Network and Service Provisioning for

OpenTV's Broadband Solutions

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OVERVIEW

Managing a subscriber, the equipment installed in their homes and the products and services they order, is becoming more complex as consumer demand for advanced services increases. Launching advanced interactive services typically require a significant investment in equipment, software and personnel by the MSO (multiple system operator).

Automatic provisioning of a user's devices and the activation of services and products over those devices has provided Operators with a way to manage advanced services, while reducing costs and improving customer satisfaction. In order to be truly cost effective, however, provisioning solutions must be shared across network devices and services, including those supporting video, high-speed data and voice – the elements of the cable "triple-play".

While iTV (interactive television) services may become the most widely subscribed digital service category in the future, historically, an MSO will launch Broadband data and telephony services before advanced iTV services. Consequently, for the MSO launching iTV, the question is often not "What is the specific provisioning solution?" but rather, "How do the iTV provisioning requirements interact with my legacy provisioning infrastructure?" Furthermore, the consumer experience of a complex provisioning process may be an impediment to acceptance and use of iTV services.

This white paper provides an overview of OpenTV's provisioning requirements, the components of the solutions it provides, and an example of integration with existing infrastructure already deployed.

BROADCAST VERSUS BROADBAND iTV SERVICES

Broadcast iTV services are delivered through the 1-way digital video broadcast transport stream. This form of delivery is based on a '1-to-Many' relationship, where all authorized users receive the same application or service. Broadband iTV services are delivered through the 2-way, on-line, high-speed IP network. They assume a '1-to-1' relationship, where each user can receive personalized applications and services.

iTV services requiring provisioning are typically services that either have restricted access, a subscription element (i.e. open Internet access) or require a level of configuration of network resources (i.e. email, assigning an IP address).

Delivery of basic broadcast iTV services typically does not necessarily require provisioning. The evolution of the interactive network often includes a period early in the deployment of iTV services where the user is encouraged to begin using a set of free, informational services such as the EPG (electronic program guide) or interactive news and weather. Access to such services and applications can be restricted through the digital TV CAS (Conditional Access System) rather than provisioning.

This means viewers benefit from a range of basic services, including EPG, games and enhanced TV, without the MSO initially being required to introduce processes, systems or personnel to support provisioning.

However, where MSOs plan to launch more advanced broadband iTV services, then the earlier an automatic provisioning system is implemented, the more rapidly an advanced, differentiated service bouquet can be introduced. Advanced broadband-provisioning platforms also enable end-user to self-manage their services, reducing call center costs; the management of complex device environments; the bundling of services and the integration of services across multiple broadband networks.

PROVISIONING THE SET TOP BOX HARDWARE

A broadband network of interconnected IP (Internet Protocol) devices typically benefits from the investment in advanced provisioning infrastructure. The historical trend in the rollout of advanced services is that high-speed data deployment leads both iTV and cable telephony. Consequently, the majority of network provisioning decisions will have already been made by the MSO before an OpenTV Broadband solution is deployed. The logical provisioning strategy is to provision the network components of a broadband STB (set-top box) in the identical manner as the Cable Modem's are provisioned. Conversely, network operators who are still in the planning phases of the rollout of digital broadband services should architect their provisioning infrastructure so that it can grow to accommodate the provisioning of all future services, including iTV.

OpenTV Core Middleware with the OpenTV HTML Package extension (and OpenTV's Device Mosaic HTML browser) use standard CMTS, DHCP servers and DNS for establishing a return path connection. Through these standard servers, provisioning of a digital TV STB can be managed using the same operational support systems that control the provisioning of other devices such as cable modems. OpenTV technology does not restrict or mandate how these are used.

Each STB will have a set of MAC addresses pre-programmed in the communications hardware interfaces. A database of STB serial numbers and the respective unique MAC addresses is usually provided by the manufacture to the MSO to be loaded into the provisioning database, just as it would for cable modems. On power-up, the DHCP protocol is typically used to allocate the STB its IP addresses and configuration files (e.g. pointer to DNS, filters, etc). DNS servers are used to enable the unit to communicate with servers on a named basis. A single STB may easily consume as many as 3 IP addresses, if it is functioning both as an advanced digital STB and a cable modem for the subscriber's home computer(s). Some future devices will have as many as 5 MAC addresses, to support interfaces such as Ethernet and IEEE1394 as well as virtual interfaces.

