The Impact of Customer Care and Billing on Broadband Data Services

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Abstract

This paper explores the role of Customer Management Systems in the deployment of broadband data services. It highlights emerging requirements and design options for system integration, content, pricing, and customer care. It is intended for content and network providers as well as vendors involved in broadband rollouts.

INTRODUCTION

The trials are over and the rush is on! You have your market strategy, you've chosen your technology, you've secured content. Now, you are faced with the difficult problem of growing and keeping market share in the competitive broadband market. The implications are frightening. Will growth affect the quality of service? Will it lead to increased costs? Will growth related issues slow down your expansion? Can additional services be sold to recover acquisition costs? Can the quality of service be maintained with the inevitable increase in complexity?

To answer these questions, you must consider many factors including the need to manage organizations, establishing processes, and training people. But, should you be concerned with the capabilities of your Customer Management System[1] (CMS)? Does customer care and billing affect your organization's ability to deploy broadband services? Consider the following two scenarios:

An engineer in a communications firm is writing a paper for an industry conference. Knowing that it will be difficult to write the paper while at work, the engineer decides to do it from home. The paper requires access to multimedia data stored on systems at work, so the engineer decides to switch from his current ISP to a broadband service. Knowing that the cable modems are being sold at a local computer store, he travels to the store to purchase a cable modem. At the store, he is greeted by a salesperson who knows all about the service and offers to sign him up and check out his modem prior to sending him home. While taking the order, the salesperson recognizes that the engineer is a premium cable subscriber and can therefore be offered the service at a discount. The cable modem checks out fine and the salesperson is able to log on to the engineer's account using the selected modem before leaving the store. After the engineer gets home, he logs on to the service with his new cable modem. He finds that he already has Email from his cable provider thanking him for signing up and informing him that he's been given a free PPV movie that he may order through their Web site.

A young broadband subscriber has a paper due for school. She attempts to get on the World Wide Web to research wild life in Alaska, but it's not working. She asks her father for assistance, but he can't make it work either. He fiddles with his PC, first checking network settings, then checking to see if all the connections are secure. He can't figure it out either, so he calls the customer support number. After waiting on hold, he gets a Customer Service Representative (CSR) who attempts to trouble-shoot the problem. After another twenty minutes, the CSR is stumped, so the customer is transferred to another number to schedule a service appointment. The next day a cable technician comes to the house and verifies that the cable connection is fine, but still they can not link up to the Web. Another appointment is scheduled for three days later. That night, the father discovers through his own trouble-shooting efforts that the Ethernet cable connecting the cable modem to the PC is defective, so he replaces it and everything works fine. He cancels the second appointment, but on his next bill he is charged for the

[1] The term Customer Management System (CMS) refers to the enterprise software that is responsible for product sales, customer care, billing and commerce, and more.

unnecessary trouble call. A month later he calls to remove service.

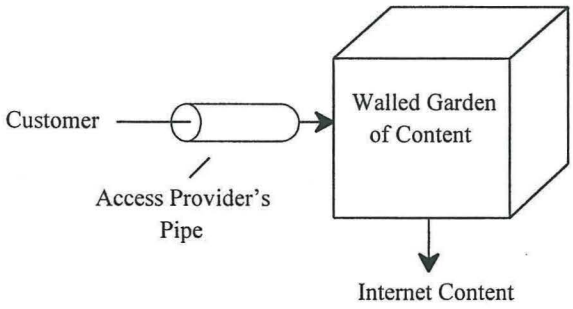
This paper details CMS requirements for providers that want to create a flexible product offering, provide flexible price and discount options, offer compelling content, integrate back office systems, and provide advanced customer care. Additionally, the paper explores the design options that are available for deploying broadband data services.

CONTENT

In the traditional video market, cable TV providers maintain a distributor relationship for the content itself. As these same providers move into the interactive broadband arena, they must think carefully if they are to maintain this relationship. By virtue of the technology itself, the provider in an interactive broadband market is not well positioned to maintain the distributor relationship. The simple act of deploying a greater than 1Mbps connection to a residence now enables the customers to seek and receive content from anywhere. Opening up the broadband network to the millions of Web sites has an enormous up-side: There is instant content that customers want and you can give it to them faster than the competition. There is also a down-side: This situation guarantees that all content flowing on the broadband network is not from the provider. Broadband providers are faced with a choice. Do they want to continue the distributor relationship for the broadband content?

