CABLE THIN CLIENTS: A NEW REVENUE OPPORTUNITY FOR MSOS

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Abstract

A thin client computer typically a PC that consists of a motherboard only and boots the operating system off of the network. Thin clients are essentially intelligent display devices that normally run applications on a server located somewhere else on the network. The lack of moving parts and ability to manage them remotely makes them a very cost effective technology for business applications such as point of sale devices, and many corporations are using thin clients for their employees based on the much lower total cost of ownership of this technology. Recently, with the availability of Open Source office applications and educational titles, schools all over the world are switching to thin clients as a more cost effective approach to providing reliable and inexpensive student PCs.

In this paper, a thin client computer technology that uses cable modem infrastructure is described. Because of its broadcast architecture, the cable plant is uniquely positioned to take advantage of thin client computing, and can provide the service more efficiently and cost effectively than other broadband wired networks. Thin clients are as robust as a cable modem, and can be rebooted and managed remotely as easily as a cable modem, which means MSOs can offer a managed home PC service without concern for additional truck rolls. Best of all, it opens up new revenue opportunities for MSOs, including pay-as-you-go data services, children's PCs with preloaded educational titles, and elderly residents who would only get a PC if a service provider supported it for them. And since a cable thin client is not much more than a cable modem that you plug a monitor, keyboard, and mouse into, MSOs can enter the market at far less than would be required for conventional computer technology. Finally, since the servers are located in the MSO's facilities, the operating system is completely under the MSO's control, and thus can be easily maintained and provide an additional portal to users.

INTRODUCTION

With the growth of competition for cable operators in the triple and quadruple play arenas, there is renewed interest in emphasizing the content and services provided by the operator to subscribers. And this content is not just limited to TV, music, and Internet portals, but many operators are providing free software, such as anti-virus applications, along with their high speed data services. These software application content offerings are generally being used today to enhance the marketability of high speed data service, rather than to specifically generate new revenue streams.

The main drawbacks of offering software content are that it can increase the software support cable operators must provide to subscribers, and the multiplicity of platforms and operating systems to support can make such content offerings undesirable to the operator. The cost of licensing such software can also be a burden to operators' revenue growth.

Businesses have been plagued by these same issues in providing PC platforms and software applications to their employees since the advent of the PC. An approach that is currently gaining ground in the business community is

to use a thin client architecture to reduce the total cost of ownership and reliability of employee PCs. Thin clients are essentially a PC that consists of a motherboard only, and boots the operating system off of a server located elsewhere in the network. In a typical thin client deployment, over one hundred clients can be run by a single server, which means the business IT department need only support a single PC, the server, and the thin clients are more like appliances that at most require an occasional rebooting. Thin clients are much cheaper than conventional desktop PCs ($150 vs. $300+), and software additions, updates, patches, etc. are done on a single server, and then apply to hundreds of clients.

To further reduce the total cost of ownership (TCO), many businesses and schools are switching to Free Open Source Software (FOSS), and indeed an increasing number of cable operators are requesting Open Source solutions for their networks and services. As opposed to proprietary software offerings, FOSS is developed by the world community and the source code is freely available to programmers to download and improve. The Linux operating system is probably the most famous FOSS package, but FOSS applications exist for all major operating systems, and in fact there is now an Open Source office suite, OpenOffice, that rivals proprietary offerings in function, power, and compatibility.

So why would a cable operator be interested in thin client computing and Open Source Software? Because these are enabling technologies for cable operators to offer new software content and new high speed data services to subscribers. An example new service that would generate an entirely new revenue stream for operators would be to offer a home PC platform, running Open Source Software, that can be cost-effectively deployed and that is easily supported by the operator. By using thin client technology as the home platform, the cable operator can standardize both the hardware and software for the system, and can manage the clients from the operator's facilities, much as cable modems and settop boxes are managed currently. For the purpose of this paper, this proposed PC platform is termed a cable thin client.

An introduction to thin client technology, an architecture for, and the challenges of delivering thin client computing over cable networks are presented in this paper. Benefits to both consumers and operators are provided, as are new MSO revenue opportunities. Finally, future network architectures that would include cable thin clients are referenced, and a summary of why cable thin clients make sense for cable operators is presented.

