consumer's computer usually connects to the provider via the Internet using a wired or wireless local area network connection. This system may involve a USB microphone connected to a laptop computer with the student that relays the speech signal to the provider through a free software program (Skype), which is loaded on the student laptop computer and on the provider desktop or laptop computer.

- In other remote systems, the provider continuously uploads the text on an Internet site that the students' laptop then accesses. This requires minimal special software on the students' computer. These websites may allow simultaneous access by multiple users.

- Some providers describe the website as similar to a "meeting room" on the Internet. This room, or site, receives the feed from the provider and allows viewing of the text by the consumer (Caption First, 2008). Software packages such as NetMeeting, which is a free download, and WebEx allow this type of meeting (National Court Reporters Association, 2002).

- Some remote systems use a classroom interface device, such as the ccSatilite box in Caption Mic, to facilitate transfer of the speaker signal to the provider.

- Preparation materials are typically gathered by providers. The service provider may be given access to the professor's listserv and PowerPoint/class outline repository.

- Some systems include downloading of an applet or other small software package onto the web browser of the client's computer. This procedure allow better viewing of the caption's on the Internet site that is accessed by the client's computer (Caption First, 2008).

- Some systems allow highlighting sections of text for note taking purposes.

- Edited text may be placed in a repository for access by students and faculty.

- The system may include a web camera so that the provider can see what is going on in the classroom (however, note limitations stated above). In addition, web cameras are one way that the provider and client may communicate with each other (Aylesworth, 2004).

- If the provider and client both share a software, the provider and client may communicate with each other on an independent channel in the software.

- There are two types of displays: a full screen of text or an image with text. These displays can appear on a myriad of screens, computers, or handheld devices. All word-for-word or meaning-for-meaning systems and technology can be displayed as a full screen of text without an image as well as text with an image.

- University Disability Service Coordinators determine the needs of the student and contracts with the appropriate service provider.

- The institution decides on the display method (either full screen of text, text with an image, or another option) to be delivered via Internet or phone line and encoder.

- Students are empowered to make personal choices about their screen display, such as font size and color. For full-screen display, a student can download the PowerPoint presentation from the professor and layer the flowing text underneath it or alongside.

- Universities are billed for services.

b. Features unique to ASR systems

- The provider listens to the audio and "shadows," (other terms are "echoes," and "re-speaks") the words into the ASR software, which converts the dictation into text.

- Dictation macros can enable the provider to insert names, or phrases into the text without requiring the provider to say the full phrase. For example, the provider may say "CLC" for "coordinated list of

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chemicals," because the provider has entered CLC into the system's dictionary as a macro for the expanded phrase (Caption Mic, 2008).

c. Features unique to CART systems

- Captions may be added to Webcasts. The captioning signal is added to the broadcast signal before being sent to the Web. The technology involved in this arrangement is similar to that used for regular broadcast captioning (Caption First, 2008).
- Some CART providers use text streaming. This technology regulates the flow of text so that it appears on the screen in a consistent, even manner. When the text box technology is combined with a Webcast, it enables the consumer to combine the text with other features, or pods that are part of the Webcast, such as audio, video, and chat functions (National Court Reporters Association, 2002).

Potential Benefits of a Multimedia Cyberinfrastructure

A multi-media cyber infrastructure refers to high bandwith connections between institutions that allow for collaboration using software, hardware, and other technologies. This working paper is intended to provide some initial ideas for development of a multimedia cyber infrastructure that provides remote communication support for d/hh students in STEM mainstream classrooms. The following possible benefits of a cyberinfrastructure are intended for a wide variety of class situations, from a standard class, to a laboratory, to a field trip.

- Inter-institution connections for a class are an economical way to teach many students.
- Allow a person to create on-demand service if needed.
- Allow coverage for a variety of times.
- Allow access to the service from a variety of places.
- Support for access to group communication situations.
- Allow choice from among a variety of services.
- Allow easy access to the saved text version of the captioning after the event.
- Allow the combining of captions with other forms of input.
- All ways for the d/hh client to ask questions; make comments; etc.

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- Maintain consistent, reliable service.

- Provide service on a variety of display devices from smart phones to desktop computers.

- Distance learning or remote students can use a chat or IM function or an audio connection to comment or ask questions. A designated person can real aloud all typed comments and questions.

- A cyberinfrastructure allows for easy access to the saved text as well as a time-coded on-demand replay of the text and video.

- Stored text allows for exams to be developed quickly and easily.

- Institutions can "share" laboratory exercises and expenses with the use of Webcam and time-coded text. Though not hands on for all students, the knowledge can still be shared.

- Institutions can share resources, including faculty, guest speakers, and tutors.

