

Introduction to Network & Enterprise Solutions Solutions to enable t-Business



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NETWORK & ENTERPRISE SOLUTIONS

Introduction

Network Operators and Multi-Service Operators (MSOs) who are planning to launch Interactive TV services are often faced with a overwhelming number of technical and business decisions. Even after the choice of Set-Top-Box (STB) manufacturer(s) and Middleware vendor has been made operators must decide on a diverse array of options such as: internal or 3rd Party application development; application development tools; network infrastructure; back-end architecture; head-end requirements; systems management; content management and transaction management solutions to ensure a profitable operation and a satisfactory return on investment. OpenTV Inc. has both the experience and the technology components to help Network Operators successfully design, launch and manage their iTV business. This document is design to introduce two families of components which together form the foundation of a successful Interactive TV deployment.

Overview

Open TV's Network and Enterprise Solutions are an integrated set of software products that enable the efficient deployment and management of iTV applications that create profitable, new revenue streams for network operators and MSOs. Network Solutions manage the generation of iTV applications, the broadcast environment and where necessary the return channel. Enterprise Solutions enable operators to control the potential revenue streams from t-commerce and advertising. Combined the solutions enable operators to blend multiple applications across a single content offering, making the viewer's experience more dimensional and the network operator's opportunity more profitable.

Features of Network and Enterprise Solutions include the following:

- Dynamic content publishing to set-top boxes
- Common return path services
- Targeted advertising within iTV applications
- Viewer relationship management for Network Operators
- T-commerce and transaction management

The products that make up Network Solutions are:

- OpenTV Publisher 1.3
- OpenTV Streamer 2.0
- OpenTV Gateway 1.3

The components that make up Enterprise Solutions today are:

- OpenTV Account 1.1
- OpenTV Advertise 1.0

Background

OpenTV's Network and Enterprise Solutions have been developed using the experience gained from deploying more than 40 digital cable, satellite and terrestrial networks in more than 50 countries around the world. The families provide an end-to-end solution that simplifies the business of iTV by integrating essential features into a single operating platform.

Existing deployments show that to generate significant profits from iTV, operators must provide a wide variety of applications and services with broad appeal. For sustained profits, these applications must be built, launched, operated and maintained with minimal overhead. Experience also shows that to provide an effective level of customer service to viewers, you must track their transactional activities. Open TV's Network and Enterprise Solutions provides the best solution, built on experience, for any combination of architecture – from telco to cable modem return, from thin client to advanced set-top boxes.

Network Solutions - Functions and Features

OpenTV's Network Solutions makes building, deploying and supporting a broad array of iTV applications easier and more efficient than ever before. The OpenTV Network Solutions has the following features and functions:

Dynamic Content Publishing

- Publishing of Internet based content over broadcast networks
- Rapid application development and generation
- Separation of business logic and data from presentation
- Highly scalable iTV applications (1000s of pages)
- Dynamic content and application updates
- Optimized bandwidth with fast viewer access to content

Common Return Path Services

- Access to standard content, application and communication servers using Internet protocols

Enterprise Solutions - Functions and Features

OpenTV Enterprise solutions is about managing the back-end or server side of the viewers experience. Enterprise Solutions enable the network operator to easily manage subscriber and supplier relationships while generating incremental revenues from iTV applications and services.

Targeted Advertising

- Management of banner and interstitial advertising inventory across portfolio of all iTV applications
- Targeting of advertisements
- Advertisement insertion into broadcast carousels
- Advertisement display and rotation within the set-top box
- The ability to links from advertisements to transaction services for direct commerce response

Viewer Relationship Management

- Self-service viewer registration
- Single sign-on support across all applications
- Unified e-wallet and address book for rapid purchases

T-commerce and transaction handling

- Transaction enabled applications

- Automatic viewer e-wallet details and insertion into transactions
- Entitlement control over application access to information and services
- Secure transaction forwarding using SSL or VPNs
- Transaction and activity logging for flexible retailer billing
- E-receipt capture and management
- Self-service access to e-receipts

Profiling & Personalization – (Future Functionality)

- Enterprise Solutions will shortly contain features that enable Network Operator's to target viewers or households based on their TV activities.
- Targeted promotions and advertising based on individual viewer TV activities
- Personalized commerce

Network Operator Benefits

OpenTV's Network and Enterprise Solutions bring the following benefits to a network operator:

- Transaction enabled applications for new revenue streams
Transaction enabling applications allows network operators to extend the revenue opportunities available from interactive applications.
- Lower support cost for invaluable customer services
Through e-receipt tracking Enterprise Solutions enables network operators to offer an appropriate level of customer service to its viewers and content providers. Self-service interfaces ensure that customer services are delivered effectively and at a lower cost.
- Cross service management and targeting of advertising for increased advertising revenue
Enterprise Solutions enables management of the advertising inventory across all interactive applications. This leads to higher impressions. Enterprise Solutions enables adverts to be targeted leading to high CPM rates.
- Integrated services for multiple revenue opportunities
Network and Enterprise Solutions enables many services to be integrated into iTV applications: publishing, advertising, t-commerce and messaging. This enables multiple revenue opportunities with iTV applications.
- Retained control of customer relationships
The features of Enterprise Solutions enable network operators to retain control of the customer relationship with the individual viewers. This customer relationship enables business intelligence and better customer services leading to strong revenue and margin for the network operator.
- Use of commodity infrastructure components
The use of existing Internet standards (like XML & HTML) enables Network and Enterprise Solutions to use commodity infrastructure components reducing the initial investment costs and the on going cost of ownership of interactive services.

- Flexible Content Provider Billing

Enterprise solution allows tracking of content provider activity supporting multiple content provider billing models, including per transaction charges, viewer information access charges and purchase commissions.

