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**TITLE** : **Collaborative Uses of Internet2 Technology**

# COLLABORATIVE USES OF INTERNET2 TECHNOLOGY

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A research paper submitted in fulfillment of the requirements for 3.0 credits,
Internet2 Graduate Independent Study, OBHRM 750 Fall 2001,
Professor Andy McGill, Faculty Supervisor

# FACULTY COMMENTS

This research demonstrates important cutting-edge learning about the organizational challenges that can disrupt applications of new technology -- and proposes, based on the team's pilot field research, methods for avoiding / overcoming such roadblocks.

Team members represented well themselves and UMBS in interactions with executives at Ford Motor Company, who praised their persistence, dedication, and data-gathering resourcefulness. Even more, Ford is making plans to move ahead with Internet2 deployment based on the UMBS team's recommendations.

Building on and augmenting prior work on a 2001 I-MAP project, this team traced the history of Internet2, described its potential as a platform to an extraordinary leap in Internet application, and underscored the importance of learning, refining and sharing best-practices as the new technology is employed in the business world. The team then conducted three field-research pilots on specific Internet2 applications within Ford - concluding from all three that the technology can work fine, but only if the people using it are properly and thoroughly prepared, Otherwise, it remains only a dramatic potential, albeit unachieved.

In pioneering usage research on Internet2 and capturing the importance of the human dimension in its effective use, this team has made an important contribution to the successful implementation of Internet2 in any business organization - and specifically at Ford. Their work will lead the way for others to follow suit in identifying keys to organizations successfully adopting Internet2 - ultimately contributing to a body of work that will smooth its adoption throughout the business world - leading to important new advantages and efficiencies for business, indeed society, and a roadmap for how best to achieve them.

As such, their contribution is not only accepted, but commended,

Andrew R. McGill, Ph.D.

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# HISTORY OF UMBS RELATIONSHIP WITH INTERNET2

## What is Internet2?

Internet2 is a non-profit consortium led by over 180 universities and research institutions working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet. Internet2 creates the network infrastructure (Abilene), middleware, and applications utilizing and capitalizing on the enhanced features of the network. In doing so, Internet2 is recreating the partnership among academia, industry, and government that developed today's Internet. The primary goals of Internet2 are:

- Create a leading edge network capable of meeting the needs of the national research community
- Enable revolutionary Internet applications
- Ensure the rapid transfer of new network services and applications to the broader Internet community

## Technology Shapes Changes in Business and Education

Internet2 is the next big disruptive technology.[1] The introduction of the web browser, Mosaic (which became Netscape), commercialized today's Internet. As Internet2 becomes more widely recognized, there too will be some "killer" applications that will transform it to the next level of success. Today, Internet2's development rests in the hands of educational institutions and a small number of business partners.

## Internet2 and UMBS

The relationship began with a UMBS International Multi-disciplinary Action Project (IMAP) for Ford Motor Company in 2001. Despite ongoing research activities at both universities and corporations, in 2001 there was no entity working to investigate true Internet2 business/commercial applications. Furthermore, there were no top tier business schools working with Fortune 500 companies in this area.[2] Findings indicate that Ford Motor Company and UMBS each believe that they failed to fully capture the immediate technological advances of the original Internet and that neither UMBS nor Ford is willing

[1] Duderstadt, James, Dr., President Emeritus and University Professor of Science and Engineering at the University of Michigan, interview

[2] Van Houweling, Douglas, President and CEO of Internet2, Former Vice Provost and Information and Technology Dean of Academic Outreach at the University of Michigan and current University of Michigan Business School faculty member

to make similar mistakes with Internet2.[3] To avoid that end, an IMAP team was created to investigate establishing a Ford-University of Michigan Business School Internet2 Experimentation Lab. It was to be the first to unite business academics with actual business to explore the technology, weave it into the fabric of each organization and collaboratively experiment with and develop future applications. As a result of the IMAP findings, Ford's Chief Information Officer, Marv Adams commissioned a team of five Ford executives to work on what was called the Experienced Leader Challenge (ELC) to further explore the viability of Ford's use of Internet2 and how both Ford and UMBS in partnership, could work to explore the viability of Internet2 business-education and commercial applications. After spending 12 weeks exploring Internet2 technologies, the Ford ELC team concurred with the recommendations of the UMBS IMAP team and supported the funding of three Internet2 experimentation sites: two at Ford and one at UMBS. Once complete, Ford asked UMBS to again have a group of students suggest ways in which the technology could be used now that the labs were complete.

This white paper is the result of that effort, highlighting three areas of opportunity for Ford to initially begin using Internet2 in a collaborative research effort with UMBS. Additionally, in an appendix, is the recommendation of how UMBS can begin to use Internet2 to re-launch its highly successful Global Leadership Program. During the research for this project, the UMBS team had the benefit of bringing on a technology partner, Trilogy Software, to help create demonstrations of how the technology could actually be applied. Trilogy's technological expertise helped make the team's recommendations a reality.

[3] Adams, Marv, Vice President and Chief Information Officer, Ford Motor Company and Tichy, Noel, PhD, UMBS Director Global Leadership Program & Professor of Organizational Behavior and Human Resource Management

# INTRODUCTION TO INTERNET2

## Corporate Overview

Headquartered in Ann Arbor, Michigan, with offices in Armonk, NY and Washington DC, Internet2 is a consortium led by over 180 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet. The consortium creates the network infrastructure (Abilene), middleware, and applications utilizing and capitalizing on the enhanced features of the network. The primary goals of Internet2 are to:

- Create a leading edge network capability for the national research community
- Enable revolutionary Internet applications
- Ensure the rapid transfer of new network services and applications to the broader Internet community[4]


During a team interview, Douglas Van Houweling, President and CEO of Internet2 and the UCAID, said that Internet2's aim is to create the next generation Internet focusing on the needs of the research community, which have found the original Internet is no longer sufficient for their work. Collaborative research initiatives have been hindered due to the lack of high-speed transmission capabilities and limitations on bandwidth for media-rich applications using the original Internet. Further aggravating the situation was the explosion of commercial traffic on the Internet, which has increased delays in the system. The Internet2 network infrastructure is a closed system[5] running on the vBNS and Abilene network backbones. Abilene and the vBNS are currently available to Internet2 members only, including educational institutions, corporations and other governmental and not-for-profit organizations doing R&D on advanced Internet technology.

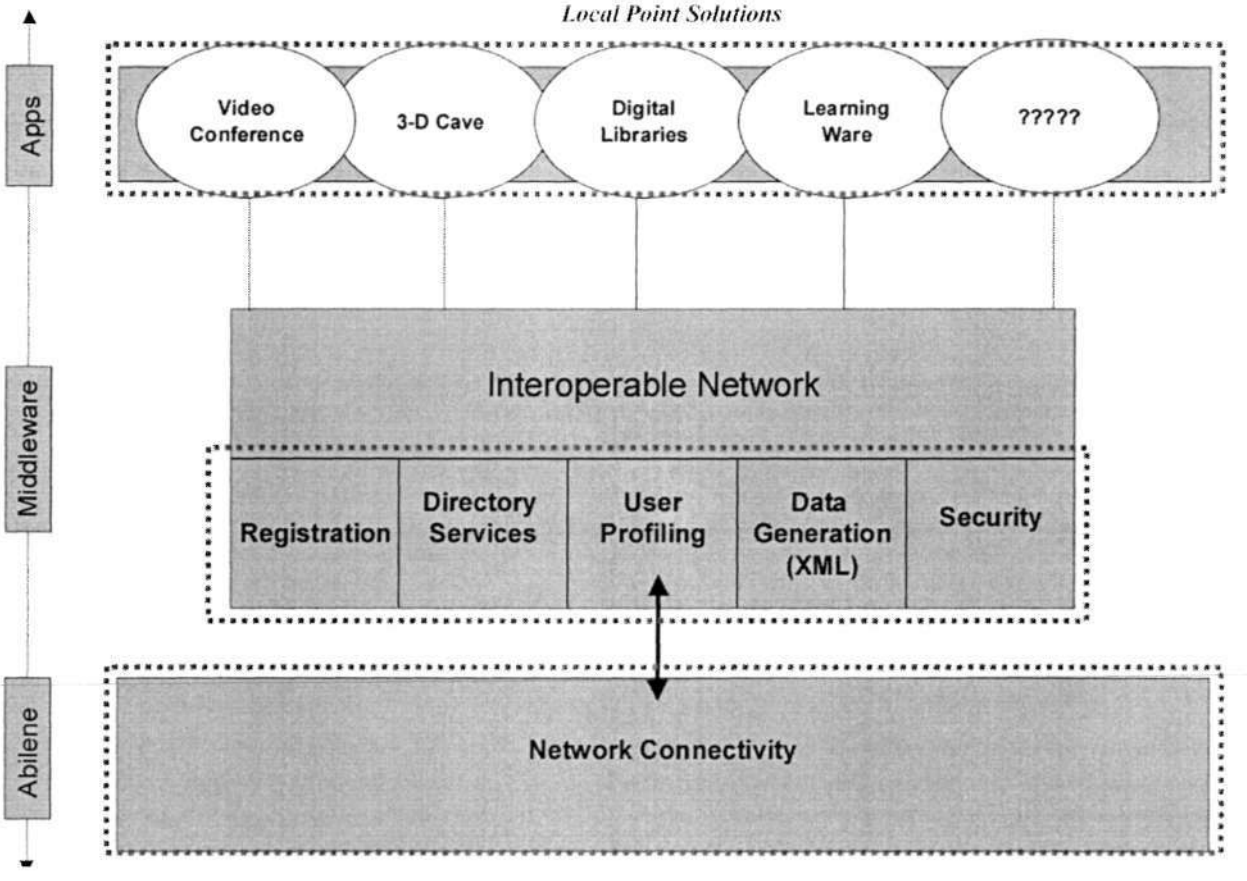
In addition to the 180 University members, there are approximately 80 corporate members. Corporate members pay Internet2 $25,000 annually in membership fees and

[4] http://www.Internet2.edu/html/about.html

[5] The closed loop system is akin to the America Online system whereby members can collaborate with each other using Internet2 but connect with non-network IP using The Internet

$20,000 annually for access to the Abilene network. They must also establish a physical connection to the Abilene network, typically through a gigaPoP, and pay their share of that connection. They may use their access only for collaborative projects with Internet2 educational members.[6] Currently, Internet2 members and work groups are collaborating on advanced applications such as videoconferencing, voice-over IP (VOIP), digital libraries, common access to remote resources and virtual reality, middleware, new networking capabilities, advanced network infrastructure, and partnerships.[7]

The Internet2 framework for technology development is based on the evolving Internet2 architecture. According to this architecture, Internet2 is primarily concerned with enhancing the utilization of technology in three segments: network systems, middleware, and applications.




