Opportunities For Application Service Providers In Cable Networks

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Abstract

Application rental services take advantage of the "always on" broadband access provided by cable networks. In this service model end users remotely invoke application features from simple thin clients. Applications run on network-centric server clusters.

This paper addresses the technical applicability and revenue opportunities of the Application Service Provider model in cable networks. It considers service models and both network and application architectures. A business case built upon these models is presented.

INTRODUCTION

Internet access for e-mail and web browsing is currently driving initiatives to upgrade cable plants to IP-centric platforms. However, the flexibility and ubiquity of IP technologies give Cable Operators the opportunity to offer new innovative services not only to residential customers but also to telecommuters, Small Office Home Office (SOHO), and medium business customers. One example is application rental services, where end users remotely invoke features from applications running on network-centric server clusters. This is illustrated in Figure 1.

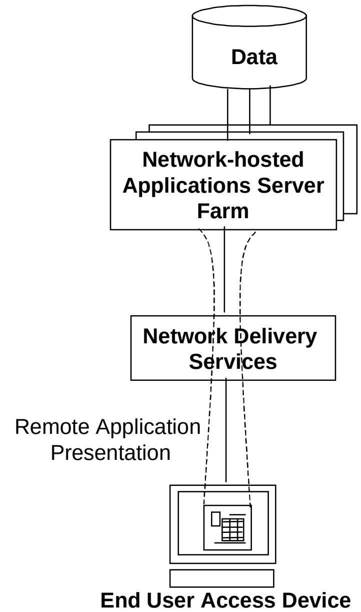


Figure 1. Delivering Applications as a Service

This network-centric service model simplifies end user system requirements and maintenance. It provides Cable Operators the opportunity to offer application services that take advantage of the "always on" broadband access that cable networks offer. In this role, Cable Operators become Application Service Providers (ASPs).

This paper provides an overview of the ASP concept and addresses its technical applicability to cable networks. First, the ASP service model is introduced. Second, a generic ASP architecture is described and then mapped to cable networks. The resulting architecture is used to run a high-level business case analysis that shows the revenue potential for Cable Operators. The last part of this paper presents the conclusions.

ASP SERVICE MODEL

The ASP service model is "one-to-many." Applications run in a network-hosted environment to serve a dispersed customer base. Initially, the ASP service model targets the small and mid-market business customer segments. However, the enterprise (i.e., large business) segment is also showing interest. And in the lower part of the spectrum, income-generating home offices (i.e., home-based businesses) may quickly become one of the key segments benefiting from this model.

There are many reasons why the ASP service model is quite compelling. Below is a partial list of these benefits.

1. Access to enterprise-grade applications and IT resources at a lower price
2. Shifts large, unpredictable, up front capital costs to smaller, predictable, recurring monthly expenses
3. Lower operational costs: smaller IT staff focused on business core competencies, longer equipment life (8 years for thin clients vs. 3 years for PCs), reduced system downtime costs, better overall utilization of specialized applications
4. Software rental for short-term projects
5. Always access latest version of applications
6. (Global) access from anywhere, anytime, on any device
7. Have multiple "desktops" for both personal and business purposes
8. Reduced risk of virus propagation and other security threats
9. Quickly add new end users

ASP Value Chain

The ASP value chain goes from co-location services to full-managed services. Co-location services are for customers wanting to have total control of their applications and servers while leveraging the ASP infrastructure. Full-managed services are for customers looking for the ASP to manage their applications and infrastructure. In all these service arrangements, customers may want to monitor security status, and application/network performance. Predictable performance translates into the ability to offer Quality of Service (QoS) guarantees that in turn drives Service Level Agreements (SLAs). It is important that compliance of SLA metrics (e.g., network availability, application response times) be proactively reported to end users as part of service offerings.

Partnering to Add Value

Given the nature of the ASP concept, where applications become services that are delivered over networks, the service model is structured into the "layered" framework shown in Figure 2. The lowest layer provides infrastructure such as data center facilities, physical connectivity (network transport and access), and data networking equipment including routers and firewalls. This layer is responsible for maintaining expected levels of network performance, reliability and security. The next layer provides the ASP platform and includes application-specific infrastructure, computing resources such as servers and operating systems, data storage resources, and application management. Next is the applications layer where application services reside. A professional services layer provides application planning, consulting, and integration services. The Operations Support Systems (OSS) layer provides fault and configuration management, accounting, application and network performance monitoring, and security functions. It also supports subscriber management and customer care functions.