All these benefits can be summarized down to providing network operators with a return on their iTV investments.

Content Provider Benefits

OpenTV's Network and Enterprise Solutions bring many benefits to the content providers (iTV application developers, t-commerce retailers and advertisers), including the following:

- iTV application development at web speed

Network Solutions enables content providers to rapidly develop and deploy new iTV applications at costs comparable to standard web development.

- Accurate and up-to-date iTV applications

Enables real-time dynamic update of iTV applications, enabling content providers to provide applications with information that is accurate and up to date. Information like news, sports scores or stock prices that has to be immediate, not hours or days old.

- Reuse of existing Internet infrastructure and processes

Enables content providers to reuse existing Internet based infrastructure, processes and procedures for both publishing content and handling transactions.

- Access to consolidated customer relationship information

Content providers can share in the customer relationship information managed by the Enterprise Solutions. At a basic level this enables controlled access to viewer details including preferences and e-wallets. At an advanced level this enables content providers to benefit from business intelligence gained from viewer usage of all iTV applications. Content providers can use this to provide personalized services including features such as targeted promotions and recommendations.

These content provider benefits bring value to network operators as well, through increased numbers and variety of compelling iTV applications.

Viewer Benefits

The end viewers also benefit from OpenTV's Network and Enterprise Solutions. These benefits include the following:

- Ease of use

Network and Enterprise Solutions can be used to provide a consistent experience for viewers making applications easier for viewers to use.

- Security and confidence

Viewer can transact with the knowledge that their personal information and credit card details are secure. Self-service e-receipt access enables viewers to know what orders they have placed and with which retailer.

- Quick and easy communication with friends and family

Unified and integrated communications enable viewers to communicate with friends and family quickly and easily using e-mail, chat, instant messaging or text messaging (SMS).

- Accurate and up-to-date information

Through dynamic update of iTV applications the information in them can be accurate and up to date, be this; sport scores, financial stock values or the availability of a must have product.

- Personalized services

Viewers can enjoy applications personalized to their requirements and profile. Personalization may be through defined preferences or via transparent profiling. This can lead to promotions, recommendations and advertising that are relevant to the viewer and that they are interested in.

These viewer benefits will increase iTV usage and the revenue streams driven by that usage for network operators.

COMPONENT PRODUCTS OVERVIEW

Introduction

OpenTV's Network Solutions comprises of the following OpenTV products:

- OpenTV Publisher 1.3
- OpenTV Streamer 2.0
- OpenTV Gateway 1.3

OpenTV's Enterprise Solutions comprises of the following components:

- OpenTV Account 1.1
- OpenTV Advertise 1.0

Figure 1 shows the relationship between these component products. A network operator can deploy each of these products separately as individually they have benefits and value. The combination of these products provides an end-to-end t-business solution for network operators with even greater value.

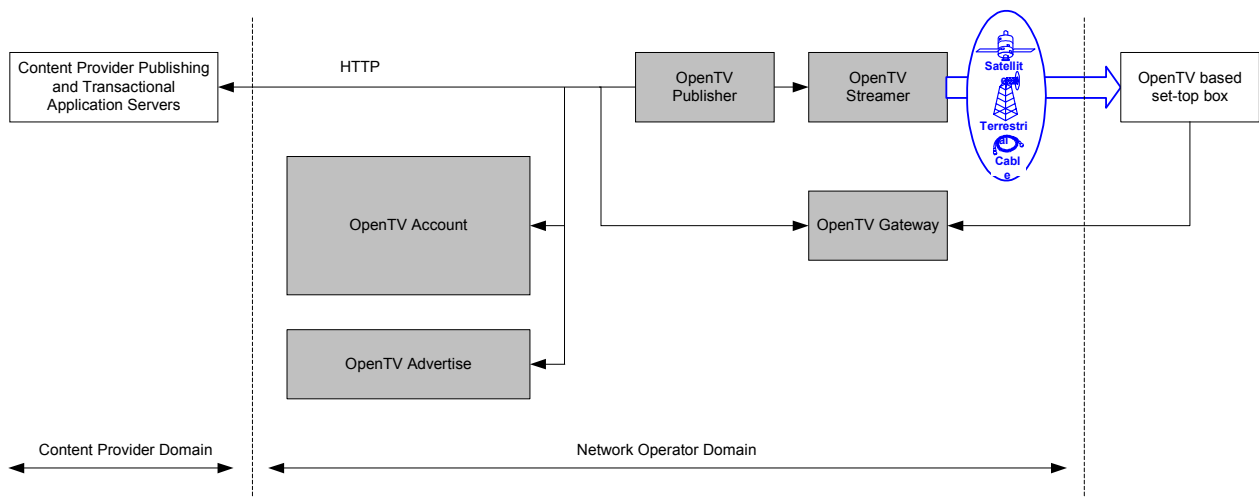


Figure 1: Network and Enterprise Solutions Components

OpenTV Publisher 1.3

OpenTV Publisher combines the latest iTV technology with today's Internet protocols to create compelling interactive applications at minimum cost and with web speed. OpenTV Publisher is available as a stand-alone product and is fully integrated with OpenTV Streamer to provide a high level of broadcast service with minimal integration work.

OpenTV Publisher is designed to allow application developers with Web based experience to develop applications for the OpenTV platform. Developers and engineers who are used to working with the OpenTV SDK environment will appreciate the ease-of-use and flexibility of OpenTV Publisher. OpenTV Publisher enables application developers to create fully functional OpenTV applications without resorting to C code. Its design is based on Internet standards (XML and HTTP) and tools such as Microsoft Internet Information Server. Applications are created within the same dynamic page-based paradigm that is already familiar to the HTML developer community.

