

BATTLE OF THE BANDwidth

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ABSTRACT

Whitman College, like all other residential institutions of higher education, has been struggling with taming the bandwidth for the Residence Hall network. It doesn't seem to matter how much bandwidth is provided, or how much packet shaping effort is made -- it only takes a handful of students with a new P2P tool to completely saturate the network, making the entire network unusable for everyone else in the residence hall.

This spring, Whitman College Technology Services (WCTS) conducted a proof-of-concept project. WCTS partnered with a local ISP to make "for-fee" higher bandwidth available in the residence hall on the same outlet as the campus ResNet. Students now have choice of using the "free" ResNet provided by the college or higher bandwidth purchased from the local ISP through the same network connection in his/her residence hall room.

There are several benefits to this arrangement: (1) students whose life depends on the Net can purchase more bandwidth, as an alternative to complaining about the lack of services, (2) by removing the high-bandwidth users from the ResNet, the rest of the students on ResNet experience better connections, and (3) Whitman College need not react to the demand of a few -- the college can add bandwidth as it sees the need and funds are made available.

We report on the result of this proof-of-concept project, discuss the technical aspects of sharing our ResNet with an ISP, and the reaction of our pilot students to the project.

Categories and Subject Descriptors

D4.6 [Operating systems]: Security and Protection – Access controls, Information flow controls and Invasive software]

General Terms: Management, Performance, Design, Economics, Experimentation

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1. INTRODUCTION

Whitman College is a private liberal arts college, nestled among wheat fields and vineyards in the shadows of the Blue Mountains

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of southeastern Washington. Its remote isolated location, while offering much for outdoor enthusiasts, has always presented challenges for connectivity. Furthermore, the current economic environment of "static" budgets allowed the college to increase bandwidth only if ISPs lowered their charges—which was not happening.

Whitman, like many other liberal arts colleges, provides Internet connections in its residence hall rooms through a Residence Hall Network (ResNet)—a network that is separate from the campus computer network. Whitman, by policy, does not charge a technology fee. So raising a "fee" to pay for additional bandwidth was not an option.

For the past several years, two T1 lines provided adequate bandwidth for approximately 800 students (of total 1400 student FTE) on the ResNet. When P2P issues began to surface several years ago, IT immediately installed packet shaping software to tightly control the bandwidth usage, and managed to get by.

As the popularity of P2P applications increased (and more and more downloads became legal, e.g. iTunes), students started to complain about the speed of downloads. The complaints became even more vocal as more students arrived on campus with performance expectations based on their home DSL or cable modem service. Strangely enough, when the total student population was surveyed about the connectivity, the majority expressed satisfaction with our connection. It was quite obvious that the complaints were coming from a minority, but were vocal enough to warrant attention.

Given the economic reality, we did not have funds to provide DSL level service to every student on the ResNet, nor did every student desire such service.

2. THE PILOT PROJECT

In late 2003, Keiko Pitter, CTO of Whitman College, started to ask if there was a way to allow selected students on the ResNet to "buy" additional (and higher) bandwidth in their Residence Hall rooms.

There were three questions that needed to be answered:

1. Would students pay for additional bandwidth, when the tuition is already so high?
2. Would an ISP be willing to partner with Whitman on this possibly money-losing venture?
3. Can Whitman ResNet infrastructure provide commercial bandwidth to specific students and not all students?

A pilot project had to be conducted to answer these questions. WCTS first solicited “partnership” with the campus Residence Life office, then with a local ISP.

PocketiNet, which had been providing Walla Walla area businesses and residents with microwave Internet connections, showed interest in pursuing the project and offered to do the following for free:

- Put up a 10M microwave feed to the campus.
- Install a core router at Whitman to handle the traffic shaping on a per student basis. An individual connection based on MAC address would be shaped to one of three bandwidth options.
- Charge the students on a month to month basis for the pilot project based on their bandwidth option.
- Create a web site for enrollment in the program.
- Provide technical support to the students.

Whitman College Technology Services was to do the following:

- Upgrade ResNet infrastructure to make this a possibility.
- Solicit students to participate in the pilot project, partially subsidizing their connection cost.
- “Cross-connect” each student’s connection on a per-port basis to the vendor’s backbone VLAN on the ResNet switch.
- Conduct assessment survey of the pilot project.