The provisioning solution resolves the MAC addresses with the subscriber account, and also provides OSS (Operational Support Systems) interfaces for the integrated Broadband Operations Center processes.

PROVISIONING SUBSCRIBER SERVICES

When provisioning the CPE (customer premise equipment) network communications is largely independent of whether a particular device is a Cable Modem, STB or Cable Telephone. Provisioning requirements of individual subscriber services diverge greatly between devices and multiple generations of those devices. For example, within the narrow application of viewing HTML content, it is unlikely that a Walled Garden product would ever be offered to a cable modem/PC user, but it is a viable service offering for the STB/TV user. Other applications need to share as much commonality between devices as possible – instant messaging, e-mail accounts and chat buddy lists should not be device specific. Single network sign-on is important for easing management of the subscriber relationship, while giving the subscriber the clear benefit of a single user ID and password.

Several individuals within the home typically share one iTV STB, which has limited memory and processing resources. While the 'network provisioning' discussed in the previous section is device specific, in many cases 'service provisioning' needs to be carried out for multiple users on the same device. In addition to the provisioning or activation of an iTV service, network databases and storage must be used to enable functionality that is equivalent to that provided by the equivalent PC applications. For example, e-mail address-books, chat buddy-lists and data normally stored locally in cookies on a home computer will be stored in the network to accommodate the hardware limitations of a STB.

Application vendors, such as, Static, OpenTV and others have purpose designed user databases that directly address the functionality and performance needs of their iTV applications. OpenTV Account is one such database solution that contains user details, e-wallet, buddy lists, address books, as well as purchase information and other application logs.

Where this information is 'common', it should be replicated in the OSS system to allow other devices and network systems to share this user-to-service specific data. Examples of 'common information' are user and device related details such as name, email address physical location, device configuration, user settings and service status.

A common data repository of user information for commerce, e-mail, chat, and gaming applications becomes a critical element of the provisioning solution to lower the costs of maintaining data replication and data integrity, while reducing systems integration complexity of the service delivery platforms. The common data repository provided by the provisioning vendor must also be integrated into the network operator's OSS and BSS systems.

JacobsRimell™

CASE STUDY

In this section, we describe the integration of the OpenTV broadband iTV solution with the JacobsRimell automated provisioning and service management platform (APS™).

Before an STB is provisioned there are two processes that take place, depending on the business processes of the operator:

- ?? The customer sets up an account. This could take place face to face with a sales person, over the Internet or via a phone call.

- ?? The STB vendor provides an electronic list of STBs in each delivery, which will include the serial numbers and MAC addresses of each STB as well as the smart card ID if the smart card has been inserted during manufacture.

An OpenTV-enabled STB, with broadband return path, needs to be provisioned and enabled for return path use; that is, the broadband modem is allocated an IP address to allow the STB to communicate with its application servers. The device may be self-provisioned by the user, or provisioned by an installer, following a dialog with a CSR (customer service representative), depending on the networks CRM infrastructure.

Once provisioned for the network, the STB may also be enabled for access to a restricted set of application/web-servers, or may be given open Internet access. A typical implementation may use conditional IP addresses to control access to different service levels. The DHCP server could be configured to check that the MAC address of the STB is already known by the system and also to allocate the level of service that the STB will be provided. Different ranges of IP address could be given, based on the level of service that a STB will be provided. A STB with open Internet access would be given an address in a different range to a STB with only walled garden access. Alternative approaches are also possible using a single range of IP addresses.

SELF PROVISIONING SCENARIO WITH APS™

Using a scenario where the above processes have taken place, the self-provisioning process is as follows:

1. The STB middleware initiates a DHCP discovery message over the cable return channel. In turn, the DHCP server interrogates the APS™ platform.

2. APS™ assigns a restricted IP address and a default DNS addresses to the DOCSIS TCP/IP stack.

3. All web access is routed to the APS™ self-provisioning page by the default DNS, so the viewer can only access the network operator's sign up provisioning pages.