The saying, "Content is king" would appear to be stronger than ever in the interactive broadband market. Never before have the broadband content owners had a wide-open distribution pipe like they get in a narrowband fashion with today's Internet. As the broadband industry blooms, so will broadband content providers.

One content option that seems probable is that the access provider will choose to create a "Walled Garden of Content" similar to Internet providers such as AOL. Then the provider will incent the customer to use its content instead of the competition's. The provider would create customer value through ease-of-use, completeness, discounting, or single-bill strategies.

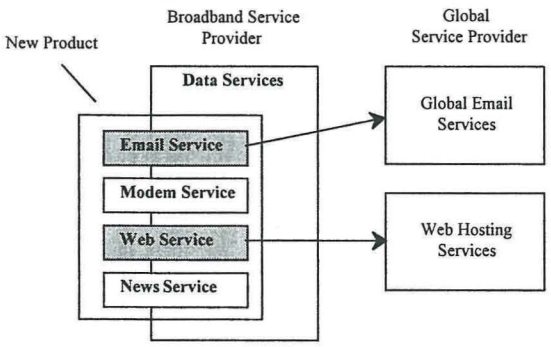


If a provider is marketing both the broadband access and the content, the provider can influence the customer to use its content through price discounts and consolidated billing. This highlights a requirement that the CMS be aware of both access and content pricing. This also highlights the requirement for discounting across products. This is one area where a strong, open CMS can be used as a competitive advantage in the broadband market.

FLEXIBLE PRODUCT OFFERINGS

There are four prevalent models that are used by broadband service providers to enter the market. These include outsourcing to a national service provider (i.e., @Home and Road Runner), partnering for content, partnering with an ISP, and rolling out one's own service. With each of the models, a business must be able to create or acquire marketable electronic services, market the service, sell the service, activate the service, get paid for the service, and provide on-going care for the customers with the service.

Electronic data services currently being deployed are widely varying from localized data content to services such as Email and Web hosting. Regardless of the business model, a provider needs the ability to rapidly deploy new services. In addition, a need exists to efficiently implement value-added services such as Email and Web hosting.



Global Services

The term "global services" is used to describe data services that providers use to add value. These services are often provided for free or heavily discounted to attract and acquire new customers. They differ in that the services require very large economies of scale which service providers can not afford to deploy on their own. For this reason, global services will typically be deployed by a national or global service provider.

If a service provider's CMS is not aware of the global service as well the global service provider, it will affect the provider in two ways. First, provisioning and billing for the global service will be a two-step or manual process. This will create an unusually high cost-of-acquisition. Next, the process will increase the complexity of resolving customer care calls for both billing queries or trouble tickets. Again this increases operating costs. A provider who can integrate the systems will lower operating costs and increase customer satisfaction.

New Services

New services are services that are not globally offered or are conceptualized and created by the service provider. Often these services have a local flavor or are community oriented. However, the services can be of any nature. For such services, the provider is responsible for content creation, site hosting, and on-going maintenance. The requirement for connecting the CMS to these services is the same as for global services. It is important to note, however, that time-to-market requirements for new services often compromise the integration of all necessary systems. If this could be the case, the provider may decide to choose an off-the-shelf commercial infrastructure product such as Microsoft Commercial Internet Server (MCIS) for deploying the services. These commerical products offer a rapid service deployment model and create a single point of integration between vendors.

FLEXIBLE PRICE OFFERINGS

ISP customers have grown accustomed to the single price service packages. Unlimited access for a flat rate is common with local ISPs and national ISP providers such as AOL. Because broadband infrastructure is expensive, the "one price fits all" model is not cost effective for broadband providers. Service providers must decide which of the startup costs they will cover (PC installation cost, cable modem cost) while determining the level that is required in the areas they service. The Yankee Group estimates the cost to acquire a broadband subscriber ranges between $550 and $1050 depending on if the modem is leased or purchased by the subscriber [Yankee, 98], see figure 1.