Building applications with OpenTV Publisher consists of defining XML-based templates and use the Merger Engine component to combine the XML data with the XML page layouts and pre-built components called gadgets, a library of gadgets are included with each copy of OpenTV Publisher. Building an OpenTV Publisher application creates a set of XML pages that comply with OpenTV's TV standard Data Type Definition (DTD) and are compiled into modules by the Publisher Engine component. The OpenTV XML DTD is extensible and thus can support new gadgets. A small footprint runtime program called the Publisher Surfer is downloaded with the broadcast stream and runs in the set-top box. Because the Surfer and the gadgets are optimized and tested components, resulting applications are extremely stable and robust.

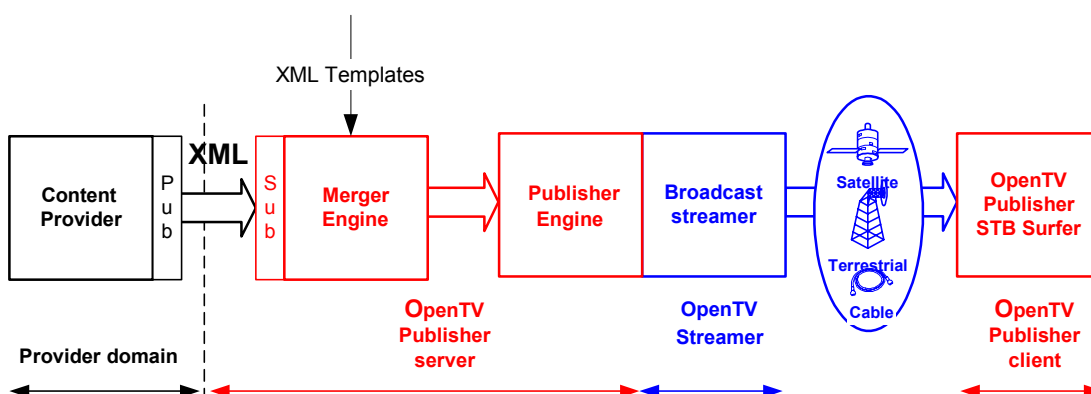


Figure 2: OpenTV Publisher Components and Architecture

The process of creating an OpenTV application with OpenTV Publisher is modular and incremental. The application development process can be done on a Web connected desktop machine. Data elements are separated from the screen template, allowing graphics designers with basic technical skills to quickly define the layout of an application. Developers can use standard graphic design tools like Adobe's Photoshop to create media assets and then link them to the page templates to build pages ready to be broadcast. For dynamic applications, the XML data elements and the templates are merged using a script language (Vbscript) and standard HTML dynamic page building tools. Any source of data (text, images, video) can be included in an OpenTV Publisher application to create a compelling iTV application in no more time it would need to develop a Web service. The pages can be sent to a broadcast streamer to view the actual results on a target decoder and TV set, simulating the target network environment on the desktop.

OpenTV Publisher Extensions

OpenTV Publisher can easily be extended to support the specific requirements of a network operator or content provider by the creation of additional gadgets. OpenTV have created a number of "gadget kits" which extend the core capabilities of OpenTV Publisher. The following gadget kits are available today:

- Transaction Gadget Kit

This kit contains gadgets required to transaction enable OpenTV Publisher applications. This includes distributed creation of complex transactions such as offline shopping carts, the issuing of the transaction to an application server over the set-top box's return path and the handling of a complex transaction response.

- Communications Gadget Kit

This kit contains gadgets required to embed messaging functionality into OpenTV Publisher applications. This includes send mail, chat, instant messaging and text messaging (SMS).

OpenTV also has a set of stand-alone messaging applications that can work in conjunction with the Network and Enterprise Solutions.

OpenTV Streamer 2.0

OpenTV Streamer is OpenTV's solution for MSOs, networks, content providers, and high-end developers seeking to broadcast interactive content using standard digital broadcast facilities. OpenTV Streamer allows broadcasters to multiplex data with audio and video signals, and is the first interactive broadcast solution capable of updating the data stream in real time. OpenTV Streamer performs real-time compilation of data modules, allowing up-to-the-second transmission of sports scores, stock quotes, and other time-sensitive data.

OpenTV Streamer's second-generation software features real-time compilation of data modules, an enhanced user interface, improved SNMP support, and MPEG2 transport stream input. OpenTV Streamer 2.0 has the capability to broadcast multiple streams of data reliably and efficiently. It offers low deployment and maintenance costs by relying on fixed-hardware architecture capable of interfacing with any standard multiplexer broadcast system. OpenTV Streamer is deployed on the popular Windows NT operating system reducing training and maintenance costs through standardization, while relying on a proven and reliable server architecture.

OpenTV Publisher acts as an Application Streamer for OpenTV Streamer.

OpenTV Gateway 1.3

OpenTV Gateway is the return-path enabling component of OpenTV's Network Solutions. It connects set-top box with content provider backend systems. Messages are forwarded to content provider backend systems using the standard Internet protocols including HTTP and SMTP. The OpenTV Gateway uses protocol adapters to translate between the low-level communications protocol used by the set-top box and the higher-level Internet protocols.

OpenTV Gateway supports the following set-top box return path networks/communication protocols today:

- Raw Modem (PSTN – Public Switch Telephony Network return path)
- Motorola Aloha/UDP (for DCT-2000)
- TCP/IP (Broadband cable and DSL)

OpenTV Gateway allows set-top box applications to communicate with standard HTTP servers without the need to support a full PPP/TCP-IP communications stack within the STB. This saves valuable STB resources and enables low-end STB unable to support such a communication stack to interact with standard Internet applications servers.

