



Implementing TV over IP on Broadband Networks

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Introduction

The increasing infiltration of broadband digital networks has enabled the introduction of rich media streaming services on a wide scale. This white paper is intended as a guide to setting up TV over IP solutions using Optibase's MGW streaming servers.

TV over IP

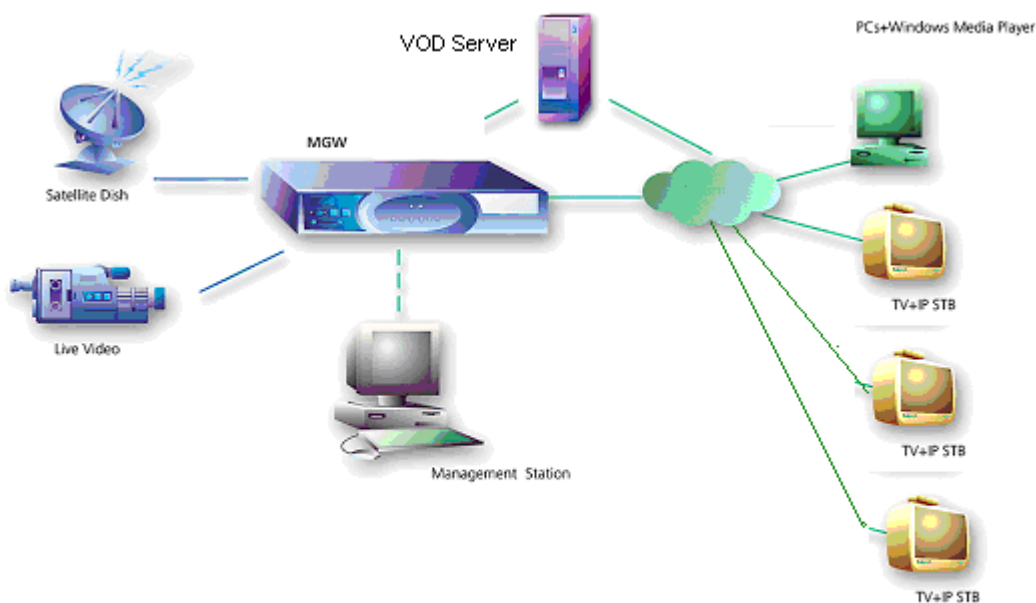
The rollout of digital networking infrastructure is opening the door for Telcos and operators to offer converged services comprising broadband Internet access and IP based TV and entertainment. TV (or video) over IP is a broad streaming solution that includes several applications, all of which can be implemented on digital broadband networks such as ADSL, VDSL, fibre, LMDS and Wireless LANs. TV over IP is being utilized in the following applications:

- TV to the living room (instead of cable TV)
- Time-shifted TV or Personal Video Recorder (PVR)
- Interactive TV
- TV to the desktop

One of the inhibitors of broadband deployment in recent years has been the lack of broadband applications. This in turn resulted in low Return On Investment in broadband infrastructure. The viability of the broadband business model is becoming much more attractive with the introduction of TV over IP services which are a major revenue engine for Telcos and operators. With TV over IP, operators can offer a greater level of service to their customers. The fact that customers receive converged services on a single pipe and interface with a single provider for all communication needs results in easier technical maintenance, streamlined billing and hence improved customer service. What's more, by utilizing digital networks, operators can offer far more sophisticated programming packages. It is possible to target specific channels at small groups of viewers, based on pre-defined viewing profiles. For example, in a residential complex of several buildings wired by fibre, operators can target the family channel to the building where families live. Interactive TV also lets viewers themselves create customized profiles based on their personal viewing habits.

Deploying TV over IP

This section describes a TV over IP solution in general and will then list the various networking and other components needed. A TV over IP solution is implemented by a Telco or operator, which typically would stream between 50 and 150 TV channels over an IP network. Content is streamed from the operator head-end over the backbone to a central/regional office. At the central office, the video is distributed over the “last mile” to the end user. Complimentary streaming equipment at the central office allows operators to insert additional channels of local content, which can be targeted at specific areas or groups of users. Later on in this paper, we’ll outline in detail, three application architectures: TV/IP over Fibre to the Home (FTTH), over DSL and over VDSL. Regardless of the network infrastructure, streaming and networking equipment needs to be installed at the head-end, the central/regional office and the end-user site.



