White Paper

Engineering and Economic Benefits of Off-loading Dial-Up Traffic from the PSTN

Off-loading dial-up traffic through deploying carrier-class switches in the PSTN infrastructure.

by Shuang Deng, Ph.D

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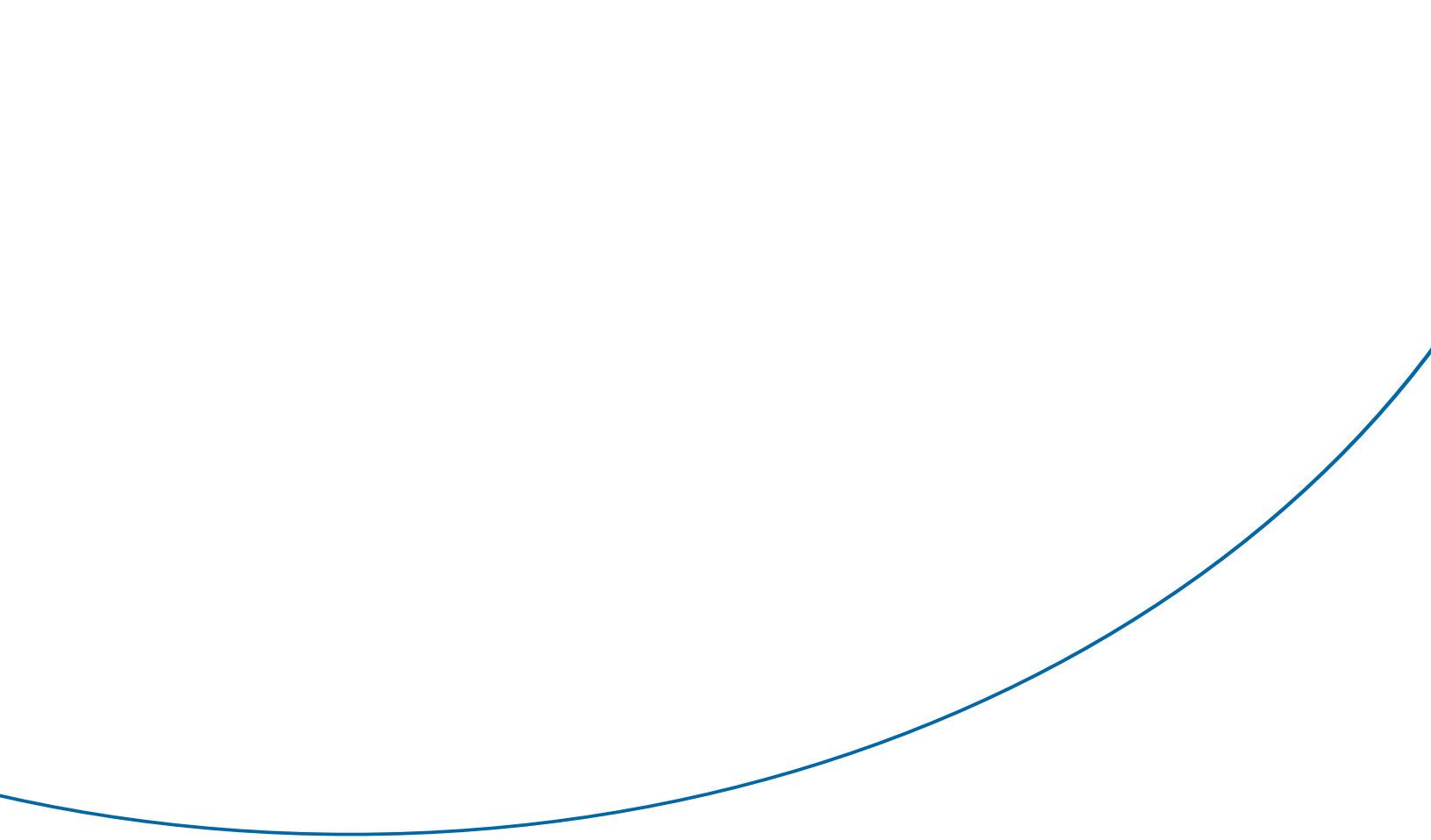


Internet Explosion and PSTN Congestion

The Internet and on-line subscriber base have been growing at 40 percent per year, presenting a very attractive opportunity for telephone companies (telcos) whose traditional telephone subscriber base has been growing at about 4 percent per year. According to recent statistics, the number of Internet and on-line subscribers have reached 25.4 million, with 15 percent of US households already on-line. All of them use the Public Switched Telephone Network (PSTN) for dial-up access, 98.6 percent use analog modems, and 1.4 percent use ISDN.