OpenTV Gateway can be utilized both by OpenTV Publisher applications using the Transaction Gadget Kit and by any SDK application. SDK applications use a set of OpenTV Gateway libraries to communicate with OpenTV Gateway.

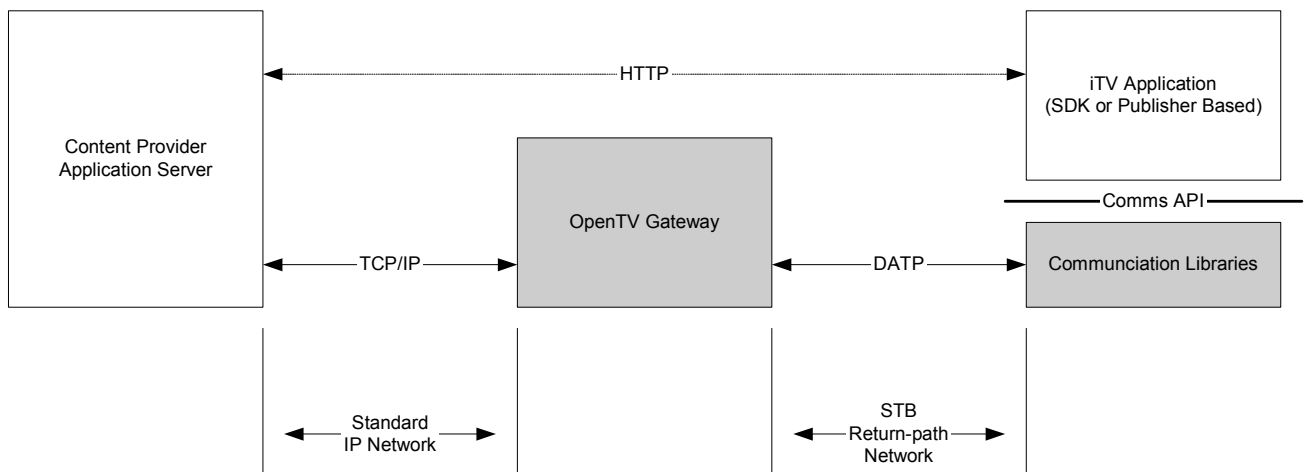


Figure 3: OpenTV Gateway

Figure 3 shows the relationship between set-top box applications, OpenTV Gateway and HTTP based application servers. Through the communication libraries provided with OpenTV Gateway iTV applications are able to communicate via OpenTV Gateway with HTTP based application servers. The logic of the application assumes a directly HTTP connection with the application server. OpenTV Gateway uses an efficient and lightweight protocol called DATP (Digital TV Application Transfer Protocol) to transport message over the set-top box return path network. DATP is then translated into TCP/IP and HTTP to transport the messages over standard IP based networks. These networks can be the open Internet, a VPN (virtual private network) or closed WAN (wide area network).

DATP is used to overcome the processing limitations of and low data rates available from low-end set-top boxes.

OpenTV Gateway integrates directly with the point of presence (POP) and head-ends of network operators for PSTN and cable return path networks respectively. OpenTV Gateway can be used in conjunction with standard PPP based access servers, providing a solution to leverage existing network connectivity for interactive television.

OpenTV Account 1.1

OpenTV Account provides a vital link between the viewer's set-top box and an operator's core management systems. It manages and implements a network operators transaction business rules by monitoring and enhancing transactions transparently, providing viewer personal and e-wallet details as necessary. It strictly controls the access to data to ensure that content providers receive only information that they have been authorized to receive.

Before messages are forwarded to the content provider applications servers, OpenTV Account interprets and potentially modifies them. This enables the Network Operator to protect, build-on and leverage their most valuable asset, their customer relationship with their viewers.

OpenTV Account implements the following:

- Individual viewer registration

Viewers can be registered via a call center or via a set-top box based self-service interface. Registration includes supports an e-wallet and personal address book to simplify online purchases. Viewer information is stored in a secure database to protect viewer's privacy.

Individual viewer registration is important to enable a platform operator to build a 1:1 customer relationship with its viewers.

- Flexible Single Sign-On

Managed central authentication of viewers using a combination of smart-cards, nicknames and PINs. This means a viewer only needs to remember a single PIN for all iTV applications simplifying their experience.

- Automated viewer details insertion

The automated insertion of viewer details into messages means that viewers do not need to enter their details (name, address and credit card details) for every transaction. This simplifies the transaction process and reduced errors, particularly when a viewer does not have access to a keyboard. Insertion is strictly controlled by Content Provider entitlements, protecting the Network Operators assets and the Viewer's privacy. Insertion is achieved by replacing keywords within the transaction messages; this minimizes the impact on content providers.

- Messaging logging

If required all messages can be logged to provide an audit trail and support billing and business intelligence. Messaging logging can be limited to headers to reduce storage overheads.

- E-receipt capture and management

E-receipts are captured to provide an audit trail of all viewer purchases. Viewers can access their own purchase history through a self-service interface. E-receipt capture is essential for providing an appropriate level of customer service. E-receipt are recognized by OpenTV Account using keywords within the messages. See example below.

- Synchronous and Asynchronous transaction forwarding

OpenTV Account is able to forward messages to Content Provider application server either synchronously for normal processing or asynchronously. Asynchronous support provides greater scalability necessary for iTV applications.

- Secure message forwarding

Depending on the requirements of the network OpenTV Account can forward HTTP messages to/from application servers securely using SSL bridging or VPNs.

Interactions

Figure 4 shows a simplified example of an interaction between a set-top box application, OpenTV Account and a content provider application server. In this example the application is placing an order with the content provider. The order message is sent by the set-top box application to the content provider. OpenTV Account intercepts the message, adds viewer details to the messages by replacing keywords within the order parameters. It logs the order details and forwards the message to the content provider application server. The application server processes the order and returns the confirmation to the set-top box. OpenTV Account intercepts the response, updates the order log to reflect the confirmation and forwards it to the set-top box.