- Use of webcams used with high bandwidth inter-institution Internet connections allows for completed information exchanges of words and formulas written on the board in class as well as facial expressions of the professor and students.

Associated challenges to creation of the cyberinfrastructure are as follows:

- Creation of technology that would coordinate the various options to permit choice. and that would allow the various options to work together.

- Coordination of agencies that provide services to allow near continuous availability of services.

- Creation of a scheduling system that would make on-demand or near on-demand services feasible.

- Creation of storage access to allow use of the saved text produced with the captions as appropriate.

- Storage of audio/video/text files

- Slowdown or shutdown of Internet

- Developing retrieval procedures and policies for specific files or classes.

- Collaboration between private (for profit) agencies and public (non profit) educational institutions

- Creation of policies that are appropriate for all clients and all environments.

- Cooperation between agencies/institutions with instructors who may not fully understand the remote process or appreciate the importance of sharing educational material with the provider ahead of time. It

could be challenging for the instructor to receive a request for prep material from a provider who is not associated with the institution at which the class is being taught.

- If one institution experienced campus wide technical issues, would other institutions experience similar issues solely based on their technical connection for the remote captioning?

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As of June 24, 2008

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«GreetingLine»   Page 1   6/24/2008
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This material is based upon work supported by the National Science Foundation under Award No.OCI-0749253

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Educational, Linguistic & Sign Language Researchers/Developers Group
Talking Points
As of June 16, 2008

Rough DRAFT

Background/Problems:
1. Historical Sketch: IDEA, its impact on separate vs. mainstream education for d/hh students, and visual technologies traditionally employed in those settings
2. Increasing d/hh enrollment at mainstream colleges/universities, effects on services and costs
3. Often no standardized signs for advanced STEM topics, effects on learning and employment
4. Isolation and communication barriers in mainstream education, effects of cyberinfrastructure

Possible "Categories" of Research Questions and Likely Audiences
1. Utilization and benefits of cyberinfrastructure: educational, linguistic, cognitive (and perhaps child development) researchers/developers
2. Needs and preferences: students, stem faculty, support services coordinators, cyberinfrastructure geeks
3. Technology, implementation, alternative business models: support services coordinators, educational captioners and interpreters, educational administrators

Immediate Research/Evaluation Questions:
1. What is the current technological "state-of-the-art"?
2. Readiness of current and emerging technology to facilitate and improve remote services?
3. What is the current technological infrastructure and support services capabilities at "typical" universities (and K-12 programs?) where remote services could be deployed?
4. What is the current educational "state-of-the-art"?
5. Student, faculty, and institutional perspectives/willingness to implement technological solutions to communication issues (including student self-identification)?
6. Need for student and/or faculty training to utilize cyberinfrastructure effectively?
7. Student preferences vs. actual educational performance with different systems?
8. Potential advantages/disadvantages for hearing students?
9. Impact on classroom dynamics when remote system is deployed?
10. Applications of remote systems within traditional classrooms, blended learning and other group interactions?
11. The roles of the student, STEM faculty, and service providers in ensuring technical, communication, and educational success with remote systems.

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12. What should be included in a "Best Practices" manual? Should there be different manuals for different audiences?
13. What elements should be incorporated in a Business Model to ensure long-term implementation and cost effectiveness of remote services?

Research Directions:
1. Long-term costs and benefits of technological solutions
2. Social or literacy effects of technologies in the classroom?
3. Effects of cohort differences in technological savvy
4. Advantages and disadvantages of synchronous vs. asynchronous services
5. Supporting collaboration within the classroom
6. Supporting multi-person discussion in the classroom (group work/study, discussion, labs)
7. Supporting instructor "buy-in" and "buy-out" - for instructors interested (or uninterested/unaware) in modifying pedagogy to be more accommodating
8. Terminology/language for ASL and STEM – possible technological solutions (and dead-ends)
9. Interpreter/captionist training and advancement in STEM (different issues?)
10. Transition programs for students from low-tech to high-tech environments
11. Remote mentoring, remote support, not just remote accommodation
12. Enhanced captioning (including graphics, diagrams, spatially important text)
13. Automatic speech-to-text (not ready for prime time?)