THIN CLIENT TECHNOLOGY

While most PCs can be converted into thin clients merely by altering the BIOS to boot the PC off of the network instead of the hard disk drive, the real benefits of thin clients can be seen in platforms designed to operate only as a thin client. Most thin clients are about the size of a cable modem, but there are also thin client solutions built into LCD monitors and even wall data ports, such as the Jack-PC from Jade Integration as shown below: (www.jadeintegration.com/jackpc.php).

Figure 1. Example Thin Clients.

Most are diskless and fanless, which means the moving parts that typically fail in a home PC are completely eliminated, and so thin clients are projected for TCO purposes to have 7-10

year lifespans, or roughly twice that of conventional PCs. During its life, all thin clients in the network may be upgraded by upgrading the servers.

The basic thin client architecture is to have at least one server on the network from which the thin clients boot their operating system and run applications, as shown below.

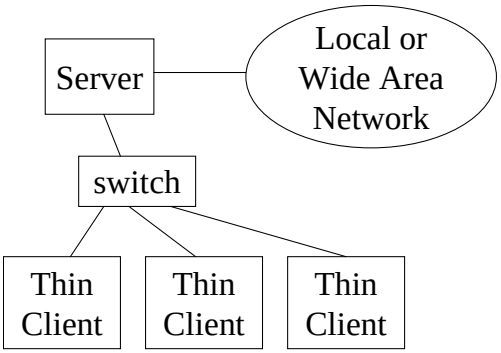

Figure 2. Basic Thin Client Architecture.

Thus, the server has two Ethernet interfaces, one to the outside world and one to the thin clients. The server can either be a single server that provides all required functions of boot, authentication, and applications, or these functions can be divided into servers optimized for each function, as is done in enterprise-style deployments of thin clients.

The author's own initial experience with thin client technology using Free Open Source Software was at his child's elementary school several years ago, where classroom computers were 7-10 years old and typically unused by teachers and students due to lack of adequate maintenance. After installing classroom servers in each room, the three existing PCs were suddenly brought back to life, working faster than ever before, and maintenance issues all but disappeared, even for PCs that were up to 10 years old. Furthermore, the software suite used was completely sufficient for all of the teachers' and students' needs, and the fact that it was free meant that copies could be distributed to as many servers as desired, and indeed install disks could be sent home with students so they could use the software at home as well as at school. The package used, K12LTSP, includes dozens of educational applications, with an emphasis on math and science. After the initial deployment, and with over 100 donated PCs from local businesses, a seachange occurred in how the PCs were used in the classrooms, and test scores even went up dramatically the number of working PCs in each room was tripled. The result is that the public school district of Atlanta is now deploying this technology, using brand new thin clients the size of a cable modem, servers which support over 100 clients each and LCD monitors. The LCD monitors were chosen because when classroom ratios of student to PCs of 2:1 are approached, the electricity available in a room becomes the limiting constraint, and lower power-consuming devices must be used. A a new thin client with an LCD monitor uses about 1/6 the electricity of a conventional desktop PC and CRT monitor.

The low cost of thin client technology, the depth of FOSS software available, and the complete success of this approach for school districts that typically struggle to maintain their information technology, led to the proposed cable thin client solution provided in this paper.

ADAPTING THIN CLIENT TECHNOLOGY TO CABLE DATA NETWORKS

To implement thin client technology over a cable data network, several modifications to the basic architecture must be made. First, the enterprise version must be implemented, wherein powerful servers in the cable operator's facilities are used. This is so that truck rolls likely involve using separate servers for boot, authentication, file, and application serving. There are two approaches currently used for application servers: first, use multiple ap-

plication servers that each have all of the application software. This approach has the benefit of providing load balancing and automatic failover if a server has issues. The second approach is to use application servers that have been optimized for specific applications. This approach often optimizes performance in the system, but unless it is combined with redundancy, can lead to unhappy subscribers.