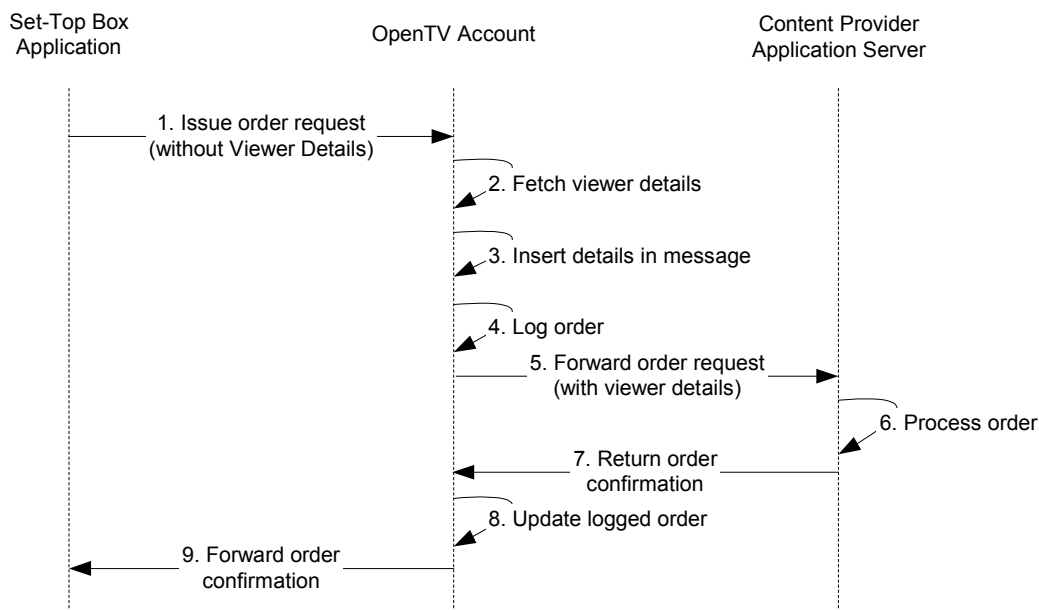


Figure 4: Example OpenTV Account Interactions

In reality, commerce transactions of this kind are likely to be more complicated and involve more messages between the set-top box application and the application server. OpenTV Account is able to monitor the state of the order over multiple exchanges. The set-top box application may fetch some information directly from OpenTV Account such as payment card details from their e-wallet.

Viewer Registration and Single Sign-On

To build on existing viewer relationships, OpenTV Account can profile each viewer individually and provide centralized viewer details to enable trouble-free commerce transactions. OpenTV Account provides online registration for new viewers, the set-up of payment details (e-wallets) and storage of personal address books. Registration can be via a call center or a set-top box based self-service application.

Once registered a viewer can use the single sign-on service to authenticate themselves to any application.

OpenTV Account securely uses data supplied by the operator's customer / subscriber management system to build the viewer profile. Access to the viewer details is strictly controlled protecting the privacy of the viewer data. The viewer data can be inserted into transactions to and from the set-top box by replacing keywords within set-top box messages.

E-Receipts

A record of all orders placed known as an e-receipt enables network operators to provide the level of customer service expected by viewers and vendors.

With t-commerce service, especially with enhanced TV, viewers may not remember whom they made a purchase from and will call the network operator if there is a problem. For instance, the purchase may be a book promoted at the end of a TV program. The viewer's perception of the network operator's quality of service will be effected if the operator has no knowledge of the purchase and unable to provide any response to a viewer's call. The call can be responded to using the e-receipts captured by OpenTV Account. A call can be avoided completely by using a set-top box based self-service application that allow viewers to access own their e-receipts

OpenTV Advertise 1.0

OpenTV's Advertise allows network and channel operators to increase and generate additional advertising revenues by delivering advertising, marketing and promotions to OpenTV based interactive applications. OpenTV Advertise allows network operators to manage advertising inventory and campaigns across their entire portfolio of iTV services. Ad avails can be managed for, and banner ads delivered to, all OpenTV based interactive applications – whether developed in-house or by third parties – including the Electronic Program Guides (EPG), virtual channels and enhanced TV programs. In addition, it is also possible to add “click through” functionality to link a banner ad to an advertiser's micro site for direct response marketing campaigns, such as lead or demand generation.

OpenTV Advertise plans, schedules and delivers banner advertisements in multiple formats to match the display requirements of the target applications. Advertisers are able to target their campaigns at particular interactive applications (for example, News, Weather or Games) to reach the required audience.