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Educational, Linguistic & Sign Language Researchers/Developers Group

<u>Research Directions</u>

September 22, 2008

1. Long-term costs and benefits of technological solutions (some not ready for prime time? e.g., automatic speech-to-text)

2. Social or literacy effects of technologies in the classroom, including remote mentoring, remote support (i.e., not just remote accommodation)

3. Effects of cohort differences in technological savvy

4. Advantages and disadvantages of synchronous vs. asynchronous services

5. Supporting collaboration within the classroom such as supporting multi-person discussion in the classroom (group work/study, discussion, labs)

6. Access strategies that are student versus organizational dependent

7. Terminology/language for ASL and STEM – possible technological solutions (and avoiding dead-ends)

8. Interpreter/captionist training and advancement in STEM (different issues?)

9. Enhanced captioning (including STEM related symbols, graphics, diagrams, typographic characteristics that enhance readability)

10. How can the access community share needs with the appropriate regulatory, standards development organizations and industrial design organizations to ensure products/services incorporate features that will benefit the diverse students we serve?

http://www.ntid.rit.edu/cat/summit

Summit Participants
As of June 24, 2008

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CyberInfrastructure Specialists
Draft of White Paper

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DRAFT
May 18, 2008

Introduction

The computing-enabled infrastructure of the 21st century, required to support a knowledge economy in today's information age, has been termed **cyberinfrastructure**. The term refers to the networked digital communications and storage technologies, and advanced software for distributed and parallel computations and visualization. (An analogy has been drawn with the traditional notion of infrastructure, a term coined in the 1920s to refer collectively to the roads, power grids, telephone systems and similar public works required for an industrial economy).

This group of experts, representing cyberinfrastructure, as well as user interface and video technologies, will offer a perspective on the state of cyberinfrastructure as it applies to the delivery of remote interpreting and captioning systems within a postsecondary educational environment.

Of particular importance for this summit and for this group, would be discussions on the creation of cybertools to facilitate communication between deaf and hard of hearing (DHH) faculty and students and hearing faculty and students in an higher educational setting with a focus on STEM disciplines. The development of cybertools would require a well-defined and organized community of practice (CoP) to define standards and mechanisms for sharing information as well as applications. They are very critical to achieve the stated goals of wide dissemination and effective usage of cybertools.

Overview of Cyberinfrastructure

Cyberinfrastructure has been defined as "*a layer between fundamental [computing] components and applications – as illustrated in Figure 1 [FRE 03]; a thick layer that empowers the federation of distributed resources - such as people, expertise, computational tools and services, data, information sensors and actuators - to create virtual organizations or teams that reduce constraints of distance and time. Distance in this context could be measured geographically, organizationally, or in a disciplinary sense. Cyberinfrastructure … [is] a means to an end, involve finding and supporting commonality of use, encapsulating best practice, enabling interoperability, making it easier, more cost-effective for a wide range of applications with specific requirements and participants.*" [HLS 04]

Cyberinfrastructure is more than just hardware and software and bigger computer boxes and wider pipes connecting them. In addition to more powerful processing and communications technology, cyberinfrastructure requires **shared development software tools and also shared, community-specific applications and data**. The focus is thus on the creation of much more powerful computing environments driven by the requirements from the practitioners in a given domain. In this work we are focusing on the domain of providing support for the DHH community in a university setting.
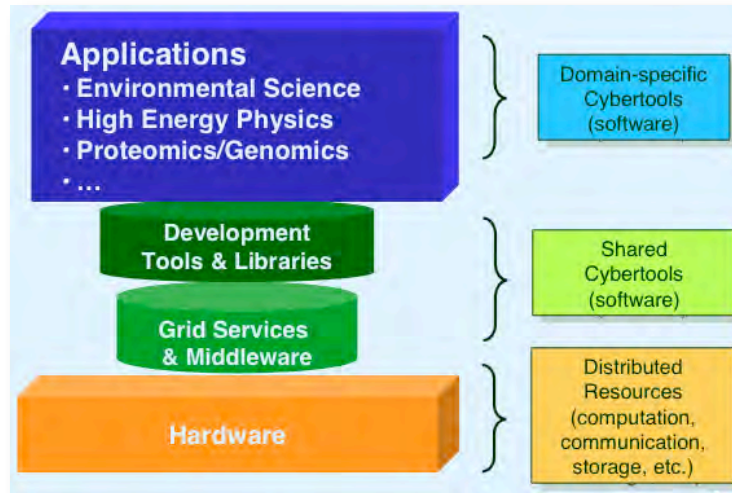
Figure 1: Cyberinfrastructure Components

Cyberinfrastructure support for the Deaf and Hard of Hearing

Services within the cyberinfrastructure framework to support DHH would include among others the following:

- Develop approaches, methods, and techniques for enabling information to be exchanged among sets of users, for discovering sets of users who could benefit from the exchange of information, and for studying how such exchanges affect those involved
- Support workshops with particular user communities to test different methods and technologies to analyze the effectiveness of the cybertools
- Provide system (and inter-system) integration, operation, and administration
- Supplement existing national or regional facilities to enable optimal and productive use of them
- Ensure effective design of the environments through participation in their development