[6] Kennedy, John, Vice President of Operations, Internet2, interview
[7] http://www.Internet2.edu/html/about.html

## Technical Highlights of Abilene

The following are some of the technical highlights of Internet2's system:

| | |
|---|---|
| **Network/Backbone** | Abilene Network - an advanced backbone that connects regional network aggregation points, called gigaPoPs, to support the work of Internet2 universities as they develop advanced Internet applications. The vBNS, another advanced backbone operated by WorldCom that can connect directly to Internet2 members and also provides access to the commercial Internet. |
| **Speed** | • 2.5 Gigabyte per second transmission speed<br>• Moving towards 10 Gigabyte per second speed<br>• 10,000 times faster than the original Internet[8]<br>• 45,000 times faster than a typical dial-up modem[9]<br>• The Abilene Network can transmit the entire Encyclopedia Britannica in under one second[10] |
| **Line Access** | 50 states plus the District of Columbia[11] |
| **Investment** | • Members spend $100MM annually to support the network[12]<br>• The infrastructure network provided by Qwest has a retail value of approximately $500MM[13] |
| **Traffic Growth** | Doubling Every six months[14] |

The federal government had begun a similar though complementary program, the Next Generation Internet (NGI). Due to the reduction in federal government support, the majority of further development will be left in the hands of the education and business sectors. The late 2000/early 2001 slowdown in economic growth that led to reductions in the research and development budgets of telecommunications equipment manufacturers (i.e. Nortel, Lucent, Cisco) and the telecom providers (i.e. SBC, WorldCom, AT&T) further enhances the role of Internet2 in the development of next generation technologies.[15]

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[8] National Public Radio Morning Edition, December 18, 2000 Reporter: Joel Obermayer

[9] Holstein, William J., "Building the Next Internet in the Future, You May be able to Touch What You Buy Online" *US News and World Report,* September 13, 1999

[10] Glanz, William, "Computer Say Internet2 for Academia Will Bring Broadcast to the Masses" *Washington Post,* August 26, 1999

[11] As of 11/1/00

[12] National Public Radio Morning Edition, December 18, 2000 Reporter: Joel Obermayer

[13] Cocks, Heather "Internet2 Meeting Offers Taster of Faster, Future Online Experience" *Austin American Statesman* November 8, 1999

[14] Corbato, Steve "Abilene Update", Director Backbone Infrastructure, Internet2 Presentation to Fall Member Meeting – Atlanta, GA, 11/1/00

[15] Thurm, Scott, "Cisco Retreats and Kills Optical Switch That It Acquired for $500 Million in '99," *Wall Street Journal*, April 5, 2001

Though limited to United States research institutions and recognized affiliates, Internet2 works closely with more than 30 other national organizations in Canada, Western Europe and Asia who are developing complementary and/or Internet2 technology in their home countries. Ultimately, this enhances the network externalities of Internet2's growing network.[16]

## Corporate Involvement

Internet2 has members that are global leaders in a number of vertical industries such as telecommunications, pharmaceutical, aerospace and financial services. Beyond membership dues of $25,000 and annual Abilene fees,[17] these firms are committed to collaborative work with the Internet2 consortium. These partnerships ensure the network's continued technological development by assisting in the creation of the technology and the applications designed to maximize the network's capabilities. Leading corporate partners include: Nortel, Cisco, WorldCom and Qwest, which are building the Internet2 network infrastructure.[18] Internet2 officials believe that collaboration with the private sector is believed to lead to commercial applications leading to greater development of the Internet2 network and middleware. To that end, Internet2 is also working with IBM and AT&T on middleware, and with Lucent and Global Crossing on international connectivity.[19]

> *Mike Turzanski of Cisco's Advanced Internet Initiatives department noted that their interest in Internet2 is the ability to test leading edge technology without competitive pressures and without risking the reliability/integrity of their own networks if the technology fails. Turzanski compared the project to a "sandbox which we can play with."*[20]

## Future Plans

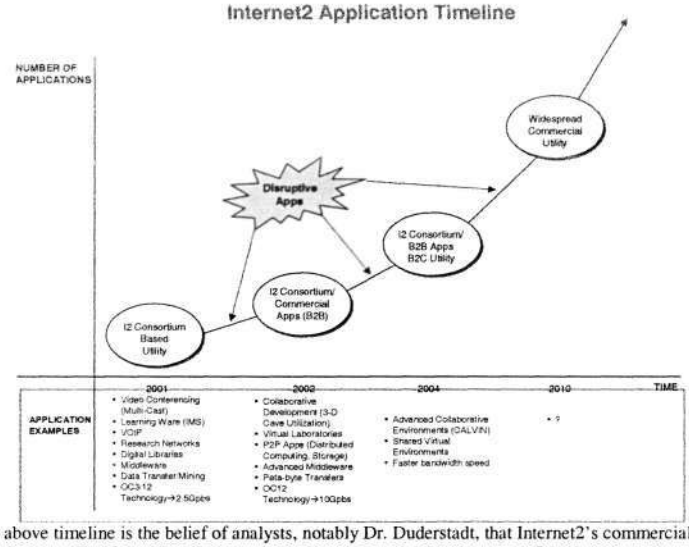
Internet2 has no direct intermediary role as the motivating force for "killer application" development. Rather the intent is to encourage its members, both corporate and educational, to collaborate on applications that utilize Internet2's architecture.

Dr. James Duderstadt, President Emeritus and University Professor of Science and Engineering at the University of Michigan, was involved in the commercial development of the original Internet. He believes that the business-to-business sector (B2B) will use

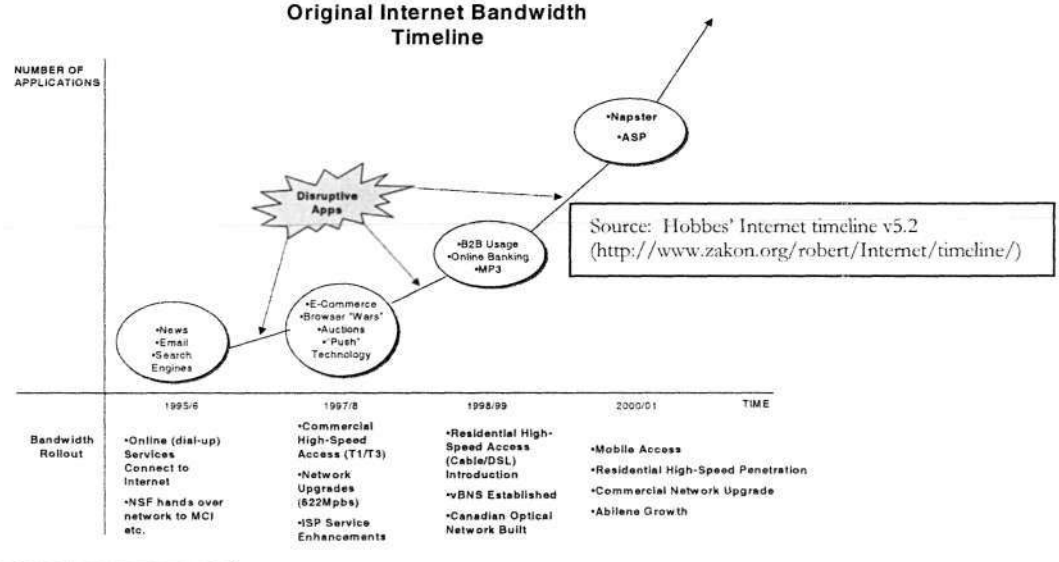
[16] http://www.Internet2.edu/html/faqs.html#
[17] Kennedy, John, Vice President of Operations, Internet2, interview
[18] http://www.Internet2.edu/html/corporate.html#
[19] Kennedy, John, Vice President of Operations, Internet2, interview
[20] National Public Radio Morning Edition, December 18, 2000 Reporter: Joel Obermayer

Internet2 applications in the next two to three years while application development for the business to consumer sector (B2C) will occur in the next five and seven years. Dr. Duderstadt believes that ultimately Internet2 will share its closed loop network with the private sector in the same manner that the Internet became a shared network. This is based upon several factors including a re-work of the corporate and private infrastructure, development of commercial applications, and cultural acceptance of potential Internet2 applications.[21]

The following is the anticipated timeline for Internet2's rollout/development:




The basis for the above timeline is the belief of analysts, notably Dr. Duderstadt, that Internet2's commercial development will mirror that of the Internet. The following diagram charts the commercial development of the Internet.




[21] Duderstadt, James, Dr., President Emeritus and University Professor of Science and Engineering at the University of Michigan, interview

## Risks with Internet2 Technology

Although Internet2 has no competition, now that NGI is not a federal government priority, the development of network applications is dependent on the educational and private sectors' innovation and development of new products to support these applications. Based upon Internet2's organizational structure, development is correlated to the financial performance of these supporting firms. Any reduction in their capital expenditures may delay the development of Internet2.

## Current Internet2 Demonstration Sites

Several Internet2 demonstration sites currently operate in the United States. The University of North Carolina, Chapel Hill is developing a "virtual office" utilizing Internet2 technology. The purpose of this "virtual office" is to test Internet2 functionality and technology.[22] Another demonstration lab exists in Columbus, Ohio, a state funded educational/research consortium project. Its mission, as well, is to further academic and research needs.[23] The laboratory at UMBS differs from other currently operating facilities, as it is the first joint venture between a major corporation and a major research business school to study prospective Internet2 research applications in business.

[22] http://www.cs.unc.edu/Research/stc/office/l
[23] http://www.itecohio.org/

# RECOMMENDED COLLABORATIVE APPLICATIONS FOR FORD MOTOR COMPANY AND UMBS

## Distance Collaboration

### *Project Overview*

It goes without saying that over the past five years, technology has profoundly affected they way business is conducted. Moreover, technological change and innovation is showing no sign of slowing down, and people in organizations at all levels are struggling to adjust to the latest, better, faster, different ways of conducting business. Among the many potential applications of Internet2 technology the most promising would enable people to communicate effectively over vast distances. As companies continue global operations when corporate belts are tightened, time constraints govern availability, and travel becomes less feasible, they will require alternative forms of communication to replace traditional face-to-face interaction. The essential question to answer is whether or not alternative forms of communication will be as effective as face-to-face interaction?

### Distance Collaboration

The concept of distance collaboration is not new – current technology enables conference calls, e-mail messaging, and interactive meetings. Ford Motor Company holds meetings among individuals at different locations using software such as Netmeeting, Placeware, and SoftTV. However, the quality of meetings held using these applications are plagued by insufficient technological capabilities. As was described earlier, a partnership among UMBS, Ford, Internet2, and Trilogy was developed to address these limitations by creating applications for the future. Internet2 offers the technology to improve communication. Its greater bandwidth, increased reliability of service, and digital quality image and sound capability take virtual collaboration to a new level. These technological advancements and additional broadband capabilities introduce new opportunities for face-to-face communication across vast distances. Although the team divided its efforts into three categories all ideas for the development of applications related to communication among individuals in different locations.