Three residence halls were selected for the pilot project:

- Jewett Hall that houses first year students.
- Douglas Hall that houses upperclassmen.
- North Hall located farthest away from the campus.

2.1 Network Upgrade

The solution required residence halls to have “switched” networks. During spring break 2004, a second fiber run was made to these three residence halls and switches (Cisco 2950-T) were installed.

2.2 Participants

The Residence Life staff developed and conducted a survey that asked all residents in the three residence halls about their network use and expectations, as well as their willingness to pay for the additional bandwidth.

103 students completed this survey. The results indicated that 98 percent of those responses considered themselves to be moderate to heavy users of the ResNet, over 60 percent said they used the ResNet more than 20 hours a week.

When asked what applications were used from their rooms, their top answers were (in order of popularity; students were allowed to choose multiple applications):

98% - Email

91% - College related business

89% - Academic research

87% - Web Surfing

84% - Instant Messaging/Chat

80% - News/Blogs

Tasks such as gaming, downloading (music, photos, movies or video) and streaming media (music and video) all rated as less than 50% usage in the survey.

Although 98% of respondents indicated “Faster Download Speed” as the most urgent needs, 45% said they did NOT want to pay extra for additional ResNet performance.

When asked specifically,

“WCTS is working with a local Internet Provider on a pilot project to offer enhanced Internet access in student rooms. The pilot project will take place in April and May of this year. Enhanced Internet access will be available for a monthly fee (\$15/month to \$37.50/month depending on level of service).

Are you interested in receiving more information and potentially participating in the pilot project?”

27 students indicated willingness to participate in the project. Fourteen students were selected to participate in the pilot program. Their assignment was simple:

- to register on-line prior to March 29th, 2004, paying for service in advance using credit card.
- to use the connection to their heart’s content
- to complete three evaluation surveys during the two month pilot timeframe.

To sweeten the deal, WCTS hired these students as “student-consultants” and paid them the equivalent of half of their connection cost, provided they completed all surveys.

2.3 The Unexpected Advantages

Walla Walla is a very small community. A partnership in such a small community has advantages that cannot be realized in larger environment.

One of the serendipitous advantages enjoyed was the local “peering” link between PocketiNet, Whitman College, and another major local ISP (OneEighty Network).

The “peering” connection allowed traffic from Whitman College headed towards a customer of these two local ISPs to travel across a local high speed network connection rather than over the normal public Internet.

This meant that staff, faculty and students who had a broadband connection at their home (off-campus) from PocketiNet or OneEighty Network were able to take advantage of faster and more reliable access to on-campus resources. The “peering” link also took much of this local traffic off of Whitman’s main Internet connection, increasing the effective bandwidth for other network users.

Another advantage for WCTS was that DMCA notices regarding P2P usage by students on the pilot project came through PocketiNet, not through Whitman College!

3. THE OUTCOME

It was interesting to observe that these 14 students, at times, managed to consume four times more bandwidth than the rest of the college campus combined (1400+ users).

The final evaluation by participants indicated the following:

- 57% said they never needed to contact the ISP for support or assistance
- 78% said they would sign up for the service again
- over 65% said they would recommend the service to their friends
- 11% of the respondents said they did not feel the service was a good value for their money (that the college's "free" connection was adequate)

A couple of students indicated their surprise in realizing they were no longer on the Whitman College network, and that they needed to setup proxy service to access some resources on the campus network.

Since students who participated in the pilot project were more "computer savvy" than the majority students, we suspect that the support needs will increase when we open this service to all students.

PocketiNet, although they did not make profit during the pilot project, felt comfortable enough to expand this offering to the entire ResNet.

4. THE FUTURE

So, it will happen. Starting fall 2004, Whitman College students living in all Residence Halls will have choice of either using the "free" connection from the college or purchase higher bandwidth.

In preparation, WCTS is upgrading all residence halls to switched networking equipment. PocketiNet is installing a DS3 connection to the campus. PocketiNet also plans to "hire" several students to work as support staff for their service.

In the meantime, we will be doubling the bandwidth for the "free" Residence Hall network and tripling bandwidth for the overall campus network connection.