Figure 2 illustrates an approach to support DHH Communities of practice. The elements of core computing and information sciences are put to work together to create computing environments especially designed to enable effective communication with DHH communities. Feedback from use advances both cyberinfrastructure itself and the community's "maturity," by answering newer questions, and by allowing quick problem reformulation. Activities associated with CoP include:

- Develop and make accessible Cybertools based on domain-specific vocabularies, ontology, and data schema for the specific solutions
- Integrate multimedia solutions to facilitate interoperability across platforms

- Identify key building blocks into a framework for the DHH computing environment
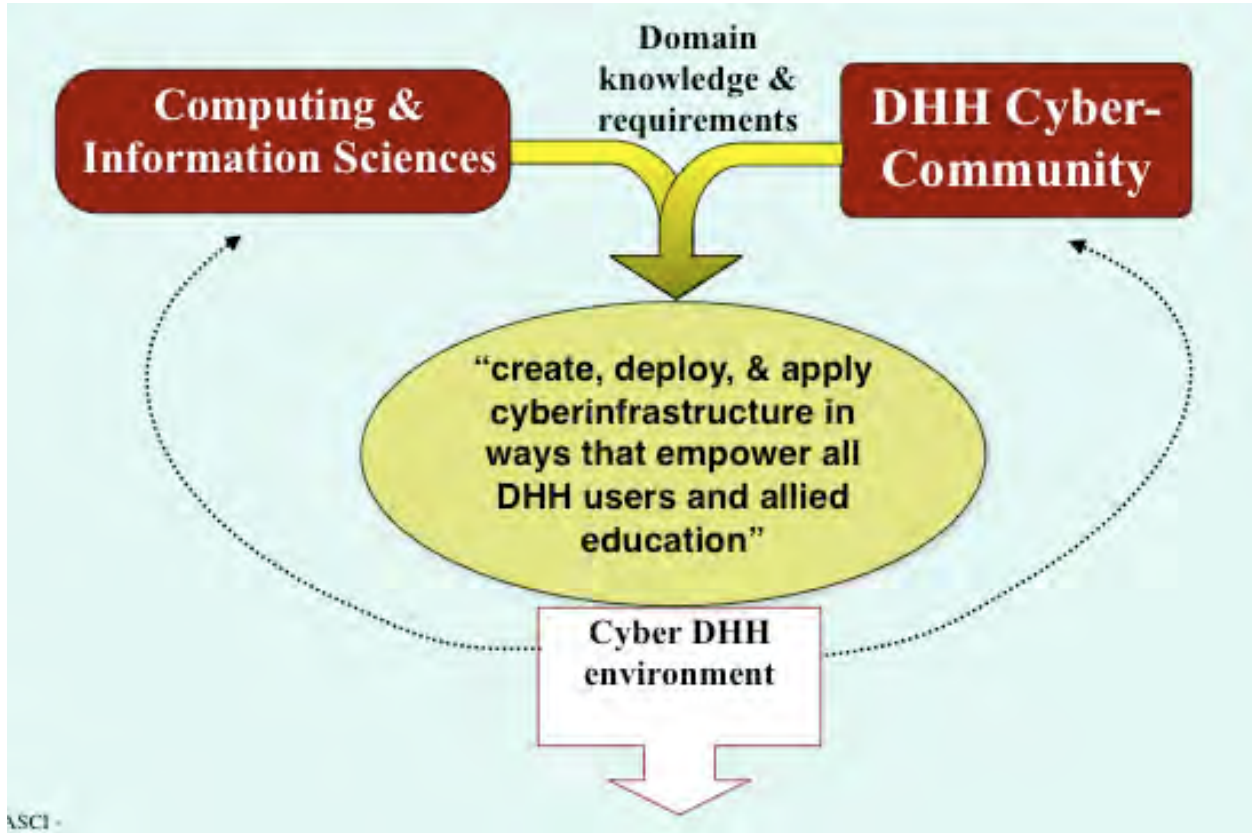

Figure 2: Cyberinfrastructure Working Model

Collaboration Tools and Environments

It is fundamental for the cyberinfrastructure framework to be effective that it explicitly incorporates the notion of domain-specific problem areas from DHH community. An important motivation for this approach is a desire to modularize systems in a domain in such a way that solutions to new problems can be built from standard parts. This would allow, for example, the development of communicating systems to help DHH persons in their core competencies quickly and effectively.

-- Microsoft NetMeeting and the Role of Internet Conferencing for Deaf and Hard-of-Hearing Users

-- Adobe Acrobat Connect Captioning Extension and Adobe Connect.