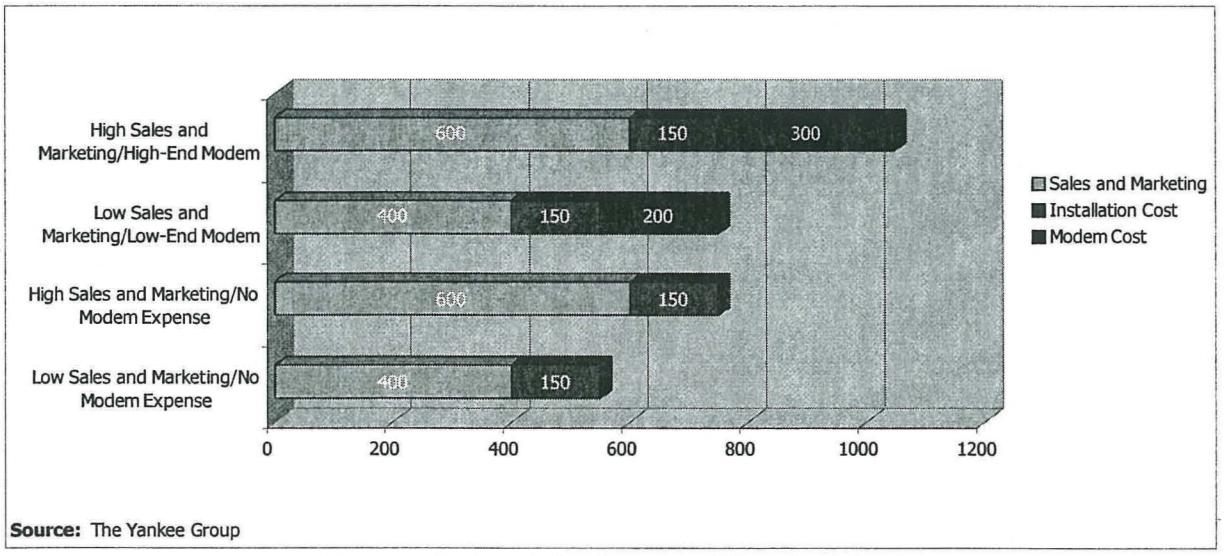


Figure 1. Cost per Subscriber Acquisition (in Dollars)

A reasonable subscription cost of $50 per month indicates that a provider would need between 10 and 20 months to recover the startup cost. A pricing model based upon the value that customers derive makes the most business sense in the broadband domain, where service is tailored to each customer's needs.

There are several prevalent pricing models that are required of a CMS. These include:

- Service tiers
- Threshold pricing
- Usage based pricing

Within each price model, the CMS must be able to bundle, discount and rebate Internet services in order to provide a competitively priced product.

Service Tiers

A fundamental capability that a CMS must provide is the ability to package and tier services with each package containing one or more broadband services. For example, a Family Internet package may contain 5 Email addresses, 10 Megabytes of Web-oriented disk space, support for two computers, and a cable modem with a transmit rate limited to 128Kbps. Groups of packages, called tiers, can then be created and organized by the CMS so that service tiers are easily identifiable and available when an Internet order is taken.

Service tiers are not unique to data services. Packaging of cable TV service is the primary pricing model used for video services (see figure 2). What makes Internet service packaging a challenge for a CMS is not the packaging, but rather the required provisioning associated with services contained in the package. In the data service domain, the CMS may be required to communicate service to many systems. Using the Family Internet package example, the CMS would be required to provision five Email addresses on a mail server, allocate 10MB of disk space on a Web server, and provision a CMTS[2] or cable modem creating one logical package spanning several systems responsible for delivering individual services. Furthermore, the representation of a data service tends to be more complex than the representation of a video service. Name value pairs, service strings, and DOCSIS MIB variable settings are examples of varying representations of service on different systems. Prior to sending provisioning commands to a CMTS, cable modem or Internet server, the CMS is required to translate the representation of service according to the expectations of the targeted system. For example, the CMS may represent the Family Internet package with more than one billing code. During provisioning, each code must be translated to codes specific to the delivery system. The translated codes must then be routed to the appropriate delivery system.