A proposed architecture for a cable thin client (TC) network is shown below. Note that four types of CPE are shown: standalone cablemodem (CM) and standalone TC; combined CM/TC, and then two similar variants where the CPE also includes a server. These latter two approaches would be applicable to MDUs and small businesses.are not required to manage and maintain the servers, as well as providing additional security for the servers and control over the user interface presented to clients. This would also

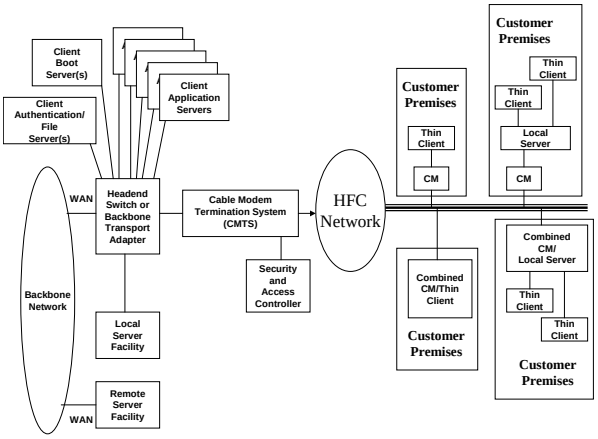

Figure 3. Example Cable Thin Client Network.

The bandwidth requirements of thin client networks can be substantial. Without any form of compression of the screen data before sending to the thin clients over the network, a single thin client can require several Mbps downstream data rate, and for particularly animated applications, a client can require over 10 Mbps downsteam data rate. Hence, even in the basic architecture, if more than 6 or 7 clients are connected to a server, then Gigabit Ethernet is required for the link between the switch and the server, which aggregates the traffic of all clients. However, most applications, like OpenOffice and even video streaming from websites like YouTube and CNN took only 1 Mbps or so per client.

Nevertheless, there are already available compression packages such as the FreeNx package (http://www.nomachine.com), which can be combined with Linux terminal server packages, and purports to offer thin client support, even over dialup networks. Experiments with this package indicate that while the latency is noticeable, it is tolerable, and clearly an optimization of such an approach would lead to better user experience, while keeping the bandwidth requirements low.

But cable data networks can take advantage of their broadcast architecture to enact further improvements in delivering thin client screen data. The desktop itself can be standardized such that much of the screen data is common across many thin clients. Further, as an overload protection for events such as popular web video suddenly becoming available, the video streams can be delayed and synched so that multicast delivery efficiencies can be obtained. Also, the thin client platform can be made thicker so that certain especially bandwidth intensive applications can be run locally. Finally, an adaptive system, which trades off client bandwidth requirements vs. latency can be used.

BENEFITS FOR THE SUBSCRIBER

Why would a customer pay a monthly subscription to have a headache-free PC in the home loaded with software that is maintained by the cable operator and replaced by the operator if it ever fails? First, there are many subscribers, especially the low income and the

elderly, for whom the desktop PC is either too expensive to purchase initially, too complicated to decide what to get, or too worrisome to have in the home unless a service provider supported it. Second, many homes with children still do not typically have a PC dedicated to the children's use, which means the children end up using the parent's PCs and often the web sites for kids end up downloading software that slows the PC down. Were the children's PC to be a cable thin client however, since the server is in the cable operator's facilities, the operator can use web content filtering and URL-blocking applications like DansGuardian and Squidgard, to provide a safe web accessto all children's thin clients on the network. Further, the operator could include other content related to the cable operator's business, such as flash-based children's programming, and built in links to cable operator' web sites for children.

The protection of user data and privacy may be effected in several ways. First, the user can take responsibility for their own data protection and use an encrypted USB flash drive plugged into the thin client. Second, the cable operator can maintain files in their facility, keeping them private via built-in mechanisms in Linux, or using other applications which increase file security. Especially for non-computer literate subscribers, the knowledge that files are automatically backed up by the operator could either enhance the service or provide additional monthly revenue. Printing, external CD ROM drives and other USB devices can also be installed in the client from the server, although a support call would typically be required.

User benefits thus include: all typical office applications (web browsing, office applications, email); children's edutainment applications; automatic, secure network backup of user files; automatic software updates; and all at no licensing cost.

Interestingly, one other user benefit of this architecture is that a user's experience is not fixed in space: a user can go to a neighbor's home, Internet café, etc., and can log onto the cable modem network there, perhaps requiring an encrypted USB key, and then their desktop environment, including all services to which they currently subscribe, are available. This kind of seamless mobility is a new wrinkle on PC mobility. In the school environment described earlier, this architecture has proven to be a method of providing ubiquitous PC access that is less costly and more reliable than 1:1 laptop initiatives, for example.