Before telcos can reap benefits from on-line subscribers, they are faced with an enormous challenge. Traffic from dial-up calls are overwhelming the PSTN, which was originally designed for low-volume voice calls.

Telcos have always been mandated to provide affordable, reliable and universal services. They are required to provide dial-tone at least 99 percent of the time (less than a 1 percent blocking rate) when a subscriber line goes off hook during peak hours. The right balance between economics and quality of service is achieved through engineering appropriate amounts of network resources shared among many subscribers. This is made possible by a well-established statistical usage pattern of voice calls which last an average of five minutes (or three hundred calling seconds [CCS]). According to an FCC study, typically one circuit worth of capacity is available on the switch for every six subscriber lines.

The emergence of dial-up traffic is changing the PSTN traffic pattern considerably, causing network congestion. An average dial-up call lasts 20 minutes (or 12 CCS versus three CCS for a voice call), and 40 percent of the calls last an hour or longer. At the ISP POP the usage is even higher, at 25-30 CCS, due to multiple sessions on the same line during the peak hour [1, 4]. If only four percent of the subscribers generate dial-up calls of 45 minutes or longer at the same time, it will cause the blocking rate to increase from one percent to seven percent, according to a Bellcore study [2]. To meet service availability requirements, a telco has to invest heavily to cope with the dial-up traffic.

PacBell attributes $100 million in PSTN upgrades directly to Internet dial-up traffic [1]. Additional engineering and operational costs are also skyrocketing. Bellcore estimates an additional $30 million in engineering costs due to Internet dial-up traffic in every large Local Exchange Carrier (LEC) [2].

Continuing to expand the PSTN is not the desired solution for telcos, ISPs or end-users. The PSTN is not designed for data traffic. The only viable solution today is to off-load dial traffic through deploying carrier-class access switches in the PSTN infrastructure.

Off-loading the PSTN

A Carrier-Class Access Switch (C-CAS) is a network access device that meets the rigid Central Office (CO) equipment requirements, while following the existing carrier operational models. It terminates modem and ISDN dial-up calls and leased lines, and aggregates traffic to the data network. In addition, the C-CAS should be capable of supporting emerging transmission technologies, such as DSL, to protect the carrier's investment. The C-CAS may be deployed at the various CO locations, including the terminating CO, in-tandem, and originating CO of dial-up calls. (A companion study [5] reviews the evolutionary history of the RAS market and architecture. The generic requirements of the new C-CAS is described in an article in Telephony Magazine [6]).

Economic Benefits of CO Deployed Access Switch

Deploying true carrier-class access switches in the CO not only relieves congestion and ensures service quality of the PSTN, it also enables carriers to offer such new services as wholesale Internet access and outsourced Virtual Private Networking (VPN). Figure 2 demonstrates the economic benefits of deploying C-CAS in the CO.

Actual data from telcos and Bellcore indicate that a carrier can produce net income of $72 million a year, including savings and new service revenue. The