Since tiers have a one-to-many relationship with services, mapping services to the appropriate provisioning system and then transmitting the provisioning commands are capabilities required of a CMS. These capabilities require complex provisioning software for broadband services, so extending a CMS's existing set-top provisioning software is usually not an option.

By way of contrast, consider the current video services model. The difference between packages simply equates to authorization code settings that are transmitted to an addressable controller. Pick HBO, set a bit in a code. To add a sports option, set ten bits. At the end of the task, the CMS is required to send the authorization code settings to the addressable controller which understands the channel mapping.

Threshold Pricing

Not all changes to Internet service affect the subscription price. The CMS must determine whether a billing threshold has been exceeded before altering the service codes attached to the account. Again using the Family Internet package example, the services included in the package (five Email addresses and cable modem support for two computers) may be changed directly by the customer from a Web site. After the customer adds an additional Email address for a spouse or child, a change of service notification is sent to the CMS. The CMS must bump the subscriber's Email service count, change the subscription price if (and only if) the service threshold has been exceeded, and record information associated with the change.

[2] CMTS is an industry acronym that refers to a Cable Modem Termination system.

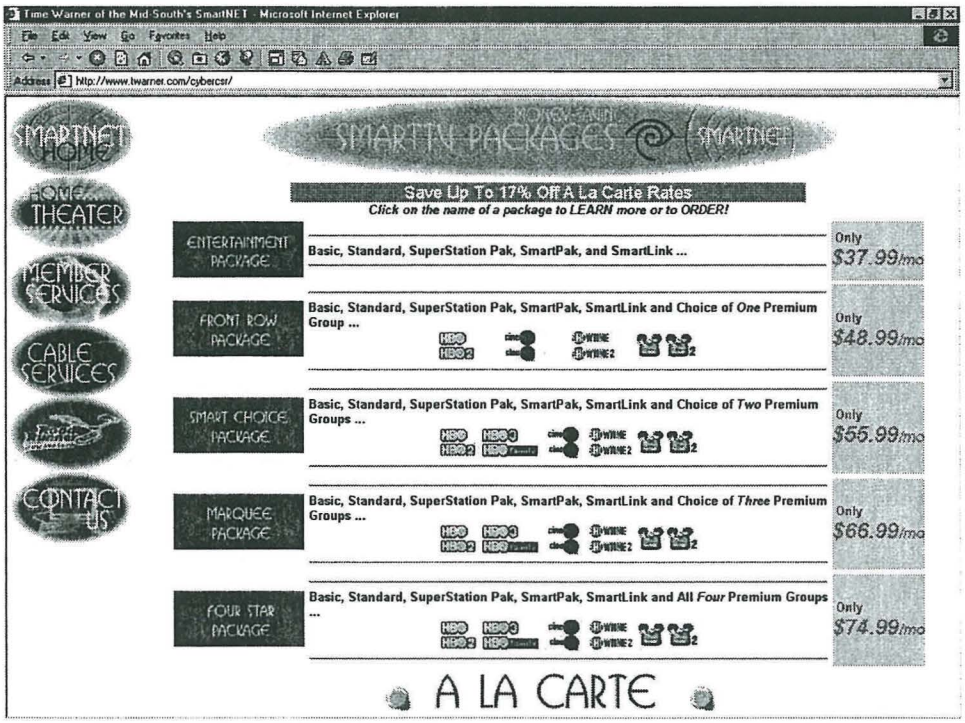


Figure 2. Time Warner's Mid-South Division package of video services as sold over the Internet.

The threshold-based change of service applies to many types of broadband services. Current examples include: disk space quotas, the number of PCs connected to a cable modem, the number of protocols required by the customer (TCP/IP and/or IPX), the number of Email accounts, the number of news groups subscriptions, the number of chat group subscriptions, etc. Since Internet service types and rules vary from provider to provider, a flexible CMS will abstract the service rules, so an operator can configure them.

Figure 3 identifies a software abstraction of an Internet service. The abstraction contains both the data attributes and the threshold change of service algorithm. The change of service function would be provided as an open programmatic interface that could be executed from an external system.