-- IBM **IBM ViaScribe**: Creates a written transcript of existing audio or video content or provides an instant transcript of live audio content
   * Automatically captions audio content as it occurs
   * Offers an intuitive interface for speakers to learn and use

* Facilitates searching and indexing of content

Setting up a Cyberinfrastructure-supported Communication System

<<TBD>>

Conclusions and Future Directions

<<TBD>>

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Summit to Create a Cyber-Community to Advance Deaf and Hard-of-Hearing Individuals in STEM (DHH Cyber-Community)

June 25-27, 2008

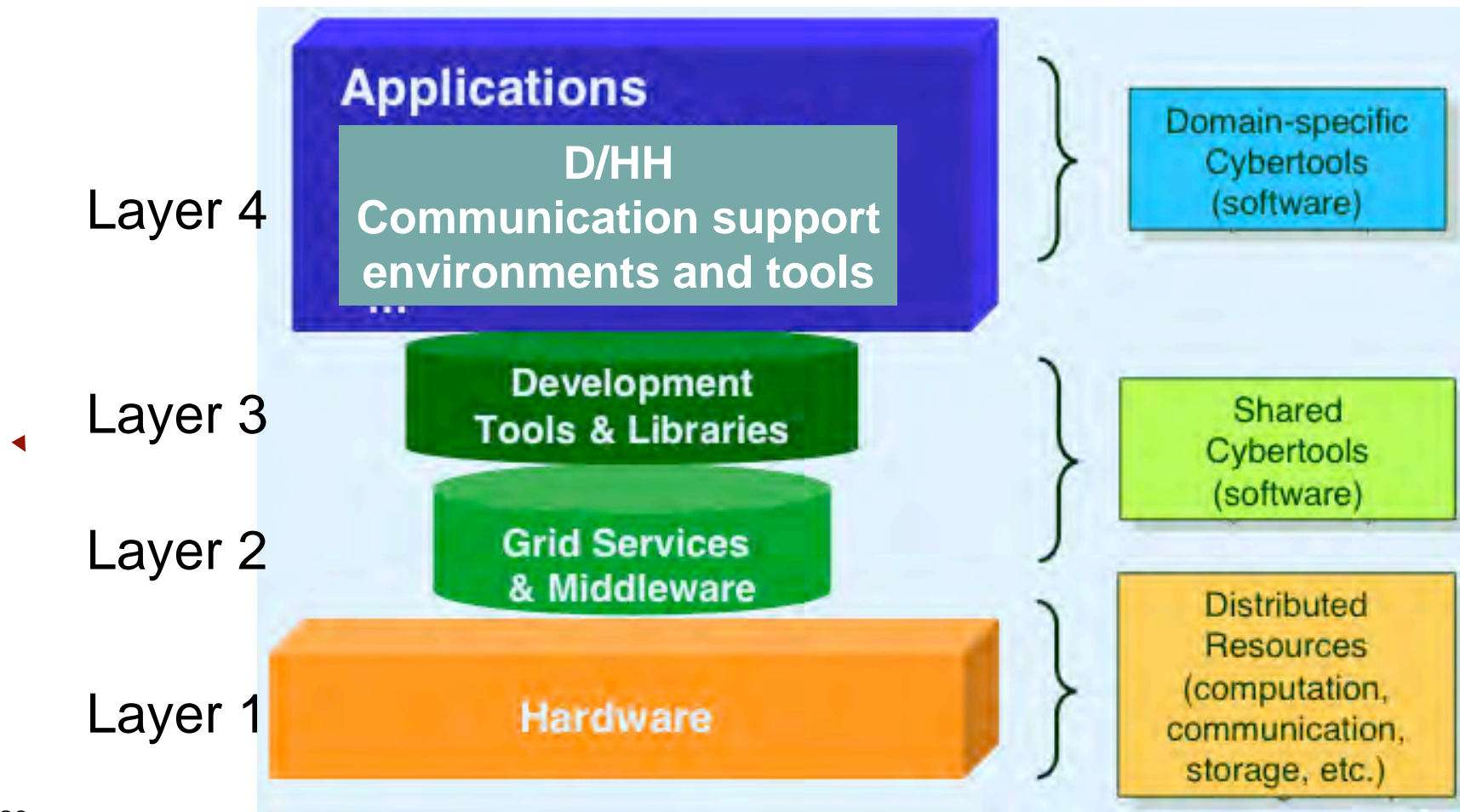# Cyberinfrastructure Specialists

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Recommendations

o Create an *Experimental Platform and Testbed* for developing state-of-the-art cyber environments to support D/HH STEM students, faculty, and other stakeholders.

- Requirements gathering

- Design process

- Challenges

- *We are NOT developing the ultimate application but providing the building blocks for others to experiment and build applications to fit their needs*

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Experimental Platform to support D/HH Appl

Applications

D/HH Communication support environments and tools

Layer 4 — Domain-specific Cybertools (software)

Layer 3 — Development Tools & Libraries — Shared Cybertools (software)

Layer 2 — Grid Services & Middleware

Layer 1 — Hardware — Distributed Resources (computation, communication, storage, etc.)