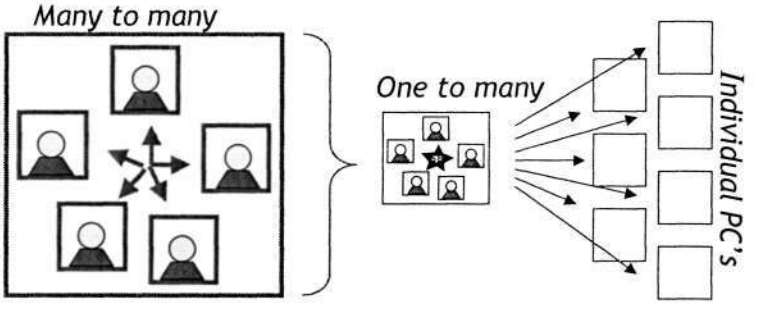
The three categories are: Distance Collaboration, E-Learning, and Quality. The difference among the three categories is the use of technology to serve differing needs within Ford. To simplify and expedite transmission of important information throughout Ford – from top to bottom, and bottom to top – we established the "Cascade Module." To address some of the shortcomings of the current Ford Learning Network (FLN), we expanded the capabilities of the "Cascade Module" to include E-learning. Quality and E-learning are addressed in the sections below. Despite our time constraint of 14 weeks to see this project from idea to prototype development and testing, we were able test the effectiveness our ideas. In sum, acceptance of new applications will be directly affected

not only by levels of comfort with technology, but also by ease of use and quality of content.

## Initial Goals and Ideas

To create technology-enabled collaboration and communication, we first identified how we could best capitalize on Ford's current internal Intranet capabilities and the added Internet2 functionality. We hoped to develop a prototype based upon the need for expedient communication through the Ford organization, with tools that facilitate interactive working sessions. After initial discussions with Ford leadership, we recognized several opportunities with the understanding that security issues would be paramount:

- Enable Ford management to participate in "multi-cast meetings" from personal office or desktop (Many-to-Many).
- Enable leadership within Ford to disseminate information to many individuals using current web cast technology (One-to-Many).




## Project Deliverable

Building upon the initial ideas of the UMBS Team, several "students" from Trilogy University (TU) - the training program for incoming employees - developed what we began to call the "Cascade Module." Taking advantage of a platform under development internal to Trilogy, Leadership.com, the TU team demonstrated the potential for a leader to communicate his or her message to targeted individuals through video and accompanying slides. More importantly, they added features designed to give leaders the ability to gauge participant response through interactive feedback mechanisms.

The project timeline first required answering challenging questions, then prototype development, testing, and the identification of next steps:

- What is not yet out there?
- What is possible to develop?
- What does Ford need?
- How can we add value to Ford?
- What can Trilogy create?
- Can this become a win-win for Ford, UMBS and Trilogy?
- Can we develop a prototype?
- Can we successfully demonstrate a prototype?
- What will be the project next steps?

## Adding Value to Ford

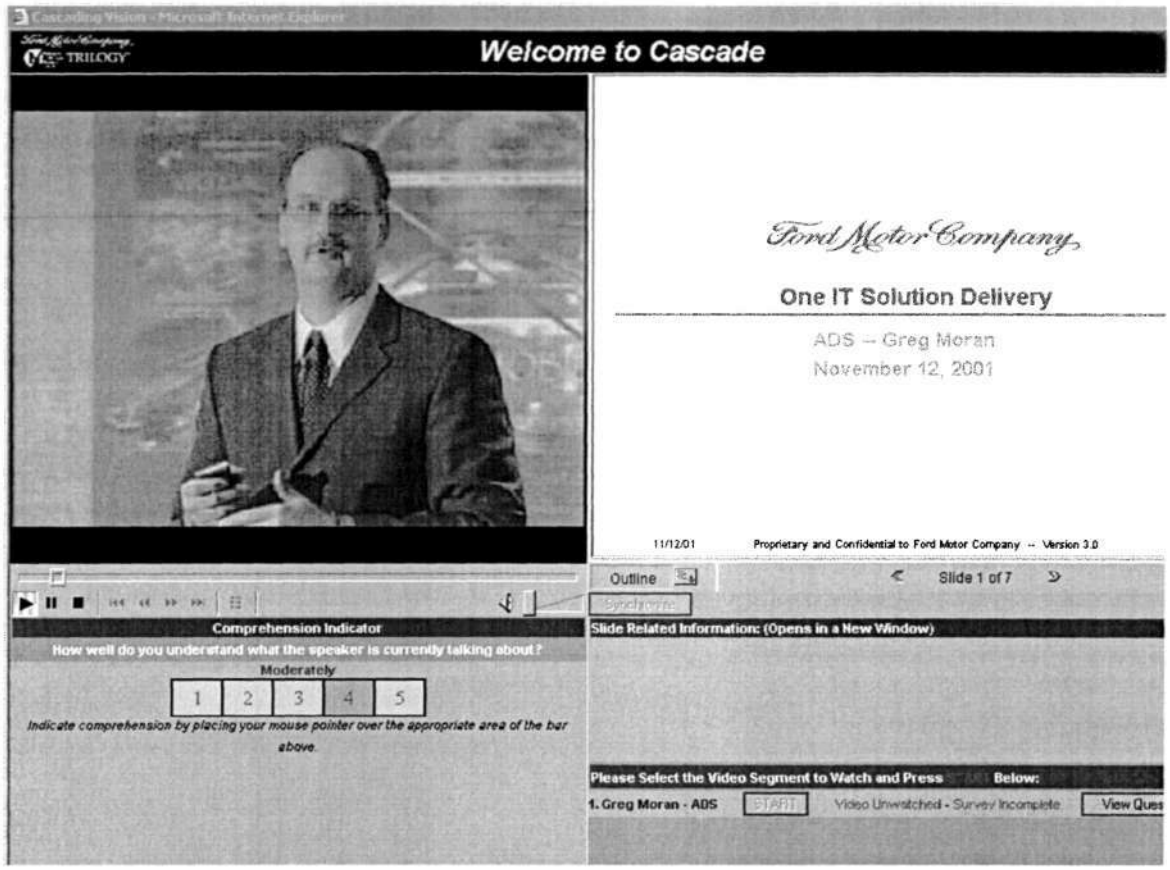
The real value that this team believed it could add to Ford is integration – the integration of current systems and technologies with future potential. In Mid-October, we spoke with Jim Buczkowski, who is the Director of Information Technology for Manufacturing Systems, Materials Planning, Logistics and Purchasing. Currently, it takes Mr. Buczkowski one month to communicate a message through his 600 person organization. Given time sensitivity of some of his information, it is important that he be able to cascade the information throughout his division in one week or less. His staff is located in six buildings and thirty plants around the world. Because messages are usually communicated by phone or in person, the interactive potential for the "Cascade Module" as a live video stream where employees could respond in real time appealed to his sense of practicality.

Upon further investigation, we confirmed that indeed the "Cascade Module" would meet the needs of Ford, and conveniently followed design characteristics pre-developed, tested and currently in use at Trilogy. Members of the senior leadership team at Trilogy currently post five to six new messages per week on a 360-degree web enabled communications platform called Leadership.com. Joe Leimandt, the CEO of Trilogy, communicates via Leadership.com once each month, and responds personally to all feedback and questions. New hires and current staff use the module to keep abreast of new developments in the company. Trilogy is about the same size as the IT Division of Ford Motor Company.

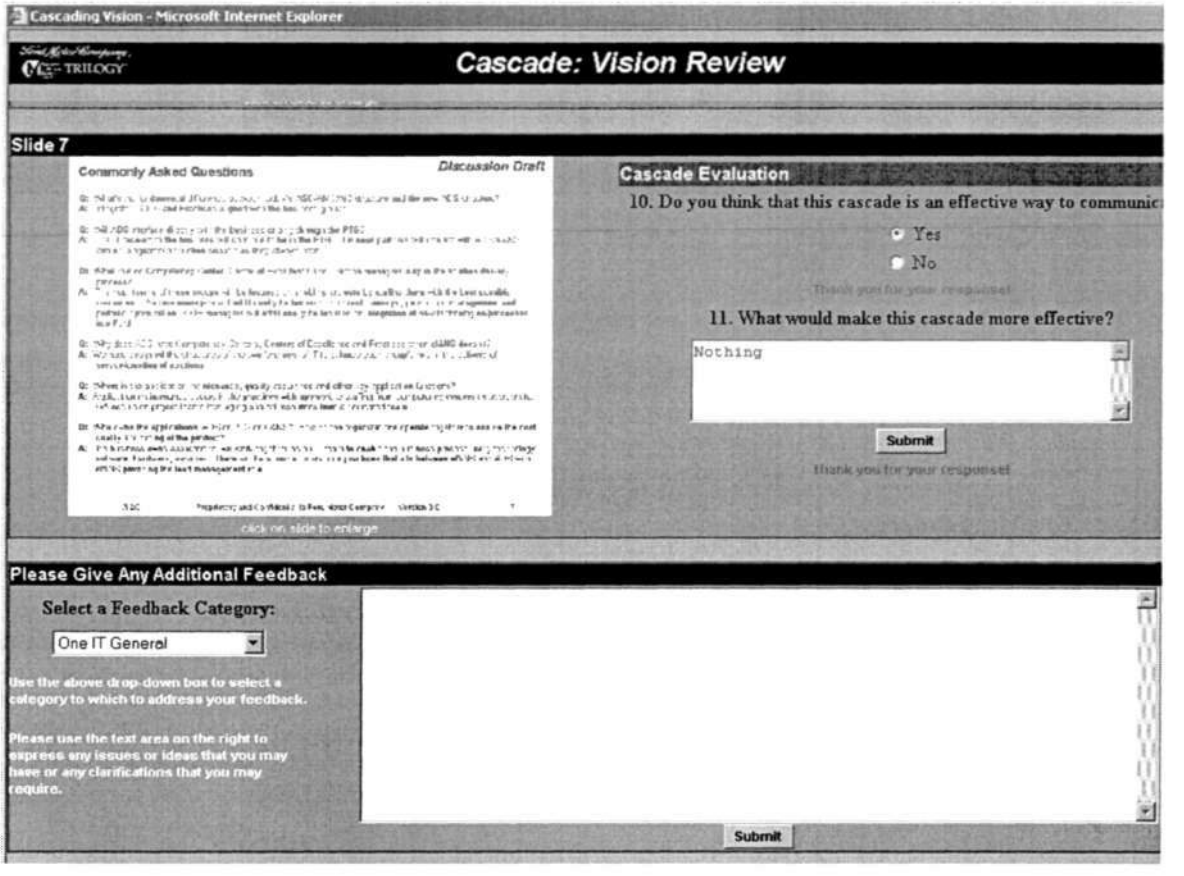
## *Prototype Development*

The IT organization at Ford is undergoing a significant restructuring effort, which will drastically change the way many employees do their jobs. In December 2001 and January 2002, Ford leadership will be communicating its new technology solution delivery strategy: One IT. To aid in the communication of this strategy, we developed a prototype to demonstrate how Ford could use the Cascade Module to deliver the content of One IT clearly, concisely and efficiently. In addition, the Module enables Ford to obtain feedback in the form of survey and free-form data from their target audience. For the One IT organizational change to be successful, employees must understand and be aligned with the strategy. Using the Cascade module, Ford leadership will be able to gauge understanding, alignment, and excitement of the individual participants.