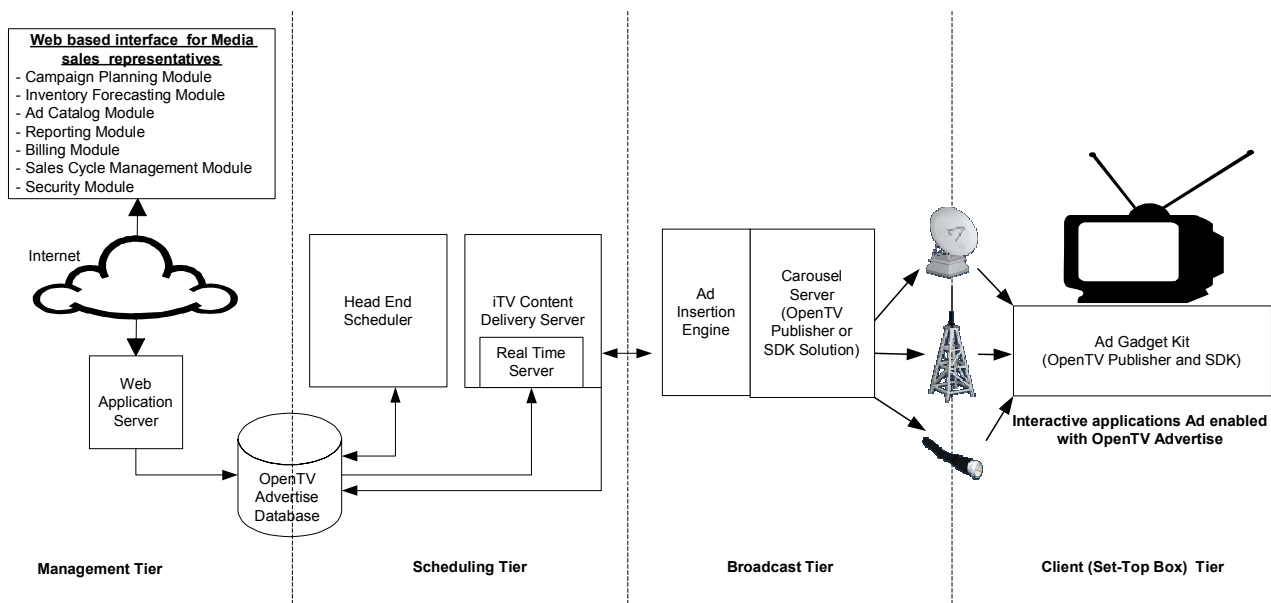


Figure 5: OpenTV Advertise Architecture

OpenTV Advertise is made up of the following tiers:

- Management Tier
- Scheduling Tier
- Broadcast Tier
- Client Tier

The Management Tier

The management tier provides the inventory and campaign management tools that allows operators to manage their advertising inventory and target banner adverts at particular types of applications, at individual applications or individual ad avails. The functionality of the management tier as accessed through a secure and easy-to-use web-based interface.

The management tier includes the following:

- Campaign Planning Module

This structures and manages campaigns in order to target banner ads in specific types of interactive applications.

- **Inventory Forecasting Module**
This gives media sales reps quick and accurate snapshot of available inventory, projected campaign delivery, schedules and progress.
- **Ad Catalog Module**
This enable an operator to view, manage and store thousands of banner ads, together with agency and advertisers contacts and names.
- **Reporting Module**
Reports can be generated in real-time for general campaign delivery status and performance reviews.
- **Billing Module**
This easily integrates with existing billing systems to facilitate a turnkey integration and ensure minimal interruption to the existing operator architecture.
- **Sales Cycle Management Module**
This helps media sales reps to view inventory, enter insertion orders, and speed the sales cycle – increasing profitability.

The Scheduling Tier

- **Head End Scheduler**
This schedules banners ads to fill ad avails to ensure required impressions are reached from the targeted applications while adhering to the campaign rules.
- **ITV Content Delivery Server**
The server dynamically provides banner ads on demand, applying addition real time scheduling.

The Broadcast Tier

- **Ad Insertion Engine**
This engine dynamically and efficiently requests and inserts banner ads and their associated meta data to target the ads into the broadcast stream of ad-enabled applications. Ads are requested regularly to provide rotation at the required frequency. The insertion engine is accessed as a COM object either by OpenTV Publisher or a OpenTV SDK build script.

The Client Tier

- **Ad Gadget Kit**
This gadget kit enables application to display rotating banner ads in either MPEG or bitmap format with click through capabilities. Versions of the gadget kit are provided for both OpenTV Publisher and OpenTV SDK applications.

TECHNICAL ARCHITECTURE

The overall architecture of OpenTV's Network and Enterprise Solutions is very flexible depending on the network's infrastructure and current Central Data center and headend set up. Components are deployed in both a central data center and within head-ends, either regionally or local.

