Provost’s Learning Innovations Grant for Faculty
Request for Full Proposal
2006-2007

Project Title:
Experimental Telephony Integration Laboratory Experiences and Curricula

Applicant(s):

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<tr>
<th>Name</th>
<th>Bruce Hartpence</th>
<th>Telephone</th>
<th>X57938</th>
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<tr>
<td>Dept.</td>
<td>Networking, Security and Systems Administration (NSSA)</td>
<td>College</td>
<td>GCCIS</td>
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Summary

IP Telephony, Voice Over IP (VoIP) and real time data are areas within the networking discipline that are possibly the most dynamic. This is because applications that currently run on traditional telecommunications networks are migrating to more contemporary IP data networks. Stated another way, methods of communicating and entertainment are moving from broadcast airwaves and traditional telephone networks to the Internet.

Perhaps the best example of this is voice communication. Instead of dialing a telephone that will be connected via your local loop and a series of class V or teleco switches, your conversation will be converted to samples inside IP packets for transmission over your local area, then wide area network before reaching the destination. This is what is meant by VoIP. In industry, service like this (Time Warner, Frontier, Vonage and Skype ) has been available for approximately two years, although the quality has been questionable.

In most cases, study reveals that advantages and disadvantages exist for all users but these vary depending the use of the technology. What is clear, is that more and more services are being offered and the challenges represented by VoIP are being addresses by industry. Compared to the work being done in other areas at RIT, little has been towards the investigation of or curriculum development in, this vibrant area. This proposal seeks to fill this gap.

To this end, there are several activities that will be part of this proposal as well as synergistic activities that my department and I have already begun. The primary objectives are to create a laboratory environment in which student activities and research can be housed, the creation of the course materials and building of lab experiences. The overall goal is to graduate students that fill a large gap in industry – professionals that have the ability to handle any and all voice communication systems, interconnect them and migrate from the old to the new. In addition, we will establish a base from which research projects can flourish. Following these activities will be an evaluation of program results, review by affected industries and dissemination of the results to the academic community. Finally, over the last couple of years we have begun working with other educational institutions on curriculum. It is my hope that this project can also be leveraged to train other faculty members at partner schools.

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<td>Traditional Telephony</td>
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<td>Streaming media</td>
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Targeted learners or population

The primary audience for this course will be students matriculated in the Bachelors of Science in Applied Networking and Systems Administration degree program. This is due to the advanced nature of the coursework which will require students to have competency in networking. Students from other departments may also take the networking courses offered by the NSSA department and as a result will fulfill the prerequisites for the VoIP coursework. These departments include information technology, software engineering, computer engineering and computer science. Students will typically be juniors and seniors.

The number of students who will be affected.

Currently we are planning to develop a pair of courses with the possibility of a third. The section size is typically 36 and the courses would be offered a maximum of twice per year initially, thus allowing 72 students to complete the coursework every year. With the advent of a third course, this number would remain the same. This does not include independent studies and research. As I have been planning the work to be done, several requests for both have been made. I would estimate that this would add another 8-10 students annually.

Historically, courses that have been created in new or exciting areas have filled very quickly and often create a demand for additional sections. It is reasonable to double the number of students to 144 if all goes as we plan, however, this will be a possibility for the second year of the program.

Anticipated impact on teaching and/or learning.

This segment of communication represents the intersection of what is new and a major trend, and what is traditional with a tremendous install base. The basic idea is that I will build a traditional telephony infrastructure and expose all of it’s components to the students. They will be required to understand and deploy their own. The lab will also be equipped with state of the art VoIP equipment provided by Avaya, a leading vendor in the market. The students will then be required to build and understand the new architecture. But the key to the lab will be the development of migration strategies and an understanding of the issues associated with moving real time data to a packet network.

The possibilities in a course of study like this are truly exciting for several reasons and to students, it is the opportunity to prepare for an exciting trend before it is forced upon them. Specifically students will work with equipment they have not even seen before, deal with issues only read about and develop the skills to become instantly successful and in demand. They will be the integrators and possess the knowledge demanded by companies now and for the next several years. These statements are made based on the feedback received during a VoIP summit I organized at RIT last year.

I am designing the program such that teachers can be at the center as well. The lab is designed for maximum flexibility, access to and the ability to “see” all of the connections and a combination of several technologies – old and new. Therefore, faculty will be able to work with and explain any and all facets of the systems, and pursue current or advanced study in any specific area they wish. These include but certainly are not limited to quality of service, real time transport, security and design.
How will your project will impact student success?

Simply stated, we will be adding a component to our program that is available nowhere else at this scale. The students will not only have coursework in the top networking program in the country, but now will have access to systems and study that challenge them in an incredibly important and cutting edge field. Entire careers can easily be built (in fact they already are) around this expertise. This makes the program both a retainer and an attractor. Students will be enthusiastic about staying with the program, but also have tremendous opportunities when they graduate because they will understand the wiring on up to the applications and deployment.

How you will measure the impact, how you will report your findings, and what you will share about your project in a faculty forum.

Currently our department is engaged in a complete assessment process. This includes determining which courses shall measure a particular outcome, how it will be measured, what data will be retained and how to evaluate success. I will follow the same process with the VoIP program. In general, I wish to ensure that students understand and can deploy both traditional and emerging telephony systems. The must also understand the issues associated with real time data and migration strategies. Finally, there are a number of transport mechanisms that we will be using to test connectivity.