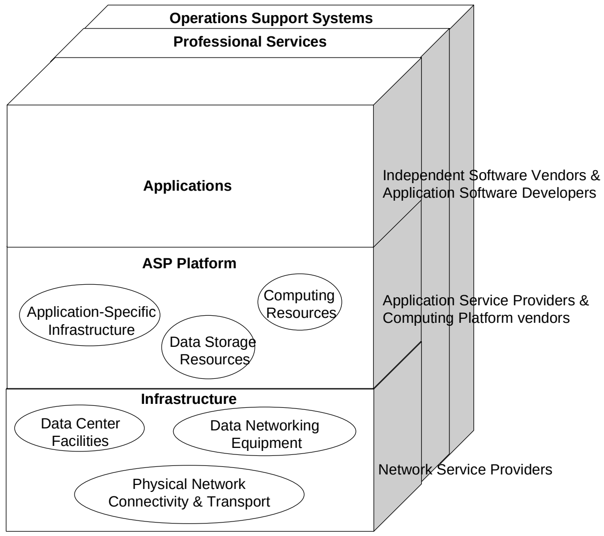


Figure 2. ASP Components

Service providers may partner with others to support all these layers. For instance, a Network Service Provider (NSP) partner provides the networking infrastructure. An Independent Software Vendor (ISV) partner provides applications and tier 2/tier 3 application-related customer care. An ASP partner provides tier 1 customer care and overall service management. A Professional Services partner provides consulting, planning and integration services. In some cases, an ASP may be cross selling services from other ASP partners. And in other cases, an ASP may have a presence in an ISP portal thus allowing the ISP to offer ASP services.

Target Applications

As mentioned earlier, the ASP service model initially targets business segments. In particular, this model is attractive to small and mid-tier business customers because it provides access to enterprise-class applications at a lower price.

At this time, business applications that do not require extensive integration or software-code customization are the most suitable to offer via the one-to-many ASP service model. Good examples are desktop productivity suites, E-mail hosting, Web hosting, calendaring, data warehousing and storage, virus control, and unified messaging. However, applications that require a higher level of customization, such as E-commerce hosting, electronic customer care (including Customer Relationship Management), sales force automation, and back-office applications (e.g., human resources, payroll, supply chain management, electronic payment) are what end users are demanding the most from ASPs.

Initial service offerings are targeting traditional, data-centric enterprise applications. A next step is to offer voice-enabled data applications that take advantage of the convergence capabilities of new programmable communications platforms. There are also opportunities to offer application services to residential end users. Some example applications include managed home networking services, (content) media streaming, and network hosted games.

The ASP service model bundles network access, managed network services, and network-hosted applications as one service. That gets complemented with ancillary services such as end user authentication, application usage reporting, and application monitoring. The advantage of providing these value-added service bundles is that it significantly reduces end user churn. This model takes service bundles to the next step in the value chain.

ASP ARCHITECTURE

The sections below describe the ASP architecture at the service, network, data center, and application levels.

Service Delivery Architecture

The ASP service model dictates a service delivery architecture. This architecture is client-server in nature, although the functionality is distributed differently when compared to traditional "fat client" architectures. In a "fat client" architecture the client performs some of the processing and relies on remote servers, if needed, to provide additional data and/or processing functions. In the ASP service delivery architecture, clients do not perform any processing functions other than presentation functions to locally display or "publish" remotely executed applications. In other words, clients only perform functions to display the user interface of invoked applications. A specific protocol is used between the client and the server to carry keystrokes, mouse clicks, and screen updates across the network.

As shown in Figure 3, there are two variants of the ASP service delivery architecture. One is Web-based, where end users remotely run applications on a web server and associated backend servers. In this case the HyperText Transport Protocol (HTTP) is used between the browser client and the web server. The other architecture is thin client-based. In this case the end user relies on a Citrix®[1] client to access network-hosted applications running on Citrix-enabled application servers. The server runs a multi-user operating system. The remote presentation services protocol used between the Citrix-based client (browser) and the application server is the Citrix Independent Computing Architecture (ICA®[1]).