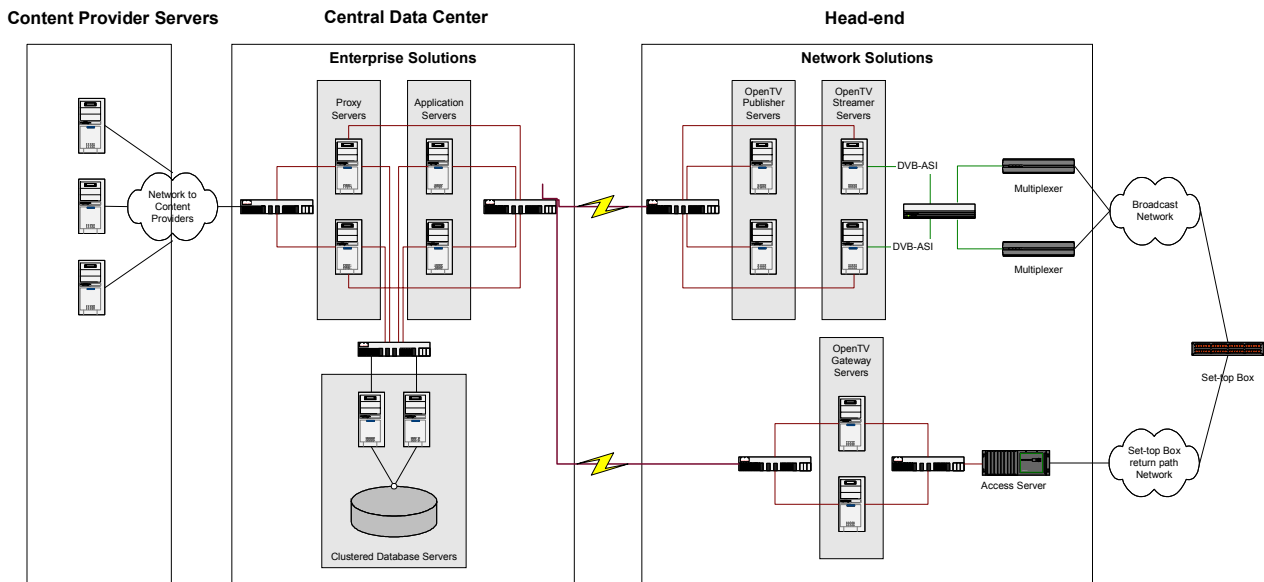


Figure 6: Example Server Architecture

Figure 6 shows an example server architecture for a deployment of both OpenTV's Network and Enterprise Solutions. This example is for a small network using low-end set-top boxes running OpenTV EN2 without embedded support for HTTP. This is a flexible model, the Publisher and Merger servers can also be located with in central data center and the proxy and application servers can also be distributed to the head-ends.

Set-Top Box

Network and Enterprise Solutions can support an installed base of existing thin client set-top boxes today and gain additional value from the latest generation of advanced set-top boxes in years to come.

The Network and Enterprise Solutions can be utilized by most combinations of set-top box hardware, operating system and middleware.

Support is provided for set-top boxes using the following:

- OpenTV EN1
- OpenTV EN2 (with and without HTTP extensions)
- OpenTV 1.2
- Device Mosaic (stand alone or embedded)

Network Solutions OpenTV Gateway 1.3

OpenTV Gateway is available for Sun Microsystems Solaris. Linear scalability and high availability is achieved by accessing the OpenTV Gateway servers via a load balancing router. An OpenTV Gateway Solaris server is able to scale to 1000 concurrent connections. A typical load

balancing router is able to scale to 1 million concurrent connections. Availability is achieved by arranging the servers in a n+1 redundancy configuration.

A small configuration would use two Solaris servers. By using two network cards in each server the internal network is protected from the set-top box network.

Future version of OpenTV Gateway will support alternative hardware and operating systems including Windows 2000.

Hardware Configuration

The hardware configuration for OpenTV Gateway to support 1000 concurrent connections is a Sun workstation with:

- Solaris 2.7 (64 bit version)
- Minimum 300 MHz CPU
- Minimum 512 MB of Ram
- 100 Mb/s Base-T Ethernet card(s) or higher.
- 4 GB of Hard Disk

Network Solutions OpenTV Streamer 2.0

OpenTV Streamer is a proven broadcast streamer system, provided as needed in a fully redundant configuration and supporting up to 40 Mbps of broadcast data streams.

Head-end

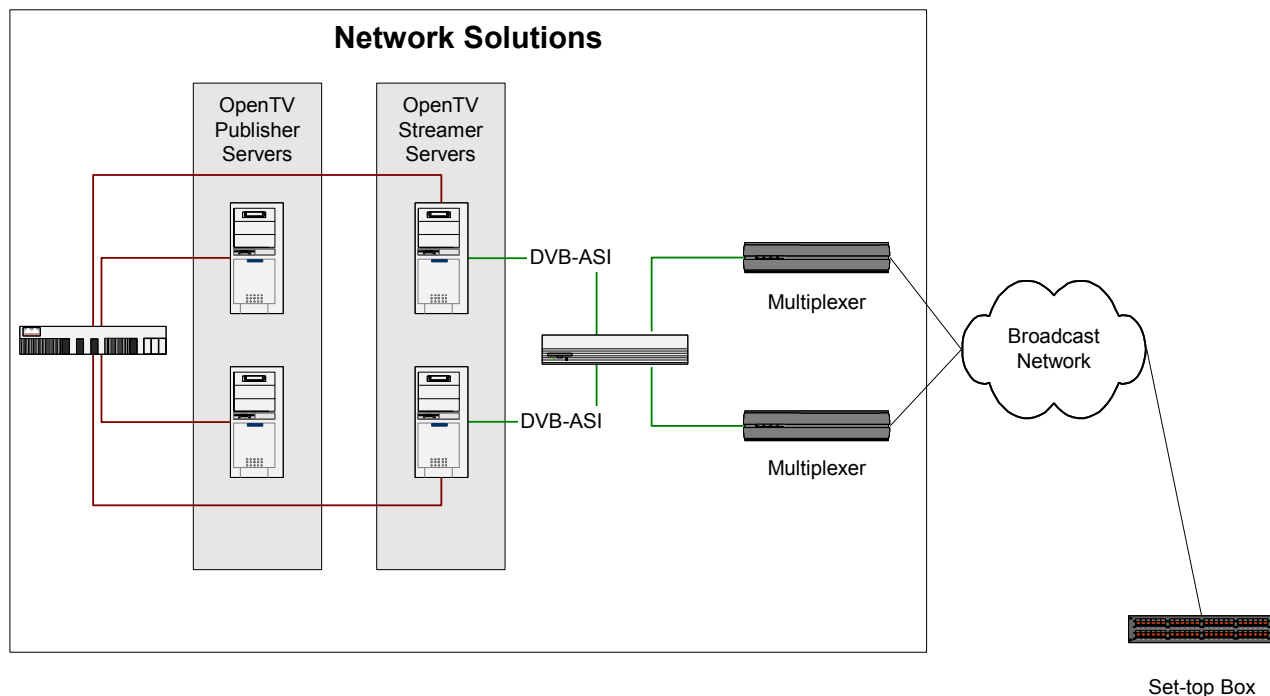


Figure 7: Example OpenTV Streamer and Publisher Server Architecture

Broadcast Streamer configuration (provided by OpenTV with software license):

- Rack-mount Compaq® DL Series server
- Intel® Pentium® III 800 MHz processor

- DVB-ASI board or optional LVDS, DHEI or RS-422 boards
- TCP/IP network connection
- Windows NT 4.0 Operating System, SP5 and SP6 supported

Supported environment:

- Hardware multiplexer supporting DVB-ASI, TCP/IP
- TCP/IP-related protocols can be supported
- SNMP management console (SNMP is not required to run OpenTV Streamer)

Network Solutions

OpenTV Publisher 1.3

The OpenTV Publisher product is modular to provide maximum flexibility to customers. The OpenTV Publisher broadcast engine is an application streamer optimized to work with OpenTV Streamer 2.0. It can be set-up in a fully redundant configuration.