Experimental Platform and Testbed

o Layer 1: existing
} ← *Focus on Quality-of-Service (QoS)*

o Layer 2: existing

o **Layer 3: new** } ← *Focus on Quality-of-Experience (QoE)*

- **A combination of open source and proprietary building blocks**

- **Remote services for DHH community provided by vendors (Adobe, MS, IBM, Sun, etc.)**

- **Permanent admin and support staff**

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Individuals in STEM (DHH Cyber-Community)

June 25-27, 2008

Requirements gathering

o Investigate how technology can assist problem diagnosis and resolution (e.g., workarounds to existing networking problems)

o Take a two-step development track:

    1. Technology for short-term deployment
      (***what can be done now***)

    2. Long-term work
      (***what may be possible in 5-10 years?***)

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Requirements gathering (cont.)

1. **Short-term activities (*what can be done now*)**

- Document and improve the use case scenarios

- Explain the Everywhere, Anytime Education paradigm

- Use existing commodity technologies as part of demonstrations

- Develop guidelines for deployment

- Use ***social computing*** to automate discovery of groups of users and Cyberinfrastructure/services that they use

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Requirements gathering (cont.)

2. Long-term (*what may be possible in 5-10 years*?)

o Build a scalable server-based host environment

o Build various clients that interface with the hosting service

o Hire permanent staff

o Build a community of practice

o Prioritize needs and approaches

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Design process

o Iterative design with lots of user involvement

- User-level "programming" without writing code

o Diversity of scenarios and on-the-fly modification (e.g., widgets placements, feature/service selection)

o UI "smart" customization

- Accessible by people with differing needs
- Environment usable at any bandwidth
- User configurable (machine-driven)

o Just-in-time and just-in-case: practice ahead of time with remote interpreter and other services

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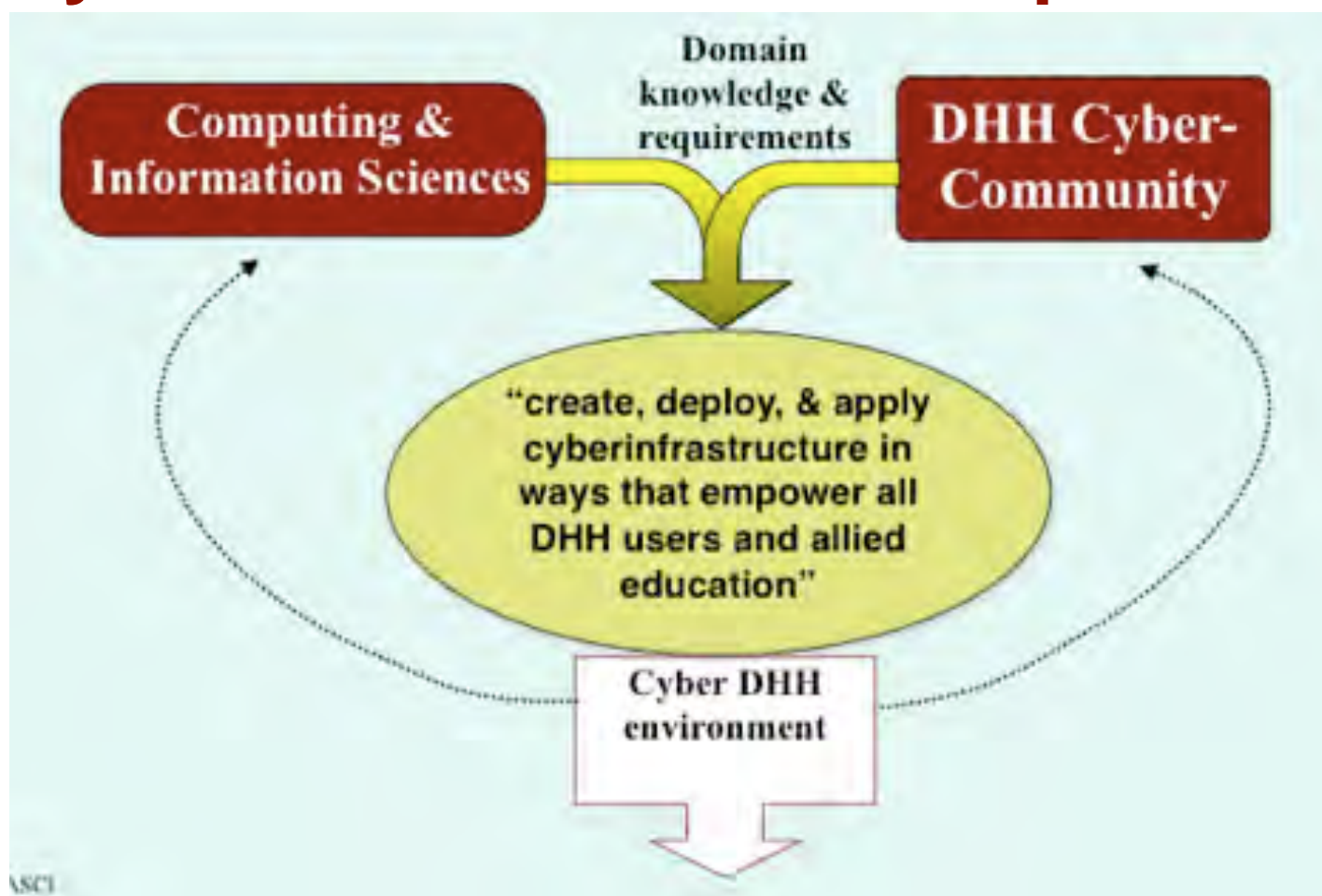
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Challenges