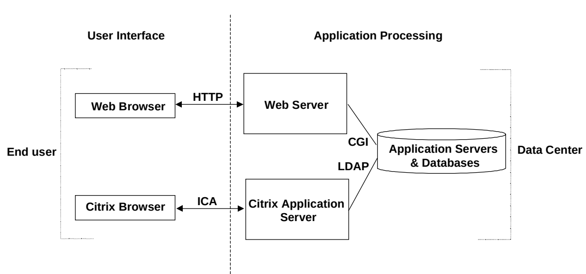


Figure 3. ASP Service Delivery Architecture

[1] Citrix and ICA are registered trademarks of Citrix Systems, Inc.

Network Functional Architecture

Figure 4 shows a high-level, generic network architecture that supports ASP service offerings. Applications are hosted in server farms running in data centers. Multiple instances of these centers are dispersed over a geographic area to increase service availability, and improve application response times via load balancing. Backbone network interconnectivity may be leased from a Network Service Provider. As shown in the figure, a Network Access Point (NAP) provides public peering to connect to the Internet. For improved performance, multiple private peering connections from data centers to major Internet backbone network providers can be coordinated to bypass congested Internet NAPs.

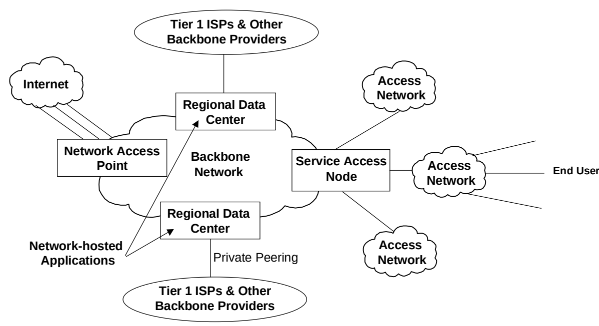


Figure 4. High-level, Generic Network Functional Architecture

Given that the ASP service model initially offers business applications, security is an important consideration. A layered security scheme that covers host, network, application, and end user (authentication) security should be adopted. Another important consideration is application performance, in particular response times and packet loss. Resource management plays a key role in supporting this. This includes traffic management to evenly distribute the traffic load over the network, and traffic shaping to enforce SLAs. Quality of Service (QoS) treatments are another part of this. These QoS treatments are based on application-specific and/or end user-specific policies.

Virtual Private Networks that provide end user access to network hosted applications may offer the necessary security, resource management and QoS treatments in a coordinated way. These are “ASP value-added VPNs” where VPNs complement ASP service delivery offerings. A special case of this is the offering of managed Extranet services.

Data Centers

The key goal of data center facility design is the optimization of application service availability. That means that data center facilities need to be highly secure and disaster resistant. That includes physical security (escorted access, card-key access, surveillance cameras and intrusion sensors), equipment redundancy, heat/smoke detectors, fire suppression systems, water sensors, air filtration systems, power/surge protection, dual utility feeders, backup power sources, and temperature control systems. However, no physical facility is completely disaster resistant. Business continuity plans are required to manage multiple redundant or backup data centers. Backbone network connectivity should be redundant and follow diverse paths. These connections should be engineered with spare capacity built-in (50% or more).

Data centers consist of 4 basic elements: application processing, data networking, transport, and operations. Figure 5 shows a functional decomposition of these elements.

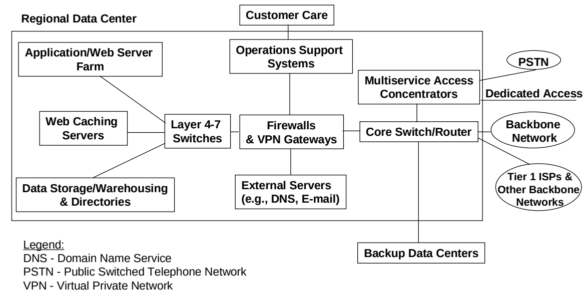


Figure 5. Generic Data Center Functional Architecture

Application and Web server farms run on shared or dedicated servers. Redundant servers may be located at separate data centers and accessed via multiple network connections. This can be coupled with Layer 4-7 (web) switches to provide local and distributed load balancing among servers. These web switches monitor server and application response times, and network utilization. Web caching servers complement load-balancing functions to offer web access acceleration services. Highly redundant database clustering or Storage Area Networks (SANs) provide data storage management services with fail-over capabilities. Firewalls, VPN gateways and intrusion detection systems provide secure access to applications, including those running on external servers. This may include secure ID token-based end user authentication, host-based security, and router access control lists.

A core switch/router interconnects components in data centers and provides connectivity to the backbone network. Multiservice access concentrators may support dial-up and dedicated access.