The OpenTV Publisher merger server is a dynamic page building engine, using Microsoft IIS, that transforms content into an iTV application, ready to be broadcast by the OpenTV Publisher application streamer server. It can be set-up either as a independent server or on the same server as the OpenTV Publisher broadcast engine, in a fully redundant configuration.

Both product components can scale easily and run on inexpensive Pentium-based computers, insuring low operating costs.

OpenTV Publisher application streamer servers:

- Pentium Pro or Pentium II workstation
- TCP/IP network connection
- Windows NT 4.0 Operating System, SP5 and SP6 supported

OpenTV Publisher merger servers:

- Pentium Pro or Pentium II workstation
- TCP/IP network connection
- Windows NT 4.0 Operating System, SP5 and SP6 supported

Enterprise Solutions

OpenTV Account 1.1

OpenTV Account is implemented on proxy, application and database servers. The sizing and number of these servers is dependent on the size of the network, the number and type of applications deployed and the level of online interactions.

The proxy servers monitor and enhance messages sent from the set-top boxes to the content providers. The applications servers support the self-service interfaces for viewer registration and e-receipt tracking.

The proxy and applications servers would typically be located in a central data center. The proxy servers may also be distributed to regional or local head-ends to reduce network traffic.

The proxy and application servers are implemented on low cost Windows 2000 hardware that scales linearly using load-balancing routers. Application servers and proxy servers can be combined onto a single set of machines. The OpenTV Account proxy and application servers are currently available for Microsoft IIS.

The OpenTV Account database run on a single instance of a RDMS. For scalability and availability this RDMS should be installed on a cluster with a parallel server configuration.

OpenTV Account is currently supported on Oracle 9i (with real application clustering).

Oracle can be installed on either a Windows NT/2000 based cluster or a UNIX based cluster. A standard configuration would be a two-node cluster, with one or two processors in each node. A clustered environment is recommended to provide the high scalability and availability required by iTV applications.

The databases servers should be installed on a separate network to the standard set-top box traffic to protect the security and performance of the servers.

Future releases of OpenTV Account will support alternative databases including SQL Server and LDAP based repositories.

Enterprise Solutions OpenTV Advertise 1.0

Each MSO or Networks Operator's iTV deployments are uniquely different with regard to the number of subscribers and the types of services and applications deployed and planned. As such, the hardware requirements will vary from operator to operator as well as vary depending upon the number of campaigns, iTV applications and advertisements planned.

All of the OpenTV Advertise servers run on Windows 2000. The following show the range of configuration:

Hardware – multiple systems configuration

- Web Application server, 128MB memory, 500Mz CPU speed, 4GB system disk mirrored
- Database server, 512MB memory, 1Gz CPU speed, 2 channel RAID controller with 64MB write back cache, 1x18 Gb mirrored, 2x18 Gb mirrored & striped (6 disks total)
- CDS & Content server, 256MB memory, 733Mz CPU speed, 4GB system disk mirrored
- Scheduler, 512MB memory (with slots for up to 2GB), 1Gz CPU speed, 4GB system disk mirrored

Hardware – single system configuration

- Combined servers, 1GB Memory, 2x1Gz CPU speed, 2 channel RAID controller with 64MB write back cache, 1x18Gb mirrored, 2x18Gb mirrored & striped (6 disks total)

Software

- Windows 2000 Server
- MS SQL Server 2000
- Crystal Reports Enterprise Version 8.0

Content Provider Application Servers

Content providers will require application servers to support publishing of content and handling of transactions. The OpenTV Enterprise and Network Solutions places no technical requirements on these. Content providers are

able to implement the functionality they require using their preferred hardware and software.

Integration

OpenTV's Network and Enterprise Solutions are extensible, modular, and open for use with applications from third parties and existing Internet technologies. They are designed to work with pre-existing solutions and packages that may already be in place. Broadcast and return path infrastructure as well as business and operational support systems such as Subscriber Management Systems (SMS), Traffic, Scheduling, Database, Communication, and ERP software can be integrated easily to provide a seamless overall solution.

Key interfaces include the following:

- Integration with broadcast head-end equipment
- Integration with return-path (within STB and at the head-end)
- Integration with a network operators SMS or CRM systems for import of subscriber details
- STB Integration (including such features as parental control)
- Integration with call center systems for supporting subscriber/viewer enquires

Additional interfaces include the following:

- Platform management
- Data warehousing
- Content provider billing interfaces into account receivable
- Viewer billing via existing subscriber billing system

The required integration can be performed by OpenTV's Professional Services division or by a network operator's preferred systems integrator.

SUMMARY

OpenTV's Network and Enterprise Solutions are the heart of a successful interactive television service deployment and will continue to evolve as network operator's businesses change and grow. The services, features and benefits of today's offering allow operator's to effectively deploy, manage, maintain and profit from their interactive services and applications.

OpenTV has more experience in iTV deployment and management than any other interactive solution supplier with over 40 working operators in over 50 countries spread across 5 continents. The entire OpenTV organization, from engineers, developers and designers are all experts in their field and are dedicated to making your iTV deployment profitable, manageable and successful.

OpenTV – It's the Experience.