Usage Based Pricing

Three months after the successful introduction of a high speed data offering, a mid-sized cable operator begins receiving calls from customers who are irate because they can not connect to the Internet using their telephony return cable modems. The engineering department determines that the 7-to-1 ratio of subscribers to modem ports is insufficient to meet current demand. To correct the problem, management decides to purchase additional terminal servers to maintain a 4-to-1 subscriber to port ratio, and switch from a flat rate to a usage-based pricing structure that would encourage subscribers to disconnect whenever they are not using the service. After the first month of the new pricing structure, the MIS department is required to manually adjust 10% of the HSDS accounts because the CMS was unable to calculate charges based on usage. The MIS department has to add staff to support this labor intensive, error prone process until rating software could be added to the CMS.

Billing customers based on consumption is nothing new for CMS's that support telephony services, but this capability presents a challenge for CMS's that traditionally support video services and are now being extended to accommodate broadband data services. Usage-based billing takes on two forms: rated and un-rated. Rated transactions involve the consumption of a service such as playing a game or sending an electronic greeting card.

```
                        InternetService Abstraction
Attributes
    ServiceIdentifier       // Email Accounts, Chat Groups, PCs, etc
    Description             // Displayable Description
    CurrentUsage            // Counter
    Threshold               // Change service is threshold is exceeded
    PricePerUnit            // Price for each item in excess of the threshold
    BillingCode             // Billing code to use for change

ChangeOfService(    in AccountNumber, in ServiceIdentifier, in Action,
                    out PrevPrice, out NewPrice)
{
    Find Subscriber's Account
    Find InternetService using AccountNumber and ServiceIdentifier
    PrevPrice = Account.SubscriptionPrice

    Case Action = Add
        Increment InternetService.CurrentUsage by 1
        if (InternetService.CurrentUsage > InternetService.Threshold)
        {
            Add InternetService.BillingCode to Subscriber's Account
            NewPrice = Account.SubscriptionPrice + InternetService.PricePerUnit
        }
        else
            NewPrice = PrevPrice

    Case Action = Remove
        if ((InternetService.CurrentUsage > InternetService.Threshold) AND
            (InternetService.CurrentUsage-1 == InternetService.Threshold))
        {
            Remove InternetService.BillingCode from Subscriber's Account
            NewPrice = Account.SubscriptionPrice - InternetService.PricePerUnit
        }
        else
            NewPrice = PrevPrice

        if (InternetService.CurrentUsage > 0)
            Decrement InternetService.CurrentUsage by 1
}
```

Figure 3. Software Abstraction of an Internet Service

Rated transactions are the simpler of the two for a CMS to handle because the price is already determined. Un-rated transactions involve the collection, aggregation and rating of usage data such as time, packets, or bandwidth. For unrated transactions, the CMS must determine the charge based on the aggregated consumption data. In both cases the CMS must be able to automatically adjust the subscriber's account based on the event charge.

INTEGRATION

If there is one CMS attribute that will significantly improve operating efficiencies and customer service in a broadband rollout, it has to be the ability to integrate with other systems. The systems that are involved in the broadband data services deployment come from a variety of vendors. It is the degree to which these systems are able to act as one system that determines the complexity of the deployment.

To maintain the level of service that customers demand the system must have:

- Automated flow through provisioning associated with order processing
- Automated billing associated with usage data and billable events
- Integrated customer care and trouble shooting tools used to isolate and correct network and PC problems

Integration Requirements

To create a seamless system integration must be accomplished between the CMS and the following types of systems:

1. Order taking systems
   - Internet self provisioning
   - Retail
2. Usage information systems
   - Mediation
   - Content
3. Service delivery systems
   - Cable Modem Termination System
   - Internet server for local services
   - Global service providers

It is important to note that there are often many different vendors for these systems. This increases the complexity of integration.

Order Taking Systems

The ability to add or modify service is also a fundamental capability provided by CMS's for video services. In the video services model, a subscriber typically calls a customer support number and receives assistance from a customer service professional to make desired changes. A small percentage of changes in service may be executed by technology savvy customers using an automated telephone system or a Web site. For broadband changes of service, the frequency changes originating from a phone call is low. Internet customers are accustomed to E-commerce applications and on-line ordering. Whether it's trading stocks on-line or altering their friends and family lists, Internet customers prefer the ability to effect changes without requiring human intervention.