The Operations Support System performs application monitoring, management, and billing. A customer care gateway, or Customer Network Management (CNM) system, allows end users to manage their services on-line. With CNM, an end user can monitor network and server availability/performance, and enter and monitor the status of trouble tickets among other features.

Application Architecture

The ASP service model is multi-user (i.e., one-to-many) and subscription-based. That has an impact on application design, as network-hosted applications need to be scalable and customizable while keeping operational costs down. End users demand customized applications at a cost lower than owning a fat PC client. This gets more critical when ASPs want to target business customers with premium applications while adopting a commodity service delivery model. One way to deal with this is to design applications end users can easily configure via templates or wizards. Alternatively, ASPs could build libraries of frequent customized versions of the applications, although that requires keeping larger inventories.

ASP ON CABLE

Major efforts are underway to upgrade existing cable access plants to support two-way data communications. In addition, Cable Operators are looking at other access network types, such as xDSL, fiber, and broadband wireless to expand their access network portfolio and footprint. That gives Cable Operators the proper conduit to reach end users as an ASP. What is still required is for Cable Operators to extend their IP infrastructure to include data centers. A generic network diagram is shown in Figure 6. In the figure, the data center also includes NAP functions to access the Internet. Private peering to other backbone network providers is also possible. In the case of smaller Cable Operators who may want to become ASPs, smaller scale data centers could be co-located with Head End facilities (e.g., Master Head End).

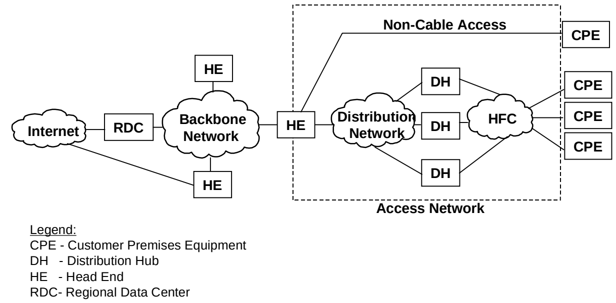


Figure 6. Regional Data Centers and Cable Networks

In a way, the ASP service delivery model may help overcome some of the bandwidth limitations of the HFC plant in the upstream direction. The ASP service delivery model keeps application processing in network data centers and relays presentation functions to end user terminals. This not only reduces bandwidth requirements but also keeps it at a predictable rate, independently of the applications used. For instance, Citrix ICA reduces required bandwidth to approximately 13 kilobytes-per-second.

Another benefit of adopting the ASP service model on cable networks is that it improves end-to-end security. Applications are exclusively run in the network, where the Cable Operator has total control. This could be complemented with Cable Operator-managed VPNs for secured access. These VPNs also help in providing end-to-end QoS over the cable plant. One interesting observation is that with the ASP service model, QoS is better served in the sense that the networked data centers are properly designed and managed to guarantee the right levels of QoS to applications. The backbone network is traffic engineered with enough bandwidth to support such operations. In the access network, only application presentation streams are transmitted with more predictable traffic profiles and with much lower bandwidth requirements. That does not preclude applying traffic prioritization in the access network and in fact, network equipment is becoming aware of the remote presentation services protocols used to support these transactions.

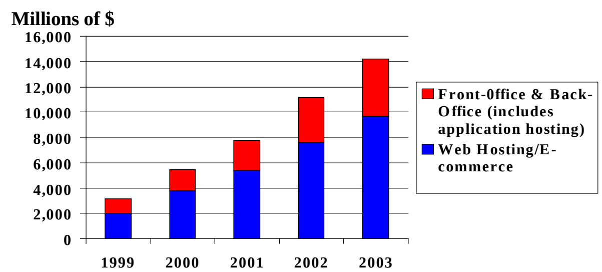
Another key feature of the ASP service model that fits well in Cable Operator offerings is service bundling. This feature is becoming critical in a time when technological advances are making possible the convergence of voice and video communications with network-hosted data applications. Cable Operators are in a good position to bring all these services together as network-hosted applications. Adopting ASP may be a good complement to current cable telephony and digital video initiatives. The "always-on" broadband access experience Cable Operators provide to end users may be fertile ground for new application and service opportunities that may not be possible for other service providers. End users connect to IP networks and the Internet for three basic reasons: communications, content, and commerce. Cable Operators are in a good position to provide services along those three dimensions. The ASP service concept may be the catalyst that may allow Cable Operators to offer these as compelling, valued added service bundles.