I will establish a list of outcomes for the program. These will be targeted in both lecture and lab settings. Once these have been established, the best measurement mechanism will be chosen. Typically these are in the form of a practical test such as a lab or hands on exam, a series of questions on a written exam or an assignment. Mechanisms will be chosen for all desired outcomes. Benchmark values will be assigned for each so that we can attempt to evaluate program and individual student success.

A final part of the evaluation will be industry feedback and peer review. To this end I have begun to establish a group of industry representatives that will provide input into the process. As I have done previously, I will be submitting the program and results for peer review at conferences such as SIGITE.

Rationale

Our current program covers a broad range of topics, most of which is designed to give our students basic knowledge and skill, and some of which is designed to advance their knowledge in one of our main focus areas. VoIP and the larger idea of real time data over IP data networks have only recently been identified as emerging and important ideas. The problem is that our field is so rich, that it is difficult to determine what we could eliminate from the coursework in order to pursue VoIP. This is the same problem faced by all programs existing in dynamic areas of industry.

However, VoIP, IP Telephony and real time data all represent something significantly removed from normal modifications to curriculum - a fundamental shift in the way that we communicate. To be clear, communication over IP based data networks still functions the same way, it is traditional telephony that is changing, applications are migrating to IP. This means that telephone calls, television, radio, video conferencing, shared work spaces, games, etc. are all moving on to networks previously designed for bursty, packet travel with no demands on arrival times or quality. Yet, customers will demand the same level of service they have previously experienced.

Over the last two years I have discussed these issues with many industry, campus and education professionals. I have arrived at a basic conclusion: the coming changes will be easier on students possessing IP data network knowledge than they will be on students possessing
knowledge in traditional telephony. This is simply because all forms of communication are migrating to IP not the other way around. So, if starting from a traditional telecommunications background, you must also spend the time in understanding IP based networks. A telephone call made from a standard telephone does not use IP anywhere in the connection.

But this is not the whole story because the challenge for our students is that when arriving on a job, they are faced with Lucent telephone switches, PBXs, ISDN or other technologies that are not central to what we teach. There are also end user expectations. Our students must also put in effort to learn something of traditional systems. Currently, they learn it when they are already on the job which increases demands, pressure and stress in an already challenging position.

So, the challenge for us is to graduate students that are skilled in the area of traditional telephony, understand IP based networks and transport, can deploy state of the art communication systems, and do it all gracefully, without interruption while providing high levels of security and quality. To date, a student could get one or two of these items in the same place, but not all of them. What I plan to provide is a comprehensive learning and research environment that bridges the old and the new, all in one place.

What makes a VoIP program relevant to our faculty is that they possess all of the fundamentals. The same is true for our students. From here, it is a matter of teaching the operation of the protocols, equipment and the strategies for operation. As far as my own background, I have been teaching in the networking department since 1998. I have previously run a research program with Nirmala Shenoy which was funded by Cisco Systems. The focus of that research was the improvement in performance on an IP based networks for roaming wireless nodes. Last year, I organized a VoIP mini-summit here at RIT with help from Mark Indelicato from CAST. This year we are expanding the event including speakers from Citizen’s Communication (CEO Maggie Wilderotter), Time Warner and Paetec. We will also have introductions by Mayor Duffy of Rochester. I am well prepared and positioned to realize success with this program.

I believe that this is innovative for a couple of reasons. First, it is easy to find programs rooted in traditional telephony. Over the last couple of years it has become easier to find programs that are teaching IP based communication. It is also becoming easier to find training programs in VoIP from vendors selling a product line. The best examples are Cisco and Avaya. In addition, programs teaching both traditional telephony and IP based networking will occasionally devote a module or two, but very few full courses to teaching IP Telephony. And certainly nowhere can one find a program that teaches it all. Yet, in a recent visit from recent graduates working in industry demonstrates clearly that this is precisely what they are being asked to manage – all of it.

Second, my goal is also to provide an environment where all facets of the systems are accessible to students AND multiple types of connections. So, not only will student be learning on a single platform such as Ethernet, they will be learning on cable, dsl, Ethernet, wireless and the telephony punchdowns. This will provide them with the maximum possible exposure to systems and give them full control over them. Between these two reasons, students and faculty will be receiving benefits that could be realized nowhere else.

**Project Timetable**

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<tr>
<th>Year</th>
<th>Description</th>
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<tr>
<td>Summer 20054</td>
<td>Development of activities, training on systems</td>
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<tr>
<td>Fall 2006</td>
<td>Offering of first course in Telephony Integration</td>
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<tr>
<td>Winter 20062</td>
<td>Offering of second course in Real Time Data</td>
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<tr>
<td>Spring 20063</td>
<td>Evaluation of first iteration, modifications made for second run</td>
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To: PLIG Committee
From: Luther Troell, chair, NSSA dept.
Subject: Hartpence PLIG Request

This letter is in support of Bruce Hartpence’s PLIG entitled “Experimental Telephony Integration Laboratory Experiences and Curricula”. His proposal aligns with not only his plan of work but also departmental and college initiatives.

He has been tasked by the Dean to run a successful and larger version of the VoIP Mini-summit he ran last year. That event was attended by approximately fifty representatives from around the industry and this year promises to double that.

Professor Hartpence has previously been successful developing new areas for our program and disseminating the ideas and information to the academic community. His pioneering approach, fresh ideas and effort are partially responsible for the attractiveness of our program and the success of our students.

Locally we are devoting lab space for curriculum focused on IP Telephony and VoIP. Bruce will be one of the key figures in this effort. For the department he will be responsible for developing course materials, leading research efforts and interacting with industry in these areas. I whole-heartily support this proposal and the amount requested.

Sincerely,

Luther Troell