For data services, an order can originate from many different sources. The primary sources that have been identified include retail outlet, provider Internet site, partner Internet site and the traditional customer service representative. To support external change requests, a CMS must provide open programmatic interfaces that allow an external system to:

- Authenticate itself to the CMS
- Authenticate the subscriber initiating the change
- Validate the change request
- Provide pricing information associated with the change
- Verify the account status of the subscriber
- Initiate the change and verify change completion

Usage Information Systems

This section details the requirement for flexible usage based pricing. The implication of this business requirement highlights the need for integrating usage information systems with the CMS. Usage information systems take the form of mediation systems that collect and manage network usage, as well as content systems.

Network usage systems typically are specific to the network elements. The hardware providers provide usage information such as MB used or connect time to the CMS. It is the responsibility of the CMS to determine if the usage effects the state of the account. The CMS could take a variety of actions including altering pricing, discounting or even limiting service.

Content systems provide content usage information to the CMS. Usage statistics such as the number of times used or the duration of usage can be passed to the CMS. The CMS can use this information to determine effects on the account such as discounting or even limiting service. Since there are a variety of content systems, the interface needs to be very flexible.

Since a CMS is typically not involved in the data collection and aggregation functions, CMS integration to a mediation system(s) is a critical issue. At the center of any system integration effort are the following issues:

- What data elements are exchanged?
- What message format will be used?
- What transmission protocol will be used to transport the message?

To answer these questions, we propose a message format (see Table I) that could be used to integrate a CMS with many different types of mediation systems.

Such billable event messages would contain an ASCII string of <name>=<value> pair information. Each name/value pair is separated by a vertical bar ('|') delimiter to accommodate variable data lengths. The message itself is enclosed in a pair of pipes. The tokens in the transactions (names, and values) are case insensitive and order independent to provide

Table I. Billable Event Message Elements

Data Element	Description	Data Type	Required/Optional
AccountNumber, SerialNumber, MacAddress	An account or equipment identifier that can be used to relate the billable event to a subscriber. At least one of three elements must be provided.	Character	R
EventDateTime	Time of event occurrence	Date/Time	R
Provider	Supplier of the service	Character	R
EventType	User defined event classification	Integer	R
Description	Description of the service	Character	O
Rated	Is the event already rated?	Boolean	R
Price	Required if rated=Y	Currency	
UnitsOfMeasure	Required if rated=N Usage units (e.g., seconds, bytes, etc)	Character	
Count	Required if rated=N Number of units consumed	Long	
PricePerUnit	Unit price	Long	O
Username	Login of the subscriber using the service	Character	O

flexibility. A data packet format of this type would provide the flexibility needed for system interoperability, and could be transmitted using a variety of industry standards protocols such as TCP/IP, SNMP or RS232.

Given the above data elements, the following are example billable event messages:

|accountNumber=07807100501 | EventDateTime=April 10, 1999 12:01:05 | Provider=GameFactory | EventType=Game | Description=Internet NASCAR | Rated=Y | Price=4.99 |

|macAddress=080F11223344 | EventDateTime=04/15/1999 17:25:00 | Provider=EDHISP | EventType=ConnectTime | Description=Monthly Usage | Rated=N | UnitOfMeasure=Minutes | Count=1833 | Username=jdoe |

Service Delivery Systems

Service delivery systems have responsibility for turning on and off the services themselves. These take the form of modem termination systems, national service provider systems, partner systems, local service systems, and global service systems. The typical CMS transaction sends a command to start, suspend, or stop service from the CMS to a service delivery system. The service delivery system can act as an order taking system.

Design Alternatives

There are two options for achieving seamless provisioning and billing functionality: 1) Add provisioning capabilities to the billing system or 2) Programmatically integrate the billing and provisioning systems. Both options assume that the billing system is responsible for maintaining customer accounts and the services tied to the accounts

When provisioning software is added to the billing system, following capabilities must be provided by the billing system to be considered a viable business solution:

- The provisioning engine within the billing system must be able to interoperate with a variety of Internet servers and Cable Modem Termination Systems.
- The billing system must be able to accept usage data, adjust customer accounts accordingly and report on the adjustments.
- The billing system must provide an open interface that can be integrated with retail interface and self-provisioning applications.
- The billing system must be able to report on installs and changes in service that originate from the various interfaces.