o Platform independence

- Technology agnostic, open source, cross platform

- Bandwidth not evenly distributed: delivery would "scale" from cell-phone to video walls, to supercomputers

o Collection of content

- Flexible domain taxonomy

- Intellectual property (who is allowed to see the archives and for how long?)

o When technology fails, what happens?

- Archiving and back-up plans

- Administration of environment(s)

Challenges (cont.)

o Ad-hoc accessibility provision

- it's not just the classroom

- Field work, chance conversations, labs, workplace, brown-bag lunch research meetings, etc.

o Universal design

- Make provision available to ALL users (notes, captions, signs, speech output, etc.)

- Crowdsourcing: if there is something wrong with, for example, archived captions, end users should be allowed to submit suggested edits for a "moderator" to review and approve.

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Cyberinfrastructure Development

Domain knowledge & requirements

Computing & Information Sciences

DHH Cyber-Community

"create, deploy, & apply cyberinfrastructure in ways that empower all DHH users and allied education"

Cyber DHH environment

Services needed for D/HH students:

o *Collaboration environments*
for multipoint teaching: unlimited, extensible, open, real-time interactive as well as asynchronous, high quality video, etc.

- Ensure effective design of environments

- High Performance Architecture: High bandwidth, Low latency, Advanced Protocols

- Authentication, authorization, service discovery, location sensing, mobile

- Real-time automatic captioning, Radio transmission (cochlear, hearing aid), Signing transmission hi-qual/3D

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Approaches to support D/HH communities

o Develop approaches, methods and techniques to enable *exchange of information* among users

- Identify key building blocks into a framework for d/hh computing environment

- Develop and make accessible cybertools based on domain-specific vocabularies

- Integrate multimedia solutions to facilitate interoperability across platforms

- Supplement existing facilities and provide system integration, operation, and administration

o Support *workshops to test* different methods and technologies to analyze effectiveness of cybertools

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Examples and Scenarios

o **Collaboration environments**

- RIT collaboration grid: Cross platform

- ConferenceXP

- Adobe Connect Captioning Extension

- Microsoft Office Live Meeting

- IBM Hosted Speech Transcription Service (INTONATA)

o **Settings**

- Academic

- Workplace

RIT Collaboration Grid

12 "CyberPortals" connecting RIT communities on and off-campus with high quality life sized, persistent, public, audio and video

- 7 Colleges of RIT
- National Technical Institute for the Deaf
- Center for Integrated Manufacturing Studies
- Student Alumni Union
- Library

- High Tech Incubator
- President's House
- Kosovo
- Croatia
- Dubai

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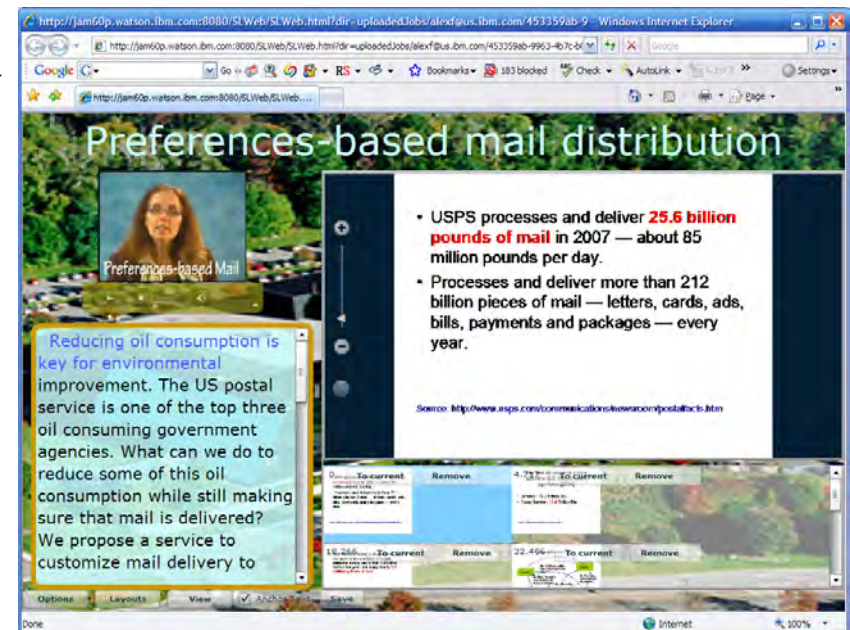
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ConferenceXP