The ASP service model simplifies end user equipment to "multimedia" user interface devices. This is aligned with the Cable Operator's goal of reducing truck rolls to install and configure Customer Premise Equipment (CPE). The emergence of ASP service offerings is driving retail sales of "Internet appliances" that are not only easy to install and configure, but also easy to maintain and has a longer life when compared to PCs. Another trend is to support wireless access and the ASP service model may position Cable Operators to serve those markets as well by adding wireless Web gateways/portals to their infrastructure.

From an ISP perspective, the ASP service model is a next step in the value-added chain. Cable Operators could adopt the ASP model as a way to differentiate themselves from traditional ISPs. And they could do so without extensive partnering to provide full service network-hosted applications.

BUSINESS ANALYSIS

According to the Yankee Group, the ASP market will grow from $3.1 Billion in 1999 to $14.2 Billion in 2003. This is shown in Figure 7. According to this forecast, web hosting and E-commerce are the key revenue generators.



Source: Yankee Group, 8/99

Figure 7. ASP Market Forecast

A market segment of interest is income generating home offices. By the end of 2002, IDC[AG99] expects over 30 million US home office households with someone running a business. About 8.2 million US households will be equipped with cable modems, out of which 6.2 million are expected to be home offices. This represents over 75% of the cable modem customer base.

One of the elements that drives home-based businesses to access and have a presence in the Internet is that it serves as a low-cost conduit for revenue-generating opportunities (e.g., E-Commerce). Also, the Internet is quickly becoming a strategic portal for business information and research, in particular for small businesses which tend to have a higher percentage of knowledge workers. This type of customer is very cost sensitive, prefers to deal with local service providers, and expects high-quality customer service. The ASP service model may help Cable Operators satisfy those needs.

A business case built around a simple scenario is presented below. A cable operator, who currently provides traditional Internet access services to residential end users via cable modem, wants to become an ASP. In this scenario, the cable operator built a data center capable of supporting a total of 50,000 end users (20,000 end users subscribed to ASP services and the remaining 30,000 end users subscribed to regular Internet access services). Another option would be for the Cable Operator to have a third party service provider host the data center. This option reduces up front capital outlays and allows faster entry into the market. But for the purposes of the business case presented here, it is assumed that the Cable Operator builds its own data center. The rest of the assumptions used to build the business case are presented in the table below.

Item	**Assumption**
Market Size Assumptions	
Initial footprint (i.e., first year)	150,000 end users
Growth rates	30% (years 1-3) 25% (years 4-6) 20% (years 7-9)
General Assumptions	
Weighted Average Cost of Capital (WACC)	12%
Terminal rate	4%
Tax rate	36%
ASP Service Penetration	
Initial penetration	1%
Annual increase	2%
Maximum	6%
Churn Rates	
Initial churn	12%
Incremental churn	0% [Economically stable service area]
ASP Service Pricing	
Service revenue	$150/month/subs
Annual increase	-$5
Partner share	10%
Equipment Expense	
CMTS (incremental to support ASP subs)	$150/sub
ASP equipment (1 data center)	$1.7 Million ($700K for software, $300K for servers, $400K for data networking, $300K for data storage)
Data Center Expenses	
Recurring expenses per year	$500,000 + 5% of gross revenue
Engineering & design	$200,000 (first year only)
Billing and OSS Expenses	
Recurring expenses per year	$250,000 + 3% of gross revenue
Customer Service & Support	
Recurring expenses per year	$30 * average number of subscribers
Sales and Marketing Costs	
Recurring expenses per year	$100K + (150 * number of new subs)
General & Administrative	
Recurring expenses per year	$500,000 + 3% of gross revenue
Installation Costs	
Installer salary & benefits per year	$100K
Number of installations per technician per year	7,500

Table 1. Cable-ASP Business Case Assumptions

The business case assumes that the Cable Operator starts offering a relatively simple set of ASP applications such as basic human resource applications, financial management, collaborative computing, sales automation, groupware and e-mail, all offered as a service bundle. In addition, a simple pricing plan is assumed based on flat user/seat/month fees. More sophisticated billing schemes are needed to support usage-based pricing either at the application level or at the transaction level. Determining the right level of billing granularity not only depends on current technological capabilities but also on the ASP business/service arrangements upon which application frameworks are implemented.