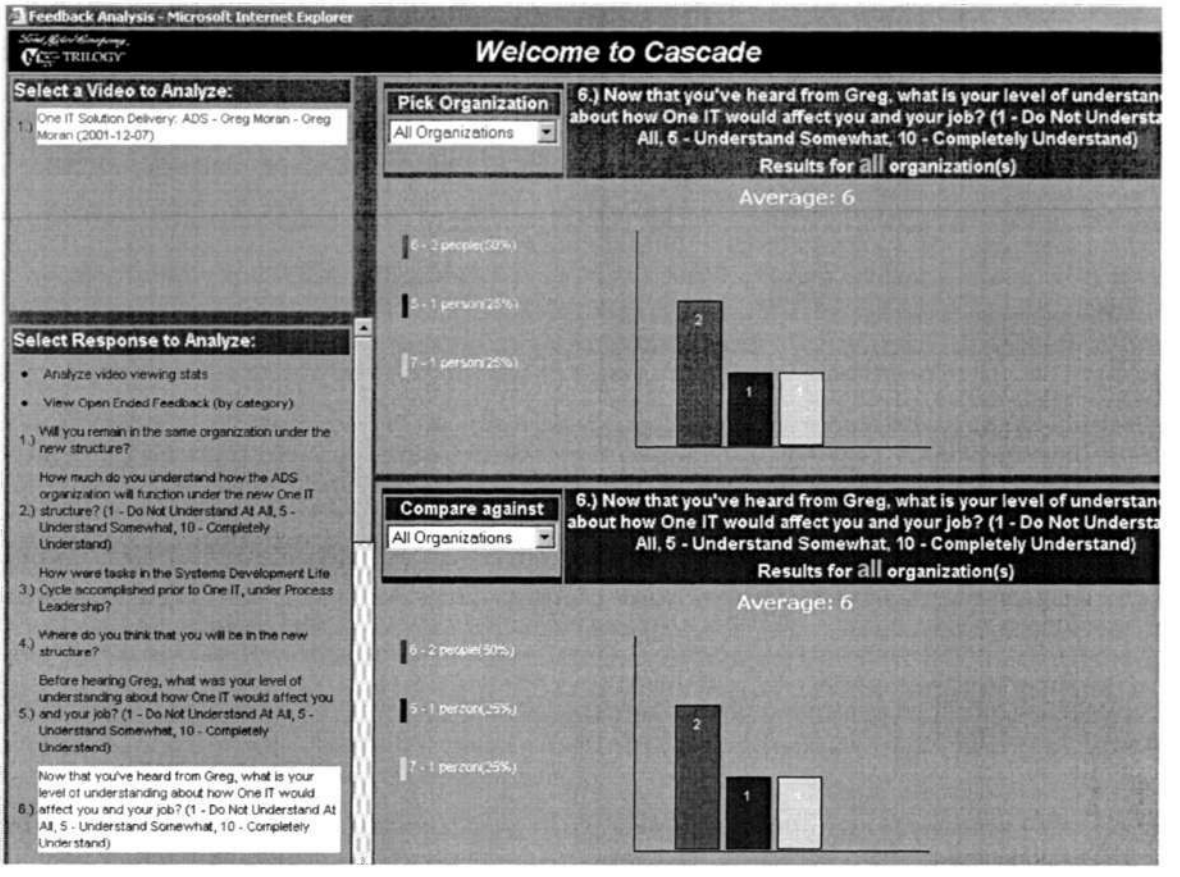
The content used to develop the prototype was taken from a presentation and slides given by Greg Moran, the Director of the Advanced Delivery Systems (ADS) Group at Ford, at an off-site meeting for the top five levels of leadership at Ford about the new One IT strategy at Ford. Questions were developed to get feedback from participants about their understanding and alignment with the One IT strategy, in addition to compare responses to those from a survey issued at the off-site meeting. The following images illustrate the "look and feel" of the Cascade Module. The first image illustrates the layout of the Cascade Module. The image at the upper left is Greg Moran speaking to the camera. In the prototype, this high definition video was pre-recorded; however, live video is possible using the extensive bandwidth capabilities of Internet2. On the upper right side of the image, accompanying PowerPoint slides track along with the content described by the speaker (in this case, Mr. Moran). Below the video is a "sentiment meter" whereby participants may indicate their level of understanding, agreement or excitement about the message content in real time. In the prototype, participants activated this feature by moving the mouse pointer over the number representing their "sentiment." The feature will record any movement among the different numbers. Beneath the PowerPoint window, the speaker may post links to related materials, ask participants to respond to a specific question, or enable a "closed-caption" feature to enable participants to follow along with what he or she is saying.




After watching the video and slides, participants are asked to respond to a series of questions. The next image, the "Cascade Vision Review" illustrates a series of feedback questions. In the prototype, four different types of questions were used: Yes/No, Multiple Choice, Sliding Scale, and Open Feedback. Participants are able to categorize their open feedback if they would like to focus on a specific issue (this feature also assists with analysis of survey results). Questions may be independent, open-ended or specifically related to slides from the presentation or independent (here, the question relates to the slide you see at the upper left of the "screen")




Finally, the next illustration is the analysis tool of the prototype. Features enable the measurement of responses by division or organization, comparison of results across divisions or related to the entire organization, and clustering of results by question.




## *Lessons Learned*

### Content

Early in prototype development, we recognized that the content available to develop the Cascade Module was not ideal. Indeed our feedback showed that content, context and presentation are extremely important for effective reception and understanding. The video by Greg Moran was one part of a five-hour meeting. Although he was concise and clear in his presentation style, participants noted a lack of understanding about the big picture.

There are many protocols for effective communication. One of the challenges for Ford of using the Cascade Module in the future will be to develop protocols that will facilitate materials development. Leaders must ensure that participants understand the context, purpose, and agenda for the communication, as well as think through and answer questions that may arise as he or she is speaking.

### Organizational Change

In theory, the new technology should be an effective way for Ford leadership to "cascade" information effectively and efficiently. However, it is important to understand that technology is only part of this equation. As Ford continues to integrate technology into its operations, the firm is asking people to change their behavior. Though many people – especially in the IT department where the prototype was tested – are comfortable with new technology, there are just as many who are not. Incorporating technology, learning about technology, becoming comfortable with new ways of doing things takes time and a concerted effort on the part of leadership to train staff. The current prototype requires hands-on demonstration, suggesting that an increased focus on ease-of-use is necessary. As we witnessed with the E-learning demonstration described below, participants were unable to focus on the teacher's lecture until they became more accustomed to the features and technology in front of them.

### Human-Computer Interaction

One obvious area that needs more research is the impact of replacing human interaction with human computer interaction. Several studies by Judith Olsen and Gary Olson at the University of Michigan Business School and Department of Psychology illustrate that it is possible to build trust over great distances. However, the challenges of implementation about how to build this trust are great. [24]

- Technology is an enabler and may be able to bridge physical distances, but to have technology actually enable distance collaboration, mechanisms need to be put in place so that participants trust their partners at a distance and so that a team environment is created as if the participants were in the same room.
- From Jim Buczkowski - Can we quantify the relative value of an Internet2 / Distance Collaboration application relative to using mail, e-mail, telephone, Pictel, Internet or any other current technology – what are we missing without the informal interactions that often result in major accomplishments? What are the social obstacles we must overcome?

## *Next Steps – Value Proposition*

In our final meeting, it was determined that Trilogy and Ford would work together to determine the exact costs and benefits of building a "Cascade Module" for use in communicating the vision of One IT throughout the department. Usability, or user friendliness, will be essential for the success of this proposal. Trilogy will have to work with Ford to see how the company can implement this idea. One recommendation is a

[24] See Bos, Gergle, Olson & Olson, "Being There Versus Seeing There: Trust Via Video," Collaboratory for Research on Electronic Work, School of Information, University of Michigan; Daniel B. Horn, "Is Seeing Believing? Detecting Deception in Technologically Mediated Communication," Department of Psychology, University of Michigan; Rocco, Finholt, Herbsleb & Hofer, "Designing as If Trust Mattered," Collaboratory for Research on Electronic Work, School of Information, University of Michigan.

joint effort with UMBS to develop, a "cookbook" that outlines the necessary steps to use the application: if you want to record a message, here is what you do, here is where you go, here is what to expect. There should be a version for leaders as well as participants. This cookbook would eventually become a set of operating mechanisms.

Additionally, it will be important that clear costs are understood. It is our assumption that it would cost less for leaders to use this type of technology tool than to hold an off-site meeting. Statistics show that once a meeting size exceeds 100 people, understanding and enthusiasm drops. Using technology may therefore be more effective for promoting understanding of these ideas.

Best practices have not yet been identified. As intrigued as Ford is by the new opportunities presented by Trilogy's Leadership.com, existing technologies are currently in use at Ford that serve many of the same functions. Although they may not be as fully integrated with the video, slides, and interactive features, Ford may be able to use current systems for the same result. A future Trilogy / UMBS Team may be able to identify best practices from Internet2 and its partners as well.

## *Concluding Remarks*

The Internet offers incredible opportunity for businesses to improve their common practices. Despite these opportunities, however, managers at the Ford Motor Company are not alone in facing obstacles to the implementation of new tools that make effective use of the Internet to improve business practices. This project further proved that expediting the communication of vital information is invaluable to the Ford Motor Company and its processes. Ford's investment in Internet2, and the accompanying collaboration with UMBS and Trilogy appears to offer one potential solution – and it may be just the solution for which the Ford Motor Company has been waiting.