Figure 1: Deploying C-CAS to off-load dial-up from the PSTN

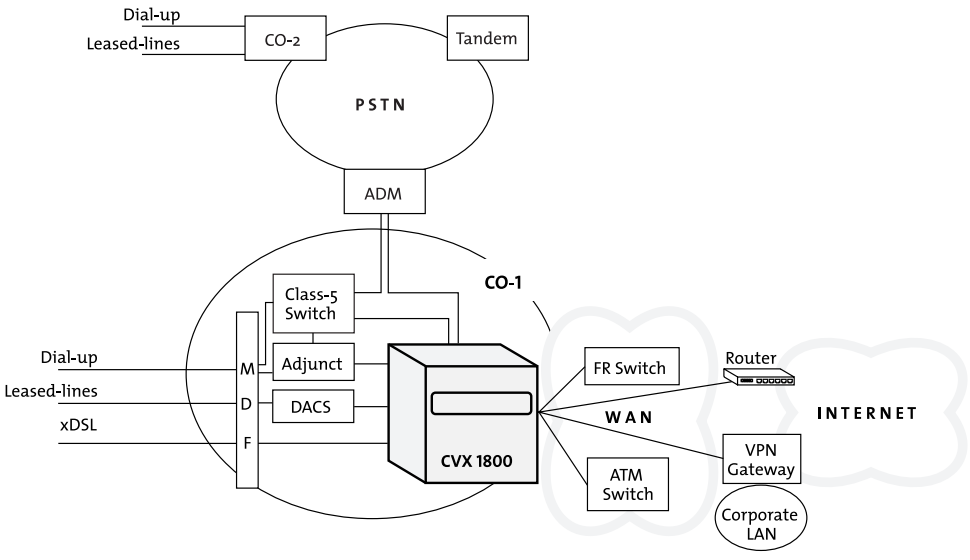
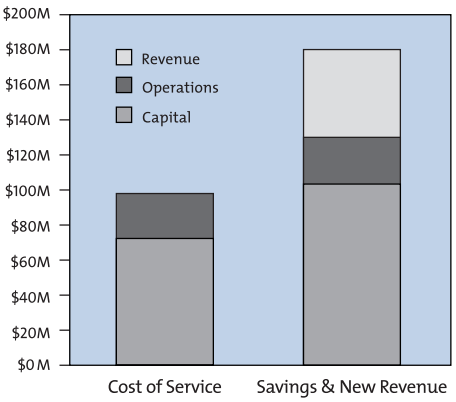


Figure 2: Cost versus benefits of CO-deployed RAS (Data Source: PacBell and Bellcore)



Nortel Networks' CVX™ 1800 is the only true carrier-class access switch on the market today. Its unique Virtual Point of Presence™ (Virtual POP) capability enables carriers to offer wholesale Internet access services to ISPs, as well as outsourced VPN services to corporations.

Savings and New Service Revenue

Consider a real-world case with actual cost figures released by PacBell and Bellcore. PacBell spent $100 million in 1997 in capital equipment upgrades to address the increased traffic load of Internet dial-up traffic on the PSTN [1]. Recurring operational costs are estimated to be at $30 million per year by Bellcore [2].

Off-loading dial-up traffic would avoid these costs, saving $100 million in capital and $30 million in operations per year.

In addition to these savings, the CO-deployed access switch would produce new service revenues. One possibility is "renting" the modems to Internet Service Providers (ISPs). This is the most conservative case, since ISP services probably generate less revenue than business VPN services. Revenue would be at least $15 per month (or $180 per year) per modem, the amount the ISP would have to pay for owning the modems without the benefit of carrier management and the reliable CO environment.

With an on-line subscriber base of 2.4 million and a subscriber-to-modem ratio of 10:1 (most ISPs are at 14:1 but targeting 10:1 over time [3]), the telco would need to deploy 240,000 modem ports to generate service revenue of $43.2 million per year. Additional economic benefits come from annual savings of capital expenditure ($100 million) and operations costs ($30 million). The total revenue and savings would amount to $173.2 million per year.

Cost of Service

The cost of deploying this new service primarily consists of the capital outlay and the operations. Assuming a purchase price of $300 per month with the same operations-to-capital cost ratio as in the PSTN case [4], we arrive at a cost of service of $72 million in capital and $24 million per year in operations.

Net Benefits

The net income for the first year of deployment is $72 million. Figure 2 shows the comparison between cost of service and benefits.

The net benefit continues to be substantial for subsequent years because the operational savings and the service revenue continue to outstrip the cost of operating the services.

Different telcos have different subscriber bases from the numbers used in this study. A smaller number of modems need to be deployed in a telco with less subscribers, hence a smaller return on a smaller cost. The relative return should remain unchanged for telcos of different sizes, because the cost is a function of the number of subscribers. The same economic benefits can be enjoyed by telcos of various sizes.

Service Platforms

The deployment of dial-access termination in the CO enables telcos not only to relieve the PSTN congestion, but also to reap economic benefits from new services. To this end, telcos need a new class of switches, namely the C-CAS, as opposed to the traditional access switch that was designed for the CPE market and cannot meet the unique requirements of telcos [5, 6].

The Nortel Networks' CVX 1800 is the only C-CAS available that is developed specifically to meet the demands of telcos and network service providers.