Figure 8 [JT2000] shows how ASP pricing models may be evolving over time. The diagram shows a shift towards subscription-based and transaction-based models, and implies that eventually pricing models may rely less on traditional software licensing. The ASP service model offers applications to thousands of users on a monthly subscription basis. This requires adapting application-licensing schemes to fit a dynamic recurring monthly fee model. One example is software licensing utilities that enable ASPs to provision applications for rental without incurring up-front license fees. The software licensing utility measures concurrent usage of application software and the ASP makes monthly payments to Application Software Vendors accordingly. This utility may also apply tiered discounts as the ASP's customer base grows.

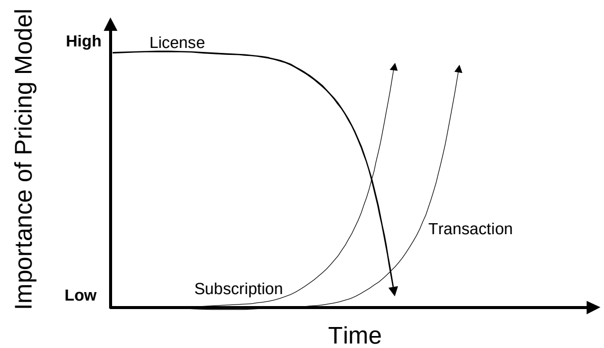


Figure 8. Evolution of ASP Pricing Models

The flat rate pricing plan used in this analysis is based upon application types. The pricing criteria takes into consideration application value and application configuration time. There are other pricing plans in use today. An example is charging according to server type and configuration (e.g., shared vs. dedicated servers). This type of pricing plan can be broken further into hardware and maintenance fees. Another example is charging according to end user access rights to application data (e.g., read-only vs. editing privileges).

Independently of the pricing plan used, the ASP service model rests on a pricing structure that generates monthly recurring revenues. ASPs have many opportunities to increase these revenues. For instance, many existing applications are being "ported" to network-hosted environments. In addition, new network-hosted applications are emerging. This creates opportunities not only to expand service portfolios, but to offer professional services as well. In fact, the ASP service model allows ASPs to cross-sell solutions from other ASPs. The service model simplifies adding new end users as well.

Figure 9 below shows the gross revenue results of the example business case analysis considered here. After the fifth year, gross revenue starts decreasing. This is due to the assumption that there were no plans to expand beyond the capacity of the single data center deployed initially, and that service pricing decreases as technology matures. This means that after five years of steady customer base growth, either new data center facilities need to be deployed or the capacity of the existing should be expanded. This of course depends on the growth rate profile assumed in the analysis.

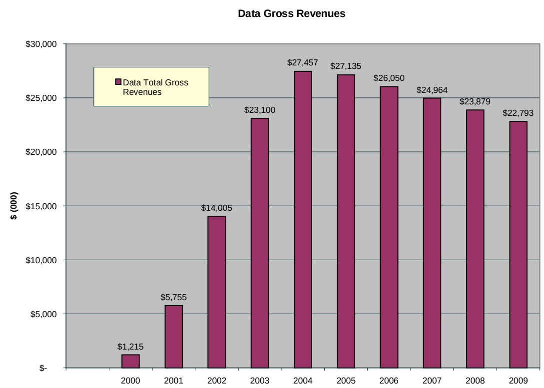


Figure 9. ASP Business Case - Gross Revenues

In terms of expenses, there are several elements that need to be considered. One element is the cost of implementing data center facilities and improved IP infrastructure. Storage costs are of particular importance. Another element is the cost of customizing application software. As mentioned before, customized software does not fit well with the one-to-many ASP service model. The time that an ASP spends customizing an application for a customer is time that cannot be applied to serving the needs of other customers. Also, application customization may increase the time it takes to complete application software upgrades. Applications should be designed in ways that optimize its customization capabilities or at least in ways that expedite the creation of libraries of pre-customized application templates.

Other elements include application delivery costs, application service trial costs, best practice implementation costs, the cost of integrating new applications into existing service bundles, and IT staff costs (e.g., hiring and training). In terms of IT staff costs, this cost is spread over a growing customer base, thus providing economies of scale benefits. IT utilization is “bursty” in nature when dedicated to one company. Once IT resources are shared among multiple customers, their utilization increases and stay at a more stable rate.

Going back to the business case, Figure 10 below shows the total expense results. Again, after the fifth year the expense growth rate slows down considerably. This corresponds to the fact that the data center assumed in the analysis has reached its maximum capacity at that time.