4. APS^{TM} asks for the viewer's details e.g. by asking for their customer number, or works order number (provided securely, prior to the install).

5. APS^{TM} verifies their identity by displaying their name, address, etc.

6. APS^{TM} verifies the level of service they have requested and optionally offers an up-sell, maybe at a promotional rate.

7. When the details are confirmed, APS^{TM} associates the viewer with the installed STB and, optionally, the associated smart card.

8. APS^{TM} then configures the services that the viewer has bought by sending instructions to the relevant infrastructure e.g. mail server, OpenTV Account, CA system.

9. On completion, the STB is automatically rebooted remotely by APS^{TM} and gets a new DHCP lease that will allow access at the level the viewer has subscribed to.

10. Finally, APS^{TM} activates the billing system for that user's services and updates the various BSS systems such as inventory management, CRM, etc.

There are many variations on this basic theme, according to how an operator wishes to run their business, for example:

?? Access to the walled garden can be pre-authorized to un-provisioned set-top boxes, in which case access to a self-service provisioning service would be within the walled garden.

?? When a user attempts to select an unauthorized service (e.g. a premium application), rather than simply bar access with a static message, APS^{TM} can be used to redirect the user to a self-service provisioning page, so the user can either trial or subscribe to the service if they wish to.

?? In a retail scenario, viewers may buy their STB's at a retail store and set up a new customer account at the time they connect it to the network, without having to contact the MSO's call center.

Figure 1: Relationship of System Components
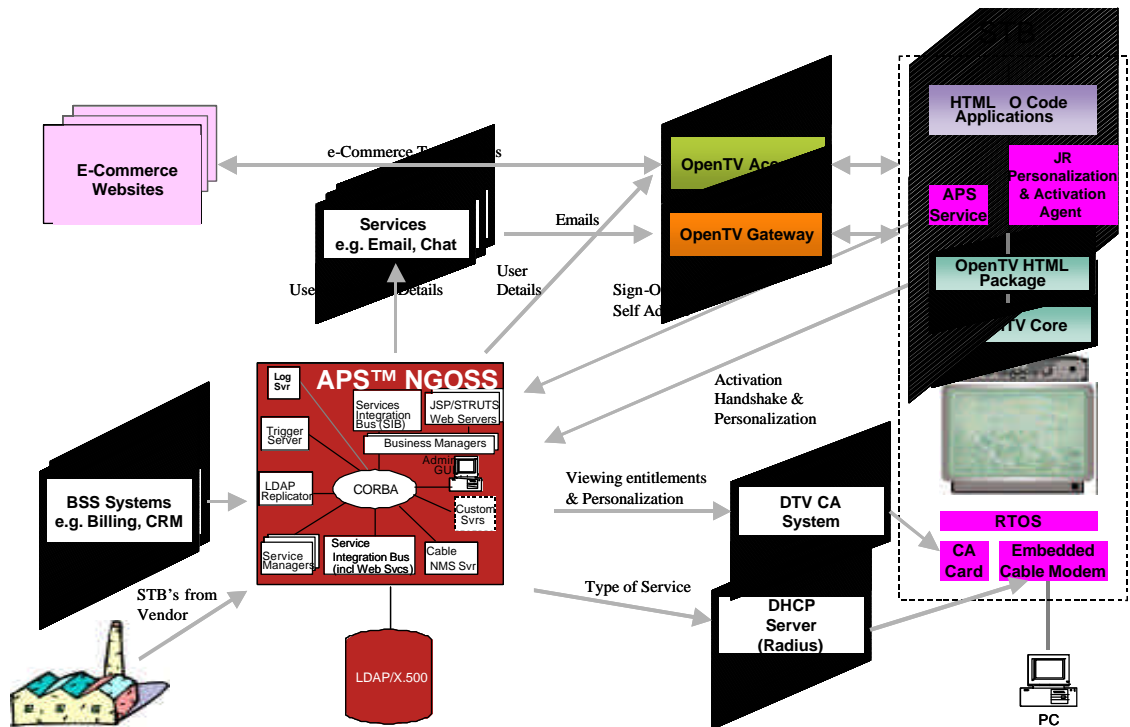
Figure 1 shows the relationship of the system components provided by OpenTV and those components provided by the JacobsRimell APS^{TM} solution. The OpenTV Account system requires data-write performance for real time logging, while the APS^{TM} systems require excellent data-read performance to enable the wide variety of OSS/BSS processes to access the common data. OpenTV Account is a proxy on the Microsoft IIS platform, compliant with ISAPI. The APS^{TM} system also provides an interface for the operational and customer support staff of the MSO.