# E-learning

## *Project Overview*

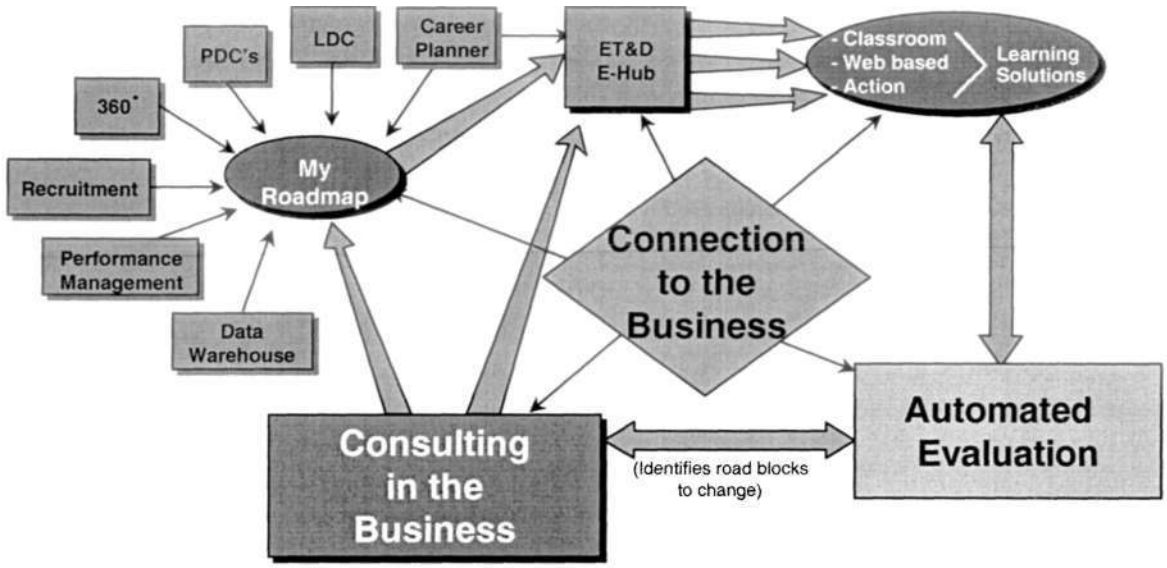
A second area of exploration identified for application of Interent2 technology was E-learning. After becoming a corporate member of Internet2 in the summer of 2001 Ford's ELC team immediately recommended E-learning as an Internet2 application.

After the UMBS team spent considerable time exploring Internet2 and Ford Motor Company, the team of students from TU was brought in to assist the UMBS team and provide technological expertise. Primary participants from Trilogy were Jonathan Berkowitz, Jason Shah, David Bixler, and Nathan Egge. Ford Motor Company contributed significant resources and time helping the team explore the possibilities of Internet2 and accomplishing its goals. Primary participants from Ford Motor Company were Bipin Patel, Charles Ogunwuyi, Karmen Tucker, Rodger Will, and Adam Maddock.

### Initial Goals and Ideas

The initial project goal was to determine a way that Ford Motor Company could utilize Internet2 technology to enhance its existing E-learning opportunities. After due diligence at Ford Motor Company, it became obvious that Ford had already made significant progress in the area of E-learning through its Ford Learning Network (FLN).

The Ford Learning Network, deployed in the summer of 2001, was designed to allow Ford employees to pursue educational, skills, and career development initiatives in a personalized manner. It is the central user interface for learning and development activities at Ford Motor Company. The FLN provides employees with "competency roadmaps" that help employees match learning offerings with their career goals. During this process, an employee's manager can become involved, providing a degree of management oversight. This entire process is centered on connecting skills and competencies to Ford's business. The diagram below outlines Ford's vision for the Ford Learning Network:




With the FLN already in place, the team sought to develop an application that would allow Ford to offer or conduct classes in real time.

## Project Deliverable

At the end of the 14-week project, the team provided Ford Motor Company with a prototype E-learning application that attempted to recreate an in-person, classroom environment. Increased bandwidth, afforded by Internet2, allowed for the development of an application that facilitated 2-way learning and communication not only between teacher and student, but also among students. In a non-Internet2 world, E-learning is too often a one-way street with students passively absorbing information. Increased bandwidth allowed the team to design an interactive application that moved the student from passive learning to active learning.

## Adding Value to Ford

Ford Motor Company currently spends $900 million annually on training programs. These programs cover topics such as Six Sigma, Brand Strategy, and Customer Insight. Ford estimates that its E-learning initiatives can save roughly $100 million in cost avoidance on reduced travel, less instructor and facility costs, and less time off of the job. The Internet2 team believes that its application would significantly add to this $100 million estimate.

While the demonstration was limited to an instructor providing an introductory lesson on Six Sigma, the team envisions many other functional applications that could benefit from

this application. These applications include learning for new hires, training for dealerships, cross-continental learning, and even product development.

In addition to these tangible areas of value creation, the team believes that the E-learning module also creates value by exposing and getting Ford employees to think about the organizational behavior issues associated with distance collaboration and learning. Developing the right technology is only half of the battle. Getting people to interact in a productive and comfortable manner is just as important. The team believes that this project has further heightened these issues within Ford's IT department.

## *Prototype Development*

The prototype development was the result of two inputs: Trilogy in-house technical expertise and UMBS organizational behavior understandings. Trilogy relied upon previous software development experience, particularly the development of Leadership.com. While certain important differences existed, many of the features in the E-learning application were similar to those in Leadership.com.

In addition, the team attempted to make the technology as user-friendly as possible by relying on organizational behavior learnings from the University of Michigan Business School. Particular attention was given to the work of Professor Judy Olson and her colleagues. Much of Professor Olson's work has focused on creating trust and improving team performance over distances. Certain features of the E-learning application, notably the feature that allowed students to "chat" during the class, sought to develop bonds within *all participants* (not just teacher-student) to enhance learning performance.

The final prototype utilized the Access Grid to recreate an in-classroom learning environment. The Access Grid provided the means to deliver the audio and video between teacher/student and among students similar to the many-to-many concept described above. The teacher had a "teacher's assistant" that monitored student concerns and administered polls. The students had laptops with interactive screens that conveyed data among all participants. In addition to a view of the live lecture, the screens allowed students to view poll questions, ask questions, rank important questions, and chat with other students. Example screen shots used in the prototype are shown on the following page.


## Implementing the Prototype

On December 10, 2001, the UMBS-Trilogy-Ford team implemented a prototype E-Learning module using Internet2 labs at Ford Motor Company in Dearborn, Michigan. For this demonstration, one group was stationed in World Headquarters and the other group was stationed in Ford's IT Headquarters. One teacher, Charlie Schloff –a Six Sigma blackbelt, was located at IT HQ. Mr. Schloff taught an introductory overview of Six Sigma to students both at IT HQ and World Headquarters. Students came from Ford's IT department and consisted primarily of those with management responsibility. At both locations, students were provided with laptops equipped with the Trilogy E-Learning module. The Teacher's View was projected onto a wall for Mr. Schloff via the Access Grid. The entire concept was new to both Mr. Schloff and the students.

## *Lessons Learned*

After running a demonstration of the application, four key learnings emerged. These learnings are outlined below:

1. *The Technology Works*
   The team was pleased that the technology worked during the demonstration. The inhibiting factors were not technology-based, but rather human-based. This provides encouragement for further development and suggests that, while the technological bugs should be fixed, the greatest value can be created by focusing on the human-side of the technology: how can the interaction between humans through technology be maximized?

2. *This Is a New Approach*
   From the beginning, the team realized that this was a different approach to E-learning. Traditional E-learning lacked the rich, two-way communication transfer that we sought to create. Accordingly, it was expected that it would take time for participants to adjust to the technology. As mentioned above, the inhibiting factors in the demonstration were human-based. The team believed that this can be attributed to one main factor: participants entered the simulation with differing levels of technology competency. Simply put, some people felt more at ease maneuvering through the application than others.

3. *Learning Styles Differ*
   During the demonstration, it became quite obvious that learning styles among students were quite different. While some students thought that the application had too many features, other students were asking for more. Little things like familiarity with a laptop touch pad, further demonstrated the differences among students. In addition, the team suspects that teaching styles will differ. Since the demonstration only used one teacher, this was not observed, but given the differences among students; it is reasonable to assume that there will be differences among teachers. Because of these differing learning and teaching needs, the team recommends that the next prototype incorporate a degree of personalization.

4. *Protocols Need to Be Developed*
   In an effort to make it easier for both students and teachers to quickly understand and utilize this application, the team recommends that best-practice protocols be developed. Protocols should focus on making the application easier to use and maximizing the learning interaction among students and teacher.

## Next Steps

At the end of the E-learning portion of the project, the team developed two next steps. The first step is to encourage Ford to utilize this E-learning tool as a way to bring new hires up to speed within the IT department. The second step involved collaboration between Ford, Internet2, and UMBS – the creation of a UMBS MAP team to study best practices associated with the organizational behavior issues surrounding this new application. This project would leverage Internet2's existing university or corporate members to act as teachers to students within Ford's IT department. The idea would be to create "brown bag" lunches that enable business school students to observe what works while those within Ford also receive value through learning.

## A Note on Change within a Large Organization

Throughout the project, the team was surprised to discover that many of its ideas already existed within Ford Motor Company. Initial discussions with Rodger Will and Adam Maddock from Ford's real-time collaboration organization were revealing because every time the team suggested an idea, Rodger and Adam would respond by saying, "We can do that."

Over time, it became clear that, while the UMBS-Trilogy team was providing value through its technology applications, perhaps the greatest value of the project was that it brought many ideas – *most of which already existed somewhere at Ford* – to the attention of senior management. In a sense the UMBS team acted the role of consultant to both introduce to and validate ideas at Ford. This project demonstrated the importance of knowing how to navigate ideas within a large organization. If our relatively simple ideas were having difficulty moving upstream to senior management within one department, one can only imagine the number of value-creating ideas that get lost or buried within large organizations such as Ford Motor Company.

## Concluding Remarks

This project has demonstrated the importance of the human-side of technology. In this case, as in other examples of a new technology rollout, the greatest hurdle moving forward is not a technical issue; the technology works. Rather, the E-Learning module that was presented to Ford Motor Company is a new way of learning. As such, the greatest changes moving forward will be human in nature - how do students and teachers adapt and learn in this environment? What protocols can be developed to enhance learning in this environment? Further understanding of these issues will vastly improve the E--Learning module moving forward.

# Quality

## *Overview*

Quality is a broadly defined and heavily integrated concept at Ford. It reaches everywhere in the company, from platform design in the office to automobile assembly on the factory floor. Because quality is at the core of Ford's business, making cars and trucks, and because quality issues typically involve a wide variety of people in numerous locations, Ford has been investigating the use of modern computer technology to enhance quality initiatives within the company. Computers are used for everything from data collection and analysis to modeling and design. However, until recently, computer-networking technology has been insufficient to allow effective Internet communication among facilities.

Using newly developed advanced networks to facilitate communication regarding Ford automobile quality has significant potential for cost savings for Ford; both in reduced travel costs, as well as in savings due to more rapid problem resolution. The objective of this aspect of the project was to explore the use of advanced network capabilities to reduce expenses while simultaneously enhancing quality at Ford. Generally, the concept was to bring high quality video conferencing over the Internet to the plant floor in order to allow suppliers, designers, and process engineers at Ford and its suppliers the opportunity to interact in real-time with quality issues. Use of high quality video would allow interaction of subject matter experts without travel. Since travel would not be required, problems could be addressed more frequently and resolved in a timelier manner. And, with the integration of high-speed networks, it becomes possible to answer questions that arise at quality meetings by integrating more complex data directly to the factory floor and therefore mitigating the need for "look-ups."

## Ford Quality

Implementation of Internet2-like technology at Ford has the potential for substantial cost savings to Ford. However, large potential savings often come, as in this case, at some cost. Quality is a vast topic at Ford, and operates in its own world of acronyms, processes, and terminology. As a result, tackling quality issues at Ford proved to be a difficult challenge for the UMBS team especially in that it took longer to establish contact with the most knowledgeable or even the right people. Significant education on Ford quality idiosyncrasies took time. Finally, quality meetings themselves occurred in infrequently and only a limited number of times during the project.