- The billing system must be able to bundle, rebate, and discount Internet service with other services that are added to a customer's account.

When a billing system is integrated with a provisioning system, the following capabilities must be provided by both systems for this option to be considered viable:

- Both systems must support a standard interface (e.g., TCP/IP, CORBA, Java, etc) to exchange data.
- The provisioning system must provide usage data to the billing system.
- The billing system must provide account and service information to the provisioning system.
- The billing system must provide scheduling information to the provisioning system.
- Both systems must support synchronization capabilities to reconcile services billed versus services provisioned.
- The provisioning system must update the billing system when service is installed or changed from any of its available interfaces.

Option 2, integrating a provisioning system the billing system, initially proves to be the most flexible for rapid deployment of new services. Although this architecture is appealing, over time the systems will need to become tighter in their integration. Since the CMS holds customer's financial status as well as a record of current services, the provisioning system will need to query the CMS before provisioning a service. If this option is chosen, the CMS and the provisioning system should be tightly coupled before moving beyond a trial

CUSTOMER CARE

If price and service are the product attributes that attract customers, customer care is the attribute that will retain them [Whiteley, 91]. However, providing quality customer care for data service products presents a difficult challenge. Unlike traditional video service, customer care for data services requires support from authentication and routing systems, dynamic host control protocol (DHCP) servers, domain name service (DNS) servers, mail servers, Web servers, and more. Table II identifies the added complexities in this area by comparing modems and data services against traditional set-top boxes and video services.

Because of the complexities inherent in broadband data services (i.e., cable modems and the connections to a PC, PC configurations, broadband routers, network management tools, etc), product support becomes a difficult undertaking. A CMS can make the customer care task easier by providing tools that can:

- isolate data service problems
- scheduling the right person for the job
- provide the work order information in the appropriate media format

Fault Isolation and Identification

One way to provide quality customer care is to staff your call center with experienced network engineers and system administrators. The problem with this approach is finding available engineers with customer-oriented skills plus the million-dollar or so requisite increase in staffing budget! The realistic solution to the problem is to require the CMS to provide better broadband support tools capable of isolating problems. Today, the most popular tools used to identify broadband problems are network management tools (e.g., HP Overview, SNMPc, Sun Net Manager, etc). A network engineer can determine if the CMTS and cable modem in question are operational and if network packets are flowing correctly; however, engineers usually don't take customer calls nor do they have access to the CMS. And CSRs typically does not understand network protocols or network management tools.

One effective solution is to have the CMS provide an integrated trouble-shooting application that hides protocol complexities while allowing a CSR to perform network management tasks. For example, when a customer calls in with a problem, a CSR accesses the account and the CMS supplies information about the cable modem and computer to the trouble-shooting application. Using the modem's IP address, CMTS information, and the customer's account information, the trouble-shooting application can attempt to isolate the problem between the PC,

Table II. Data Services vs. Video Services

Data Services	Video Services
Cable modem vs. Set-top box	
Active two-way device	Passive device with limited upstream capability
Consumer determines modem make and model	Operator controls box make and model
Managed via standard network protocols	Managed via proprietary protocols through an addressable controller
Complicated installation	Simple installation
Installation and Account Management	
Service is provisioned on many systems (e.g., CMTS, cable modem, authentication server, DHCP server, mail server, etc)	Service is provisioned on the set-top box through an addressable controller
Many service installation options available (installed directly by the consumer, through a retail outlet, or with the assistance of a CSR)	Service is installed with the assistance of a CSR
Service is managed by the consumer via the Web	Service is managed with the assistance of a CSR.
Problem Isolation and Identification	
Service interruption can be attributed to many possible factors (e.g., problems with the customer's PC, the modem itself, a network outage, Internet servers, etc)	Service interruption can be attributed to a few factors
Requires many skills sets to support (e.g., Network Engineer, RF Engineer, PC administrators, Web masters, etc)	Requires one or two skill sets to support

cable modem or broadband network (see figure 4). Furthermore, the trouble-shooting application can display an interactive image of the customer's cable modem (extremely important in a DOCSIS environment) to allow the CSR to mimic LED behavior that the customer's modem is displaying in order gather additional information.