References

[1] PacBell White Paper, "Surfing the 'Second-Wave'," which is available at http://www.pactel.com/about/pub_policy/esp/WP-internet-part1.html

[2] Amair Atai and James Gordon, "Architectural Solutions to Internet Congestion Based on SS7 and Intelligent Network Capabilities," a Bellcore white paper, which is available at http://www.bellcore.com/DOWNLOADS/PRESS/atai_web.pdf

[3] Infonetics Research, "ISP Opportunities 1997"

[4] Bell Atlantic filing to FCC, "Report of Bell Atlantic On Internet Traffic," March 1996

[5] "Remote Access Market and Product Evolution," a Nortel Networks white paper, which is available at www.nortelnetworks.com/pcn/aptis/pdfs/remote.pdf

[6] S. Deng, "Carrier-Class Access Switch (C-CAS) Architecture," Telephony Magazine, January, 1998

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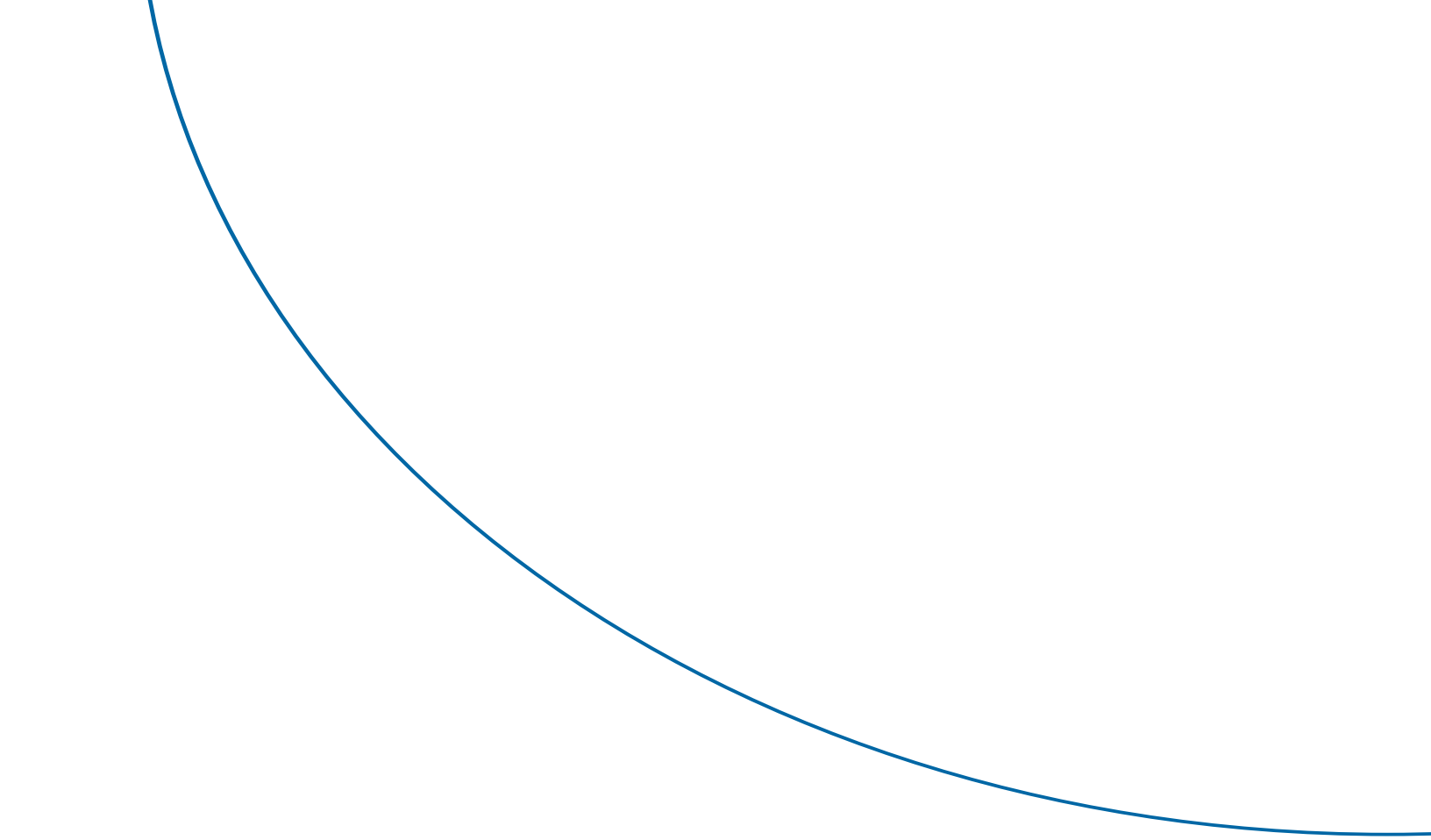

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