In an effort to better focus on the Distance Collaboration and E-learning portions of the study, and not believing they could have substantial impact on quality, the Trilogy team opted not to pursue a quality application with the UMBS team. In the long run, Trilogy's pullout from the quality portion of the project made the topic seem smaller and by some

definitions, it could be said that less was done. However, at the same time, Internet2 initiatives at Ford still have their greatest potential cost impact in the quality arena. With the development of a working, useable, low cost cart to provide video applications to review product quality, this portion of the project may have the most immediate impact on Ford's bottom line.

## Initial Goals and Ideas

Initially, the objective was to explore Internet2 technology applications in the quality arena at Ford. While the specific application was yet to be determined, the following big-picture objectives were developed at the beginning of the project.

Initial discussions determined that any quality solution should include:

1. *Developing successful virtual meeting protocols*
   It was generally understood that all three portions of the project (Quality, Distance Collaboration, and E-learning) shared common ground in that their main Internet2 advantage came in the form of high-quality video conferencing. However, how to successfully implement meetings of the type encountered in the quality arena was not fully known. Therefore, the team decided that the project should include meeting protocols to maximize the benefit of any new equipment developed and minimize the constraints that ensue with the use of new technologies.
2. *Assessing current Ford meeting processes*
   In addition to developing protocols, it was hoped that current quality meeting protocols should be assessed, as they currently exist, with the hopes of exposing areas for improvement.
3. *Collecting & storing quality root cause data*
   Whatever the solution, it should include the capability to focus meeting resolution to include the collection of identifying parameters of the root cause of the quality issue that instigated the meeting. Collection of this data would allow for analysis of longer-term trends at Ford and possibly would allow exposure of deep, system-wide quality problems.
4. *Systematically feeding lessons learned back to the design process*
   In addition to collection, root cause data should be systematically fed back to the design process to allow future manufacturing processes and hardware to be designed for top-quality manufacturability.
5. *Improving real-time Supplier/Design Engineer interaction (and others)*
   The most obvious of cost savings that occurs with the use of video conferencing is reduction of travel cost. The concept is that people that are intimately knowledgeable about the issues being addressed by plant floor personnel could be

included in daily meetings to help reduce problem resolution time and increase meeting effectiveness.

6. *Real-time ability to access supporting data that is frequently needed in Quality reviews*

   While video conferencing offers many benefits, it is not the only source of advantage that comes with using Internet2 type technologies. Quality issues frequently require technical supporting data or documentation, drawings, and part history. By providing access to this information in real-time at the meeting for all people participating in the meeting, problems could be more effectively addressed immediately instead of being put on the back burner while waiting for someone to lookup an answer to a technical question.

7. *A software tool to support all above*

   Trilogy software was brought in during the early to mid stages of the project to provide a software tool that would perform or support all of the above objectives. Since this software tool would integrate all the project objectives, it was the core of the project during the first phase. Unfortunately, Trilogy was unable to provide such a complex tools in the short span of this project.

## Project Progression Summary

Initially, the UMBS team sought to gain a terse understanding of Ford quality and then choose a more focused approach to the project. The entire team met with Rodger Will and Adam Maddock from Ford Real-Time Collaboration to learn more about Ford quality. Roger and Adam gave the team a general understanding of their initiatives at Ford with regard to Internet2 technologies. Additionally, Dan VanderWoude was put in touch with Nick Smither, Director of Ford IT Product Development, in order to learn more about the specifics of Ford quality. Nat Girish, IT Program Manager, was assigned as the Ford point of contact and met with Dan VanderWoude to be introduced to the project. Nat provided several names of people more involved in the quality initiatives of Ford Information Technology, which were pursued. Other meetings also occurred in which the primary purpose was to further explain the project, solicit ideas, and focus the project into a more manageable task. During the initial meetings it was determined that Ford quality in total was too substantial a topic and could not possibly be addressed in its entirety during the project timeframe. Therefore the UMBS team attempted to narrow the focus of the project to one type of quality meeting or problem frequently encountered at Ford.

As Dan VanderWoude met with the various Ford personnel to get a grasp of Ford quality, Trilogy software and VanderWoude developed screenshots of a conceptual software tool that would allow videoconferencing and would also provide interaction with the complex data that typically is associated with quality concerns.

With a potential target meeting as the daily quality meetings called "tire kicks" that occur at the Michigan Truck Plant, and with the idea that the UMBS team would simulate a

quality meeting using two Internet2 labs (and Access Grid videoconferencing software), the November ninth project update meeting came. By the end of the meeting more refined guidance had been developed for the quality portion of the project. The guidance was to focus on the Video Collaboration (VCL) Carts that had been used at the Maumee stamping plants under the guidance of Plant Manager Alexandria Maciag.

On November 15th, Dan VanderWoude met with various Ford personnel as recommended by Alexandria Maciag (including Joe Lin, Paul Doorn, and Rodger Will, Mickey Ellison, among others) in order to learn more about the current VCL cart capabilities. At this meeting, a new Ford IT software product was shown. The product, Process and Tooling Tracking System (PATTS), strongly resembled the meeting tracking features that had been independently suggested by the UMBS/Trilogy team. It was this development that eventually led to the withdrawal of Trilogy from the quality portion of the project on November 22nd. Trilogy felt Ford was well on its way to meeting some of the project objectives initially set, and that it was too complex of a task to explore the data integration portion of the software prototype (e.g. data integration with Six Sigma information on part production).

On December 7th, Dan VanderWoude, Rodger Will, and Paul Doorn (among others) observed the use of a VCL cart at the Woodhaven stamping plant. The meeting was a "match & fixture" meeting, which reviewed the cosmetic aspects of all the body parts of a Ford F150 pickup truck.

Between November Ninth and December 14th, Rodger Will was able to upgrade one VCL cart so that it could provide one-way high quality (30 FPS at 300 Kbps) videoconferencing. Unfortunately, the Woodhaven stamping facility did not have the appropriate network infrastructure to support the new version of the cart, so it could not be used within the project timeframe. On December 14th, the final project presentation was made.

## *Results of the Project*

While the project was stopped short in many ways when Trilogy software removed itself from the quality portion of the study, many lessons were still learned and are discussed below. First, each initial objective of the project is reviewed. Then, lessons learned in areas not directly covered by the initial objectives are discussed.

### *Objective 1. Developing successful virtual meeting protocols*

Despite only one meeting was available for analysis on December 7th. However, a few lessons learned were gleaned. The VCL cart, as is, severely hampers communication. The video feed supplied by the current cart updates the image only once every 6 seconds, which is completely unusable in an interactive meeting. The video camera was only used to zoom in on specific topics of conversation (i.e. body parts on the truck), and then a screenshot of the camera image was captured and placed on the Microsoft Net Meeting

whiteboard for review. The Microsoft Net Meeting whiteboard (an interaction tool) was never used during the meeting.

Additionally, the audio system on the VCL cart is extremely cumbersome and incapable of meeting the meeting participant needs. Right now three cordless headphone phones are used to dial in to a phone conference using regular phone lines. Unfortunately, there were four meeting participants at the Woodhaven plant, so one had to do without. The others used noise-canceling headphones, which will be a necessity on any future cart as there is very high background noise level from the factory. Since the phone audio travels over regular phone lines, it is always 7 to 10 seconds ahead of the video feed provided by the cart. Speaking with online meeting participants, this delay between the audio and poor video makes the cart very difficult to use and follow. Apparently most meeting participants treat the meeting just like a phone conversation, but with occasional video to support it.

Result: No explicit protocols developed. Further development of cart is required to allow real analysis.

### *Objective 2. Assessing current Ford meeting processes*

Results:

A) Trying too hard to hold traditional meetings over on-line medium
The meeting participants are using mostly visual and audio communication with little special tool support. Unfortunately, the information needed is too fine for it to be properly viewed on the poor video of the current VCL.

B) Mostly verbal communication was used over phone due to the poor quality of the video.

- Both A and B may be enhanced if more visual tools are used to communicate technical information, such as the distance between a gap.

C) Several requests for data that may represent improvement opportunities
Production data: "When was this part first produced"
Design data: "Is it supposed to be like that?" "I don't know, I'll find out"
Drawings would have been very helpful and would be easy to implement
Meeting data: "What did we decide on that last time?"

D) PATTS could do a better job of tracking problem history
Currently using a printout of an excel file. PATTS allows storage of images with the file, and also tracks events as they occur chronologically.

### *Objective 3. Collecting & storing quality root cause data*

Result: Already met to large extent by PATTS. Written description of problem archived and searchable by Part number, Text, Etc. Contact Joseph Lin for more detailed specifications.

*Objective 4. Systematically feeding lessons learned back to design process*
Result: Available with PATTS, but very manual in nature. Designers can pull up previous quality concerns by Program Number, Part type, Dates, Word search in write up, etc. Contact Joseph Lin for more detailed specifications.

*Objective 5. Enabling real-time Supplier/Design Engineer interaction (and others)*
Result: Currently possible with existing cart, but limited benefit. Will be greatly enhanced with upgraded cart (30 fps, integrated sound), but we were unable to test in the real environment. Multicast will allow large numbers of online attendees with lower bandwidth requirements. Also, 2-way video will also enhance collaboration when it is available.

*Objective 6. Real-time ability to access supporting data that is frequently needed in quality reviews*
Data proved too complex to meet during short duration of project. Trilogy has some ideas on aggregation of complex quality (i.e. Six Sigma) data over whole of Ford to allow more comprehensive analysis.

*Objective 7. Software tool to support all above (portions that are possible within time constraints)*
Development stopped due to complexity of problem and to allow better support of other two areas of project.

*Objective 8. Other results/recommendations*

A) Tracking of quality problems
Currently there is a disarray of solutions in use throughout Ford. (QR2 (paper/fax based), Form 26 (MS Excel file over e-mail), PATTS (Web-based problem tracking database)).
PATTS is an excellent beginning, but not being used widely (if at all) and there is no apparent enforcement or promotion of the product. There seems to be an overall lack of consistency in quality practices between various Ford locations.

B) VCL Use
Twenty-eight carts developed at $12,000 per cart. Video rate (1 frame every 6 seconds) is unusable. Audio participants limited due to phone lines. Environment is noisy – noise cancellation required (and used). Anecdotal evidence suggest only a couple are being used regularly. As mentioned before, it is too difficult to use in current configuration. Upgraded version addresses some of the significant issues

Additional data on carts can be found in Appendix II

## *Lessons Learned*

### Scope

The scope of the project could have been drastically reduced with little effort from Ford personnel. This would have sent the UMBS team in the right direction in the beginning and would have saved several weeks in the process.

