

Proposal

Network Charging Algorithm

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By

Pat Burns

I. Introduction

The University is experiencing increases in costs for networking that exceed the ability of Academic Computing and Networking Services to fund. As high-quality networking is critical to the conduct of University business, a means to fund these costs is being explored.

Fortunately, the University will in November of 2001 be paying off the debt associated with purchase of its telephone switch. These debt reductions resulting from this payoff in Fiscal Years 2002 and 2003 are projected to be approximately equal at the University level with the new networking costs. The current plan is to use this debt reduction to offset the new networking costs. This will be accomplished by performing budget adjustments that offset the new networking costs with reductions in basic service telephone rates. The goal is to spread equally across the University the net costs or net savings. Because units are budgeted at the departmental level, the budget adjustments will be identified at the departmental level. This requires that all telephony and new networking costs be partitioned among all departments on campus. The budget adjustments will be aggregated and instituted at the Vice Presidential/Dean level, and are intended to be percolated down to individual departments.

Expenses included in the networking costs include:

- a. Wide Area Networking (WAN) costs – WAN costs that are rising dramatically due to increasing usage, increasing per unit costs (the State's extremely good prices for networking from SuperNet, Inc. are no longer available), and decreasing subsidies from the National Science Foundation.
- b. Network device maintenance costs – These are expenses of annual maintenance for shared networking devices, including Internet routers, backbone switches and shared building switches. These costs used to be insignificant, but are becoming significant with the increasing number and cost of such devices as we evolve to active, intelligent network devices.
- c. Access to shared databases – These costs are for access to shared databases, including the Web of Science, that are widely used at the University.

Although the preponderance of these costs are for Wide Area Network connectivity, note that the maintenance and database costs are costs associated with on-campus usage. Thus, it is cautioned that the charging algorithm should not be based strictly on WAN costs or WAN usage.

Charge back directly for network access will be implemented in FY 02. This model possesses several advantages over a centrally funded model:

- 1) Units that are not centrally funded will, under this model, pay their fair share.

- 2) Experience with the central modem pool has indicated that it is feasible to maintain high-quality, low-overhead services under a charge-back model. Contrariwise, the experience we had with the central modem when requesting central funding for the modem pool had no positive result (recall the “free busy signals”).
- 3) A viable management structure for the charge-back exists in the Modem Management Committee.
- 4) Individual charge-back poses the least risk in terms of audit.

The disadvantages of this model are the complexities and administrative overhead of determining, allocating and collecting the fees, especially when networking technology has not been designed to accommodate charge back, as has telephony technology.

II. Guiding Principles for the Charge-back Model

Guiding principles for the charge-back algorithm can be used to establish a philosophy for charge back. These principles may be regarded as ideal principles that, in some cases, may not be attainable but should be approached appropriately. A good set of principles will also eliminate some possible “thrashing” when discussing specific models, as the models all need to be tested against the guiding principles.

The following guiding principles for the charge-back algorithm have emerged from discussions with several campus units, notably the subnet managers group and the University Information Technology Support Services (UITSS) Committee.

The charge-back model should be:

1. Simple - understandable by everyone at the University.
2. Equitable- the same for everyone.
3. Enforceable - need to be able reasonably to control delivery of services, or deny services to those who do not pay.
4. Indisputable - charges need to be indisputable - long distance telephone charges can be regarded as indisputable, where the charge is allocated uniquely to a particular telephone and the exact duration of every call is measured – this is akin to traffic accounting for every computer on campus, infeasible due to limitations of technology and staffing.
5. Predictable - traffic-based charges are not reasonably predictable and are difficult to budget for, and should be avoided.
6. Auditable - must comply with federal cost accounting
7. Low overhead - desirable that staff maximize delivery of services and minimize administrative aspects.
8. Sensible - to the extent possible, the algorithm should be sensible. For example, we should avoid algorithms that would discourage use of portable computers, or activating spare ports, or use of emerging technologies such as wireless networks, or encourage individuals to unplug their computers from the network, etc.

III. Inherent Difficulties of Individual Charge Back

The difficulties inherent in an individual charge-back model are legion. Mostly due to the immature state of network accounting technology and cultural issues of networking always

having been “free.” Perhaps the best manner in which to illustrate this is to contrast the state of technology and support of network accounting with that for telephony.

Telephony - At the University, we charge about \$21 per month for basic telephone service, and from 6-10¢ per minute for domestic long distance calls. To support these charges, telephony technology incorporates sophisticated hardware and software that meters all long distance calls and enables all long distance calls to be attributed to individual users. To “work,” a telephone must be attached directly to the telephone switch and activated in the switch, during which process, accounts for billing the individual user are established. The Department of Telecommunications has more than 20 FTE employees, about half of whom support installations and billing. About 10,000 phones are connected to the campus’ telephone switch. Annual central costs of telephony service are approximately \$5 million.

Networking – In this discussion, it is important to realize that ACNS provides only the central, backbone network. Colleges and departments connect into this backbone to receive networking and Internet services. At CSU, colleges and departments “own” their own computing and networking environments, and can install and deploy local area networks whenever and wherever they wish. Currently, there is little or no control of who or what can “plug in” to the network. This is in contrast to telephony, where the technology makes this impossible and the Department of Telecommunications “owns” the entire telephony infrastructure, end to end. At the University, we currently charge nothing for data networking service, except for the one-time cost of the hardware required to “plug in” to the backbone. There are no facilities in data networking technology to attribute network “calls” to an individual, however a limited amount can be done manually (more on this below). To “work,” a computer can be connected anywhere on any active Local Area Network (LAN). Indeed, portable computers are intended to be used anywhere at the University. Some colleges with foresight are activating many spare network jacks to support this activity. There are only 4 FTE’s who support central networking, none of whom are devoted to accounting or billing. There are about 16,400 devices connected to the campus network.

Based upon the above information, several inherent difficulties become immediately obvious:

- There is no technological infrastructure in data networking that supports accounting and billing – all accounting and billing will have to be accomplished manually.
- There is no control of the infrastructure, either of who “plugs in” or where. In fact, data networking ports are being deployed purposefully to support connecting portable computers anytime and anywhere. This is further exacerbated by the emergence of wireless networks that do not have even a physical wire that can be traced back to a computer.
- There is no staffing or infrastructure (i.e. billing and accounting systems) to support accounting or billing for data networking.

Discussion

Charging back for data networking is partitioned into two fundamental tasks: 1) identifying devices connected to the network, and 2) associating a billing account number with every device. These charges would then need to be aggregated at the departmental level.

In summary, there are a number of issues which make this a portentous and formidable undertaking: 1) lack of maturity in networking technological to support billing, 2) inadequate control of the networking environment, making it extremely difficult to identify what devices are connected to the network and where they are connected, 3) a process that is manually very labor intensive, and 4) finally, lack of staff to perform the required work.