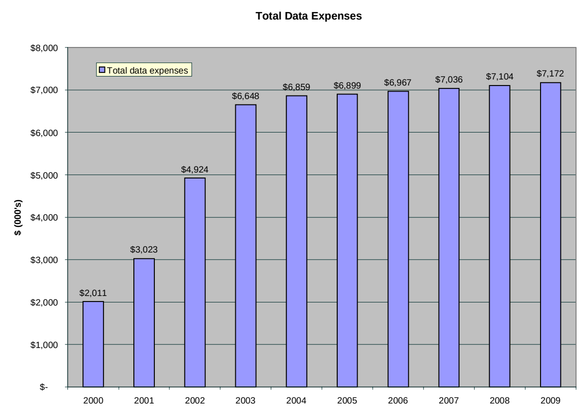


Figure 10. ASP Business Case - Total Expenses

Figure 11 below shows the results of the free cash flow analysis of the business case. Again, after the fifth year cash flow starts decreasing given the assumption that, at that point, maximum capacity is reached in the data center and there are no plans for additional growth. At the same time, annual service revenues keep decreasing. Of course, no additional investments are made as well. In a more realistic scenario, the Cable Operator may plan for growth, both of the customer base and the service portfolio. Also, there will be technological advances that will increase infrastructure capacity and enable more profitable emerging applications.

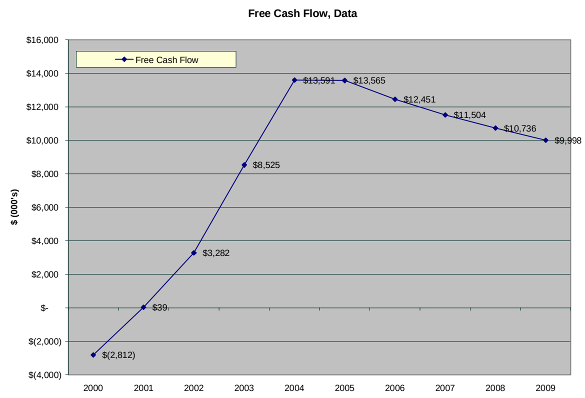


Figure 11. ASP Business Case – Free Cash Flow

Figure 12 below shows CDCF results of the business case. With an initial investment of about $2 Million, a relatively simple portfolio of application offerings and limited growth planned, the business case predicts over $41 Million in 10 years with the break-even point reached in less than 3 years.

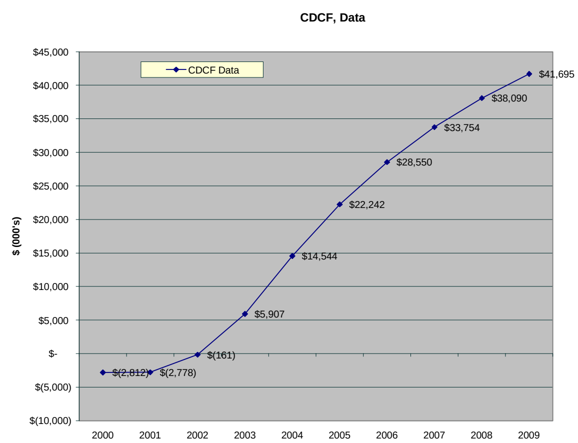


Figure 12 ASP Business Case – Cumulative Discounted Cash Flow

CONCLUSIONS

The ASP service model and architecture provide Cable Operators the opportunity to differentiate from traditional ISPs and exploit their strengths in offering converged service bundles. This model moves application processing, security, and QoS to the network and relays presentation functions to end user terminals. Security and QoS treatments are still needed to guarantee proper delivery and application response times, but these can be provided in a more efficient and simpler way over the cable access network. End user equipment gets simplified, meaning a reduction in truck rolls and overall maintenance support.

There are some challenges, however, that need to be addressed. Depending on the situation, the ASP service model may require partnering with other service providers to provide certain components. That means proper measures need to be put in place to guarantee the combined security and QoS that satisfy end-to-end SLAs. Another challenge is the definition of best practices. Critical areas include: data center operations, network operations, client-server operations, application management and monitoring, and CPE management.

Other challenges include: designing applications that run on distributed network computing environments under a service subscription model, evolving data center computing platforms to support converged voice/video/data applications, and developing schemes that will allow Cable Operators to guarantee the required application and network performance levels as dictated by SLAs.

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