### Tutorial on Ford Quality

Projects like this should begin with a tutorial on the project at hand, in this instance, Ford quality. The team had to go door-to-door to find the right contacts to learn the right things. Unfortunately, significant time was lost from constantly switching the points of contact.

### Full Time Liaison

While Nat Girish was provided as a point of contact, he did not have the requisite time or knowledge to support this short-term project.

## *Next Steps*

Below is a summary of the recommended next steps regarding VCL quality carts. They will provide a benefit to Ford, but require further refinement to reap maximum benefits. In general, the plan is to appoint a VCL cart champion who will then implement the following steps. The steps are designed to develop one or two carts to their most beneficial form and then replicate them for general use in Ford. The current carts were put out in the general use too early and were a waste of money because they are not being used at all in the field. The steps include:

1. Appoint a high-level IT/Quality champion
    a. Need focus/promotion of VCL cart and PATTS - both seem to be lingering with no champion, therefore little use
2. Involve the engineering school for development of the technology/vision
3. Determine ideal target meeting type for upgraded cart
    a. Process/Motion intensive - takes advantage of video
    b. Accurate human senses not required - look/feel factor of Match & Fixture meetings can't be met with video
    c. Located in factory with acceptable infrastructure - 10/100 **SWITCHED** Ethernet
    d. Six Sigma related
    e. Frequent meetings required (more frequently than monthly)
        i. Facilitates development support and interaction
        ii. If too infrequent, hard to test iterations of development
    f. Recommendations

i. Assembly related & close to Rodger Will's office
ii. Daily quality meetings in plants

4. Determine data needs of target meeting
    a. Drawings, specifications, process steps
    b. Six Sigma data
    c. Evaluate if software support tool is justified
5. Develop 2-3 carts to the hilt and test/develop for 3-6 months in experimental manner
    a. 2-Way, high speed (30 fps) Video, synched with audio - video technology already exists, this should be easy
    b. Need audio solution
        i. Need more headsets to accommodate all meeting participants
        ii. Radio broadcast signal connected to voice over IP on computer - avoid phone use altogether to eliminate delay
    c. Train users so carts will actually be used
    d. Develop plan for use
        i. Monthly regular meetings
        ii. Weekly or rotating daily video meetings
6. Develop communication tools needed for target meeting to facilitate and include visual measurement tools
7. Test upgraded carts in experimental situation *in one or two plants*
8. Investigate infrastructure upgrades required
    a. LAN
        i. Current LANs are not sufficient in areas where needed
            1. Plant floor
            2. Industrial areas (Matching meeting)
        ii. Need 10/100 Ethernet **switched** at a minimum
    b. Wireless (LAN)
        i. Wireless network to VCL would be ideal to allow max use in industrial areas
        ii. Seems to be high potential for interference, may not be feasible
            1. Cordless phones
            2. Welding
            3. MRP wireless data links
    c. Wireless (Short range for cart accessories, i.e. Bluetooth)
        i. Camera is fixed to very large, laborious cart
        ii. Will not be able to use

## *Concluding Remarks*

The primary benefit of this portion of the Internet2 project is the realization that the potential applications of the technology in the manufacturing world are vast. However, while matching high-speed network technology with the old-school technology of manufacturing has great potential, the costs have yet to be fully realized and the benefits subsequently justified. Further exploration of suitable applications is required. While the virtual meeting cart can complement and enhance communications, it cannot fully replace in-person meetings in its current technology state. Additionally, the infrastructure to support high-speed network access to the plant floor is only now starting to get into place. Ford should include one or several line workers in the virtual cart development process. Line workers (or workers from any workspace that has the potential to benefit from the cart) will provide the greatest insights and bridge many gaps that the information technology specialist will be unable to realize.

In the near future, Internet2 technology also has significant potential to link Six Sigma process-improvement techniques to real time operations analysis and to display it all in a graphical format that is easy for a typical worker to understand and act upon within the manufacturing environment. Most likely, larger benefits will be realized during product launch (i.e. building the factory) and the first few months or years of production.

# APPENDIX I – GLOBAL LEADERSHIP II

## Leveraging Technology in Executive Education

### *Overview of the University of Michigan Global Leadership Program*

In the 1980's major companies needed to globalize to the extent where cross border interactions proceeded seamlessly. Seeing this need, University of Michigan Business School developed the Global Leadership Program (GLP) to aid companies in this endeavor. Starting as a five-week intensive leadership course, executive students came to Michigan to interact and engage in the course. The classes went to the Outward Bound School, met government officials, and traveled to other countries to work on cross-cultural projects and develop international perspectives. The program was held once a year and was comprised of 30-36 senior leaders of Global 100 companies. By the mid-1990's, the process for globalization had become commoditized and the program was halted.

The original GLP programs objectives were:

- Provide a deeper understanding of global geopolitical forces and their relationship to business
- Provide cross-cultural understanding and skill development
- Provide tools and techniques for carrying out overseas business opportunity assessments
- Provide exposure to the political, social, cultural and economic environment in the host country
- Provide new global business strategies for joint ventures and alliances
- Provide global network building among business leaders, host countries and business academic leaders

During its tenure, the program received accolades from the business community. University of Michigan Business School was heralded as an innovative and quality delivering organization. Many of the participants considered the program to be a life and career-enhancing event. At the foundation, the University of Michigan Business School developed a new instructional method of teaching that transcended social boundaries. GLP pushed its participants out of their comfort zones and made the executives become active participants instead of passive students.

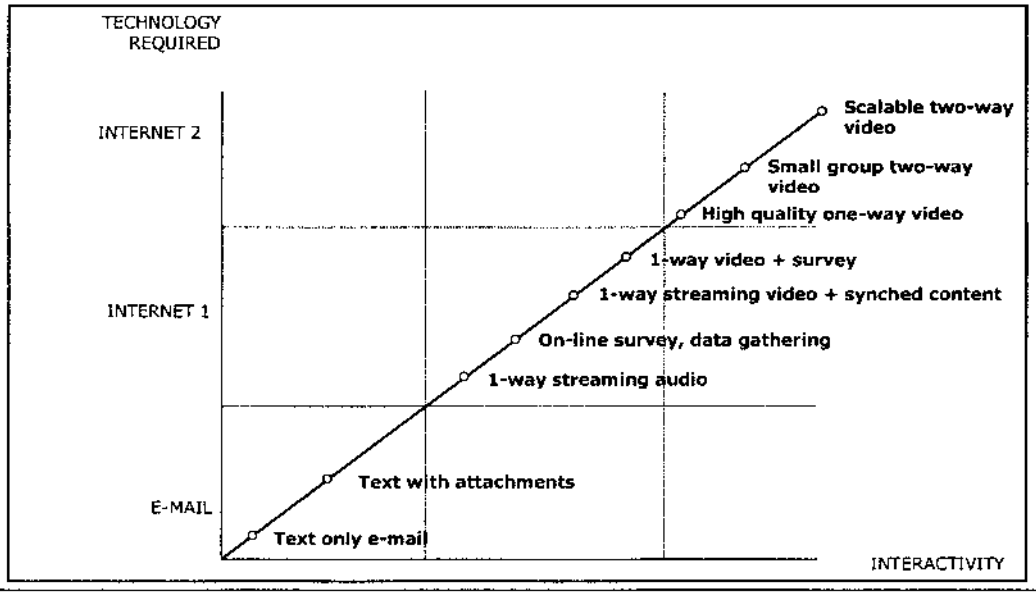
An ongoing research program at UMBS supported the Global Leadership Program to:

1. Develop a precise definition and framework for understanding globalization
2. Provide cross-cultural insights essential for successful global leaders
3. Define steps that can be taken to develop successful global leaders
4. Assess various global examples of successful leadership
5. Learn varied effective global management practices and policies

## *New Arena – New Need*

In today's new century, globalization has become the standard, and major corporations are effectively and efficiently operating across international and cultural boundaries. This new environment has given rise to many new opportunities. Prominent among these is technology and its usage. The past decade has witnessed a gross investment in technology and a proliferation of different technical tools. Although companies have extracted value from their IT department, the question remains "What more can we do?" One painful lesson learned is the fact that technology alone is not the answer. Technology is only a tool, an enabler. It is the company that uses this tool best that will reap the greatest return on their technological investment. IT alone cannot run your business, but most businesses can run without IT.

One of the most prolific uses of technology has been in the acceleration of communication. This development gives rise to the concept of distance collaboration and E-learning. In light of the terrorist attacks of September 11th and the already considerable costs of travel (time, inconvenience, and hazard) there exist tremendous benefits to be gained by leveraging technology on this issue. Over time, as the network externalities of the Internet grew, distance communications has become much more interactive. Until now, most of that development has been reactive. A strong demand existed before technology could adequately satisfy it. Now greater technologies are being introduced that will require non-traditional methods of implementation and use. Below is a graphical representation of what the new technologies will be able to accomplish.



High bandwidth data transfer (Internet 2) will enable a new level of communication that is fantastically superior to anything in mass use today. The boundaries of these enhanced capabilities are still unknown, but we have a good understanding of where the technological limitation will soon take us. Armed with this knowledge, we are now well suited to push the developmental needs of the consumers along with the rapid pace of technology.

## Technology Enables Global Leadership Program II

Enter Global Leadership Program II (GLP II) and the development of the Michigan Protocol. Already well recognized as a leader and innovator in business education and development, UMBS is in a prime position to breakthrough new barriers of communication across digital mediums. As the only business school allied with Internet2, we are at the forefront of this technological revolution. Connected to the Abilene network, we actively participate in the development of high bandwidth communications, bringing scientific and educational research to businesses. In order to execute on these opportunities, a new Global Leadership Program (GLP II) is the ideal platform from which to extend this opportunity into the corporate world and explore the boundaries of distance collaboration and E-learning.

This current research project with Ford Motor Company and Trilogy, UMBS is addressing these issues of distance collaboration and E-learning. Together, we are proposing new solutions that capitalize on the technologies of enhanced data transfers capabilities. These proposals include new protocols for collaboration between geographically dispersed units. The development of these are unique to Michigan and could become the online communications standard, - the "Michigan Protocol". In addition to working on the Michigan Protocol, the research team is actively studying enhanced methods of E-learning or distance education. This includes active, and enhanced computer based training, and a hybrid of these two ideas.

As an institution with a core competency of developing innovative instructional methods of education, UMBS can leverage its relationships with Ford and Internet2, capture our research, and deploy it to the corporate world. As the original GLP broke through social boundaries, GLP II can break across a myriad of other boundaries. Executives in the program would be pushed out of their technological comfort zones and begin real world applications across technological mediums now unfamiliar. Together, the classes can develop best practices and learn methods to further enhance communications in the future. The possibilities are endless.