CONCLUSION

The OpenTV broadband solution utilizes both 1-way broadcast iTV technology as well as 2-way broadband iTV technology. The broadcast iTV components provide a means to provide interactive services without the need for provisioning infrastructure. The broadband iTV components do require provisioning and can be provisioned in a manner consistent with existing cable modem provisioning practice.

The provisioning of broadband iTV services is enhanced by the architecture of the OpenTV Account proxy server. This Account server has been architected to integrate with advanced provisioning systems that now links to the MSO's OSS / BSS systems. Finally, this architecture has been validated in collaboration with JacobsRimell and their advanced provisioning and service management solution - APS^{TM}.

In combination OpenTV and Jacobs Rimell can ensure a fully integrated broadband iTV architecture for the delivery of advanced interactive services. The partnership between OpenTV and Jacobs Rimell also enables MSOs to launch off-the-shelf iTV services more rapidly, at a lower cost and ensure that these new services are integrated with their existing data and telephony services.

ABOUT JACOBSRIMELL

JacobsRimell is a leading supplier of operational support system (OSS) software to the broadband and telecommunications industries. Their solutions have been deployed in 13 countries to date and are proven to rapidly drive revenue generation, unify services and reduce costs. Their flagship product APS^{TM} is a highly extensible, scalable and available provisioning and service management engine. The company is headquartered in London, with regional offices in Denver, and Sydney. For more information about JacobsRimell and APS™ please visit their website at www.jacobsrimell.com, or email enquries@jacobsrimell.com or call +44 20 7786 4000.

GLOSSARY

TERM	DESCRIPTION
APS	JacobsRimell's provisioning and service management engine.
BSS	Business Support Systems. Includes cable operator's customer care and billing systems.
CA	Conditional Access, the scrambling of pay-TV content.
CAS	Conditional Access System.
CM	Cable Modem. A modem designed to operate over cable TV lines.
CMTS	Cable Modem Termination System, a system of devices located in the cable head-end that allows cable television operators to offer high-speed data service to home computers and digital cable set-top boxes.
CPE	Customer Premises Equipment. Communications equipment that resides on the customer's premises.
CRM	Customer Relationship Management.
CSR	Customer Service Representative.
DHCP	Dynamic Host Configuration Protocol, a protocol for assigning dynamic IP addresses to devices on a network, such as a cable modem.
DNS	Domain Name System (or Service), an Internet service that translates domain names into IP addresses.
DOCSIS	Data Over Cable Service Interface Specification. Developed by CableLabs and approved by the ITU in March 1998, DOCSIS Specification defines interface standards for cable modems and supporting equipment.
DTV	Digital Television.
EPG	Electronic Program Guide, also know as an IPG (interactive program guide).
IEEE 1394	A very fast external bus standard that supports data transfer of up to 400 Mbs (400 million bits per second). Products supporting the 1394 standard go under different names, depending on the company. Apple, which originally developed the technology, uses the trademarked name FireWire. Other companies use other names, such as i.link and Lynx, to describe their 1394 products.
IP	Abbreviation of Internet Protocol,
ISAPI	Internet Server API, an API for Microsoft's IIS (Internet Information Server) Web server.
iTV	Abbreviation of interactive television.
MAC Address	Short for Media Access Control address, a hardware address that uniquely identifies each node of a network.
MSO	Multiple System Operator. A cable network operator with multiple systems.
MTA	Multimedia Terminal Adapter – Voice over IP telephone device.
OSS	Operational Support Systems. Systems used for operational management of cable systems.
STB	Abbreviation for set-top box.
WWW	World Wide Web.