The goal of the trouble-shooting application is to bridge the gap that currently exists between customer care and engineering thus providing smooth turnovers to the appropriate tier 2 support organization(s).

Scheduling and Work Orders

Another requirement that broadband services place on the CMS is the ability to assign one or more technicians to an installation or trouble call job. Since data services requires both cable and computer skills, multiple technicians may have to be assigned and scheduled accordingly. There is nothing more disturbing for a customer than to have a technician with the wrong skill set show up for a scheduled appointment.

The multiple technician requirement also implies that multiple work orders may have to be generated by the CMS for a single job. Furthermore, today many operators outsource PC support, so work order information must be Emailed to the outsourced business.

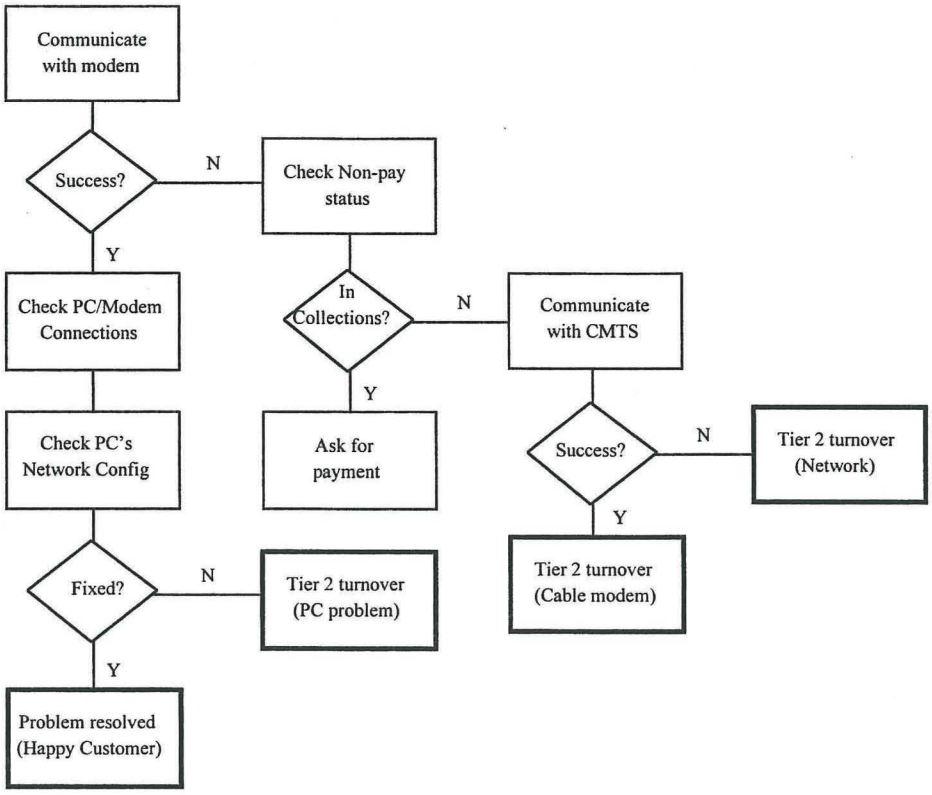


Figure 4. Problem isolation provided by broadband support tool

To adequately support work force management the SMS must:

- Support the assignment and scheduling of multiple technicians to a single job
- Generate multiple work orders that allow the operator to: 1) select the data contained on the report, 2) tailor the report format, and 3) select the destination of the work order (printer, fax, or Email).

SUMMARY

Customer care and billing have a clear impact on a provider's ability to succeed in the broadband marketplace. The Customer Management System used affects every aspect of a rollout from deploying content to provisioning services. A strong flexible CMS enables a provider to create a flexible product offering, provide flexible price and discount options, offer compelling content, integrate back office systems, and provide the advanced customer care that will attract and retain customers in the competitive broadband arena.

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