o Platform for real-time high-quality multipoint conferencing

o Example Deployment: UW Professional Masters Program

o Key features of the platform

- Extensibility

- Archiving

o Challenges/Future Work

- Customization for this domain

- Network infrastructure needs

- Technical support requirements

- Not cross-platform

Adobe Connect

o Structured into "pods"

o Instructor sets the size and position of pods

o Favors a mode of communication in which one person is the presenter at any given time

o It is possible to conduct an entire meeting in text chat, but this is not the favored method for delivering primary course content

# Microsoft Office Live Meeting

o **Accessibility Labs**

- Adaptive UI optimized for specific person (layout & content)

- Improving usability of assistive technology

- Comm Types: ad-hoc, structured, mobile, across disabilities

- Accessibility requirements for MS coom. products & dev. tools

o **Microsoft Research (MSR)**

- Improving speech recognition

- Translating information between all devices and display sizes

- Recording experiences

- Searching through large amounts of data

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IBM Hosted Transcription Service

Equal access to information == meaning must be to be conveyed by any combination of modalities

Sign

Audio — Meaning — Text
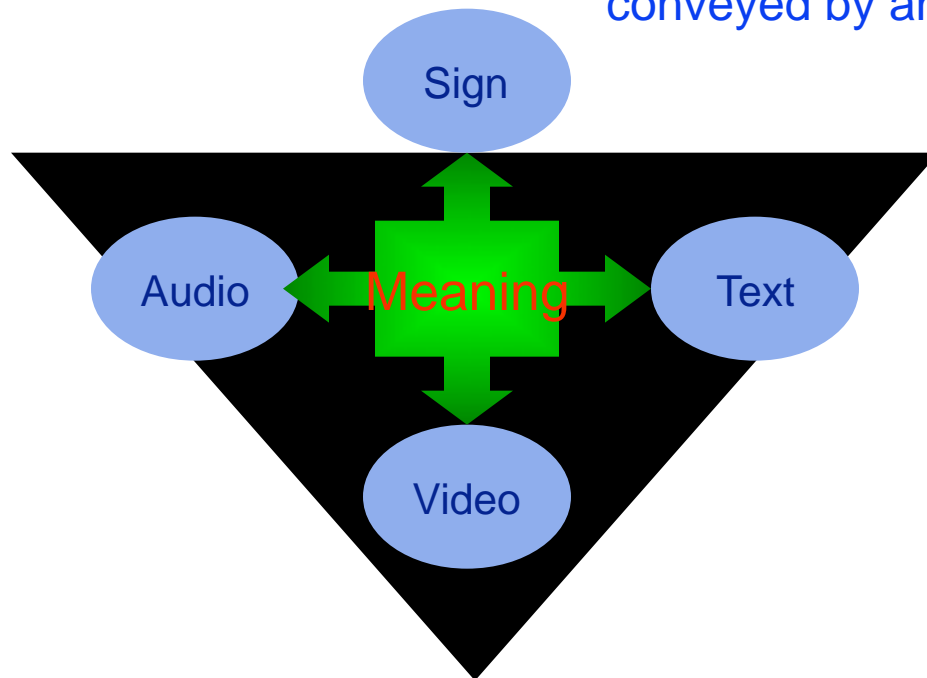
Video

IBM Hosted Transcription Service is currently focusing on Audio/Video/Text triad.

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Scenarios

o **Academic settings**

- Lecture-oriented classroom & seminar style

- Synchronous & Asynchronous

- Fixed & Mobile locality

o **Workplace settings**

- Coops

- Internships

- Labs

Philosophical differences

o **What is a classroom?**

- static lecture room

- classroom of the future is "everywhere"

o **"Everywhere, Anytime Education" Scenarios**

- Internships

- Research almost always not conducted in a lecture room

- Individual meetings, Small ad hoc research groups, Large and small group discussions

- Brown-bag lunch research meetings