CABLE OPERATOR OPPORTUNITIES

The main new opportunity for cable operators is a completely new source of revenue from offering a cable thin client subscription service. This addresses both existing high speed data customers as well as a currently untapped base of subscribers. Minimum 2 year contracts with free thin clients are a possibility, similar to the cell phone model. And a cable thin client goes beyond even the quad play arena into the so-called x-play scenarios, where new devices leverage multiple services, applications, and user experiences; a cable thin client is a platform for PC-TV as well as IPTV and interactive TV. Since the thin client is a "12 inch" interface, but can easily include more typical video content, the operator now has a platform for ITV that moves into the next generation of applications without concern for the often limited processing power and capabilities of older settop boxes.

The opportunity for ad revenue enhancement is also significant. With a cable thin client using a common portal and linked to the operator's content, the cable operator has unprecedented influence on the web and video experience of the subscriber. And by integrating data from such a service with other home services provided by the cable operator, the op-

erator has valuable usage data across a variety of platforms and services that can raise ad revenue rates for the operator.

FUTURE DIRECTIONS AND SUMMARY

Looking to the future, when high definition video, ultra high bandwidth data services, peer-to-peer video sharing and conferencing are all being delivered via cable operator's networks, the cable thin client represents yet another bandwidth consuming service, but one that easily integrates with existing services. In these scenarios, other means of delivering high definition video, which can include thin client screen data, may be required. One example is the DOCSIS IPTV Bypass Architecture (M. Patrick and G. Joyce, "Delivering Economical IP Video over DOCSIS® by Bypassing the M-CMTS with DIBA, SCTE 2007) as shown below, where the thin client servers have been moved deeper into the back office and the thin client uses DOCSIS 3.0 technology to further increase the bandwidth available to the client.

The benefits of thin client computing over cable networks can be summarized as follows:

For the service provider:

- New revenue opportunities
- Better metrics on customers, enhanced content value
- Leverages existing broadcast infrastructure
- Leverages existing Open Source applications

For the consumer:

- Maintenance-free computing, automatic updating of software and features
- Low cost entry to Internet computing
- Security, privacy, and reliability

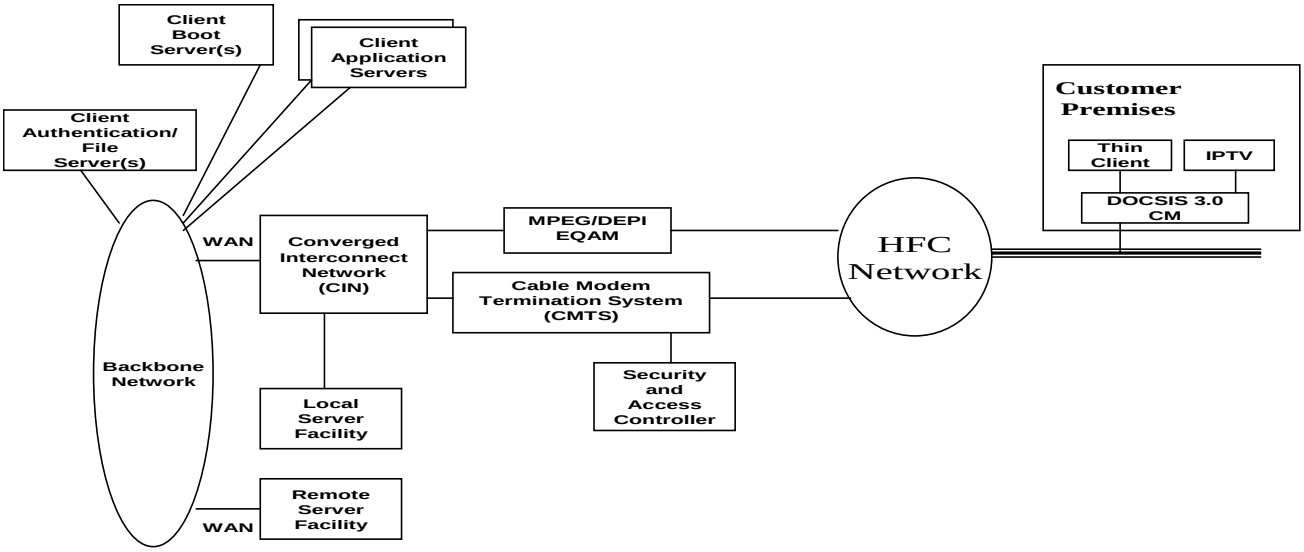

Figure 4. Thin Client Architecture Using DIBA.