## Recommended program objectives:

1. Provide deeper understanding of technology capabilities and their relations to business
2. Provide distance collaboration practice and model for development
3. Provide techniques for carrying out distance collaboration engagements
4. Provide exposure to E-learning (methods, advantages, forms)
5. Provide strategies to implement and use E-learning
6. Provide network building among business leaders

## Expanding on these points:

1. Today, most businesspersons use e-mail and other methods of communication. On the surface, high bandwidth communications would appear to only provide a faster e-mail or quicker delivery of a spreadsheet. This alone is not worth any time or fiscal commitments to the average user. When you begin to explore the possibilities of real-time, face-to-face video communications with peripheral enhancements attached, the possible impact on business transactions becomes much more real and worth further exploration.

2. To communicate without personal interaction remains a semi-foreign concept for the average person. There are concepts relating to the development of trust and cohesion that directly affects working across a technical medium. Judy Olsen, a faculty member of UMBS, has conducted extensive studies regarding the development of trust in technologically mediated communication. There are many facets to ensuring a good communication foundation that will continue to work in the digital mode. The development of a good working model is key to enjoying continued success in this endeavor.

3. When there is understanding about the importance of trust and we understand the models that ensure success. A good technique needs to be developed to ensure distance collaboration is effective. These techniques are not limited to understanding or using technology, but also include the social aspects of engaging in this arena. Again, it's the use of this technology that will reap benefits, not just the technology itself.

4. Many people today have heard of or at least seen some E-learning initiatives. One thing is clear though; majority of companies are not employing this development to its utmost potential. In order to enhance your company's competency in this arena, GLP II allows you to experience E-learning first hand so that you may know how it may be used in your company later.

5. Similar to the development of strategies for distance collaboration, we will be doing the same for E-learning. In order to provide a viable and effective product, there needs to be a strategy developed in order to effectively use E-learning. Increased exposure to UMBS staff and curriculum also provides added structure to the development of effective learning tools.

6. Finally, one aspect this program will provide is a valuable forum in which participants can get to meet and work with members outside their regulars work environs. This allows cross-pollination of ideas and promotes the sharing and development of "best practices".

Global Leadership Program stands to be a continuing educational offering of the University of Michigan Business School. This second iteration would be based on the application and development of high bandwidth data transfer within corporate environments. All participants would stand to benefit greatly from any involvement in this project.

## Program Outline

The original Global Leadership Program was an intensive five to six week course. Participants were detached from their organizations while their efforts were dedicated solely to the program.

| Week 1 | Week 2 | Week 3 | Week 4 | Week 5 |
|---|---|---|---|---|
| **UMBS** | | **On-Site Country Visit** | | **UMBS** |
| ❑ Team Building<br>❑ Country Business Assessment Preparation<br>❑ Outward Bound<br>❑ Washington, D.C. visit | | ❑ Country Business Opportunity Assessment<br>❑ Interviews with Government Representatives<br>❑ Business Visits<br>❑ Regional Visit and Assessment | | ❑ Preparation and Presentation of Final Reports |

Today this is no longer a truly viable option. Senior level managers cannot be removed from their organizations for such a protracted amount of time with out severely affecting their performance.

GLP II aims to provide the same level of value as its predecessor, but not devour the same time commitments in one period of time. In recognition of today's demand, the format will be modified to ensure that the time management of senior executives is maximized. The intention is to require similar levels of commitment but to space them over an extended time frame. Additionally, much of the course would be completed via

electronic medium, thus negating the need for travel. Some face-to-face interaction will be required, but the goal is to minimize travel and meetings while maximizing outputs of the teams' effort.

In lieu of one continuous class, GLP II would extend the activities over several months with short, interspersed commitments. The course would tackle real issues that form the basis of study. Issues such as the rising cost of health care for major corporations in the U.S. could be an example. Using technology, participants would collaborate on projects across a variety of different mediums from distant locations for the majority of the project duration. Since this is a learning environment and these are newly assembled teams, there will still be some 'meet and greet' time to coordinate efforts. A proposed plan would be as follows:

| Week 1 | Week 2-4 | Week 5 | Week 6-9 | Week 10 |
|---|---|---|---|---|
| 5 Days | 3 x 2 Days | 3 Days | 3 x 2 days | 3 Days |
| **UMBS** | **Home Turf** | **UMBS** | **Home Turf** | **UMBS** |
| ❑ I2 Boot Camp | ❑ Team research and distance collaboration | ❑ Half-time<br>❑ I2 Advanced course<br>❑ Lessons Learned | ❑ Team research and distance collaboration | ❑ Final preparation and presentation |

The intention with this format is to satisfy several objectives.

- **Week 1:** The first week is on-site at the University for "I2 Boot Camp." During this intense 5-day period participants meet their teammates, learn about the new technologies, are assigned project goals and are provided an opportunity to practice with some of the new technologies.
- **Weeks 2-4:** the teams will have returned to their home offices and are responsible for coordinating how to best manage their time. The goal is to spend 2 days per week working on the project (research, interviews, fact finding, etc.).
- **Week 5:** Half-Time, the teams will return to the University for more advanced training on technologies, sharing with other teams their lessons learned, and to spend face-to-face time with their team members planning and preparing their efforts for the final 4 weeks of research.
- **Weeks 6-9:** Similar to weeks 2-4, with the teams returning to their home turf to continue completing their research and project goals.
- **Week 10:** The final week will again return to the University to put the final touches on presentations.

In total, both GLP and GLP II would be expected to consume approximately the same amount of time (25 days), but the intention is for GLP II to be more flexible for the senior personnel expected to attend. This schedule is only to serve as a guide.

## *Concluding Remarks*

In summary, University of Michigan Business School is a recognized leader with a proven track record to develop and provide innovative learning opportunities that provide solutions to business leaders looking towards the future. As the original Global Leadership Program created a solution that overcame socio-cultural boundaries for global companies, we now stand to repeat a similar performance with Global Leadership Program II. University of Michigan has the potential to forge ahead with a new leadership course that takes senior leaders and guides them onto the technological super train that will propel communications and distance collaboration to new heights and benefits.

This portion of the Internet2 project encompassed many challenging facets that added to our educational experience here at UMBS. Beginning with the study of the first Global Leadership Program, we learned how value was created through out the lifecycle of an educational project. Secondly we learned what are UMBS' strengths and competitive advantages. Finally, we concluded with this plan to leverage these strengths and advantages into a future endeavor. Combined, this project has been a valuable experience from a planning, managerial and research perspective.

# APPENDIX II – DETAIL ON FORD VCL CARTS

**VCL – current status**

- 1-Way video
  - 1 digital handheld video camera
    - Connected via analog signal converter (SLOW)
    - 1 frame every 6 seconds
  - Hard mounted on cart
  - 1 digital still camera (for high resolution photos)
- Audio
  - 2 Cordless phones with headsets (noise canceling)
  - Audio 10-14 seconds **ahead** of video, difficult to watch/listen
- Software - MS Net Meeting
  - Online participants log in to see video, share data

**VCL – upgraded**

- Current VCL with following upgrades
- 1-Way, High-speed digital video
  - FireWire connection to camera (all digital, at 30FPS)
  - 150Kbps or 300Kbps needed
- Audio over IP (with video)
- Still need audio solution for scalable, wireless headphone/microphone

**Costs to upgrade**

- Video upgrades estimated at $3000 per cart
  - ~ $1000 for digital video card and cable (fire wire capable)
  - ~ $2000 for time/software to upgrade video codec and computer
- Audio (wireless headphone/microphone for 5-10 people)
  - Basic, Phone-based, 5 people
    - ~ $1000
      - Requires set up of phone conference
      - Low cost but low quality solution
  - High quality, noise canceling, radio wireless, scalable
    - ~ $5,000 -$20,000
      - Technology is emerging with prices dropping
      - More research required

**Cost savings with new VCL cart use (potential)**

- Applies to assembly plant claims to internal stamping plants
- Potential for $18 Million annual savings with improved communications
  - Uses actual Ford defect rates

- Assumes
  - All stamping plants can reach average defect rate of good plants
  - 40% due to causes not solvable with cart
  - 70% effective rate of defect resolution for defects found
  - $50 per defect
- Please contact Mickey Ellison for more details. Most of the supporting
- Information for these calculations is "Ford Secret."

# TEAM BIOGRAPHIES

## Chris Combs

Chris Combs graduated from the University of Virginia in 1997 with a double major in American History and Foreign Affairs. After college, he worked as a research analyst at Collier Shannon Rill & Scott, a Washington, D.C.-based law firm specializing in antitrust matters. While at Collier Shannon, he analyzed the competitive effects of mergers and acquisitions for numerous Fortune 500 clients, including Ford Motor Company. Chris is currently pursuing an MBA at the University of Michigan Business School. During the summer of 2001, Chris worked at Internet2 on licensing and distribution issues for Shibboleth, an Internet2 middleware initiative

## Gregory Hryniewicz

Gregory Hryniewicz graduated from the United States Naval Academy – Annapolis in 1994 with a B.S. in Systems Engineering. After his commissioning, he served five+ years as a Naval Officer onboard two U.S. Navy Warships in Texas and California. His time aboard ship was spent between Operations and Engineering. Additionally, he served in the Kingdom of Saudi Arabia as an instructor and advisor to the Royal Saudi Navy. Greg will graduate from the University of Michigan Business School with an MBA (Corporate Strategy; Finance focus) in April of 2002.

## Chris McArdle

Chris McArdle graduated from Georgetown University in with a Bachelor of Science in Business Administration double majoring in Marketing and Management. Upon graduation, Chris received the Gannett Award for Academic Excellence in Human Resource Management as well as the Dean's Citation for Exemplary Service to Georgetown University. He also studied Asian Business Policy and International Marketing at the Chinese University of Hong Kong. After graduating from Georgetown, Chris worked for Ford Motor Company's Marketing and Sales Division in Detroit, Kansas City, and Washington, DC. While at Ford, Chris held a variety of positions including Zone Manager, Sales Development Manager, and District Manager. Chris will complete a General Management MBA at the University of Michigan Business School in April 2002 with emphases on Corporate Strategy and Marketing.

## Eva Skidmore

Eva Skidmore graduated from Tufts University with a Bachelor of Arts in International Relations. She will complete a General Management MBA at the University of Michigan Business School (UMBS) in April 2002 with emphases on Corporate Strategy and Marketing. Prior to attending UMBS, Eva dedicated five years to organization / change management, fundraising and development, and volunteer coordination for non-profit organizations such as the Sundance Institute (Sundance Film Festival) in Salt Lake City, Utah, and American Wildlands in Bozeman, Montana. During the summer of 2001, she

worked as a management consultant for the Human Capital Strategy Group of Deloitte & Touche and received an offer for full time employment. Currently, Eva is the Student Government Vice President in addition to the President of Leadership for the school's chapter of Net Impact.

## Daniel VanderWoude

Dan VanderWoude graduated from the University of Wisconsin – Milwaukee in 1992 with a B.S. in Biology. After college, he spent eight years in the U.S. Navy as a nuclear trained submarine warfare officer. He earned an M.S. in Systems Engineering from Virginia Tech in May of 2000, and will graduate from the University of Michigan Business School's Tauber Manufacturing Institute with an MBA with a Manufacturing Concentration in April of 2002.