TV/IP: General Layout

Equipment Needed for Implementing TV/IP Solution

MGW Streaming Server

Optibase’s MGW streaming server resides at the head-end. It can encode and stream up to 6 live streams in real-time and 16 pre-encoded streams that are stored on the video server. MGW transmits the streams to the switch or router which transfers them over the backbone to the central/remote offices, and from there to the end user location. An additional MGW server can reside at the central office where it receives local live feeds for transmission to targeted areas.

Video Server

Video servers fulfill several purposes at head-ends. For store and forward transmissions, they store digitally encoded content and stream it through level III devices via operators’ networking infrastructure. They receive

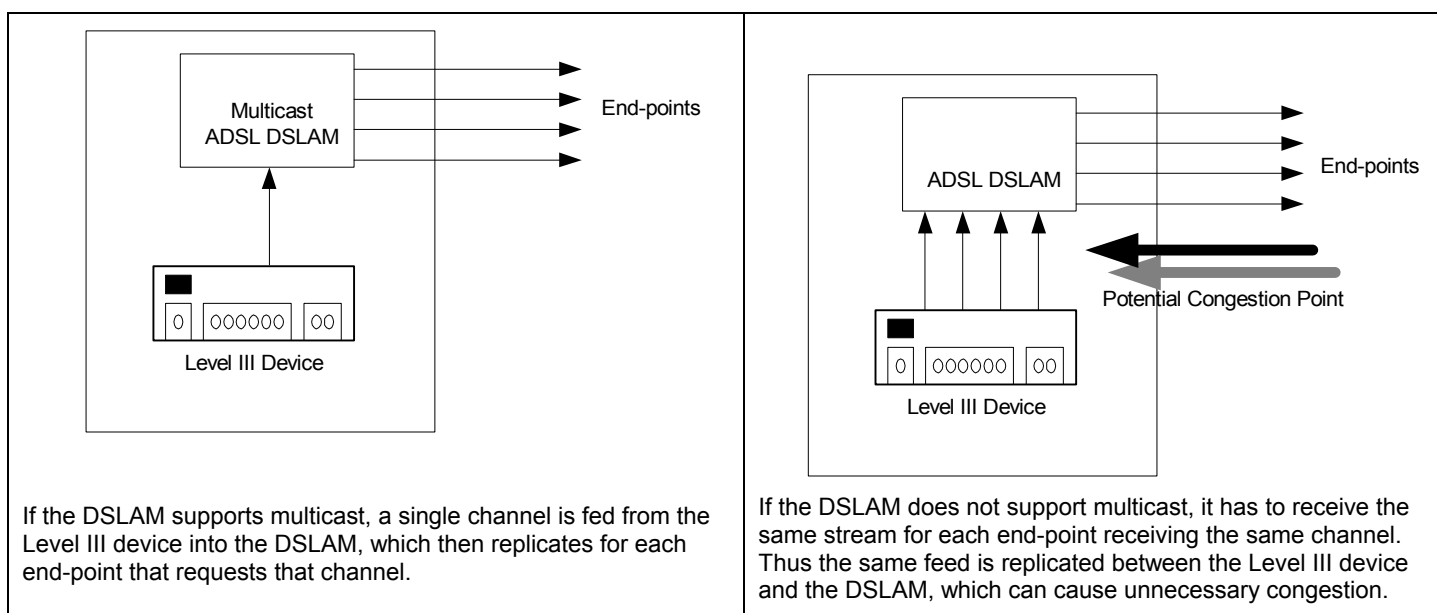
newly encoded digital content that is uploaded from the MGW server. They also enable time-shifted TV applications. For this purpose, MGW 2000 encodes all channels on a daily basis uploading them to the video server. Viewers at home can then watch any program at a time convenient to them.

Level III Device

A switch or router that supports multicast transmission. The router or switch resides at the head-end, interfacing with the network. Another router or switch receives data at the central office and transmits either to DSLAMS located there, or into end-user Ethernet based network .

DSLAM

The DSLAM (Digital Subscriber Line Access Multiplexer) resides at the central office, connecting xDSL subscribers to the backbone and subsequently to the head-end. When distributing TV over IP, the DSLAM should support multicast transmission. If it doesn't, the switch or router at the central office has to replicate each channel for each request. This can cause congestion at the DSLAM input level. If the DSLAM supports multicast, it receives one stream for each channel and replicates the stream for each end point.



CPE (Customer Premises Equipment)

The equipment located at the end-point that receives the TV/IP stream. Usually the term CPE refers to the DSL modem. The DSL Modem receives the stream from the DSLAM or level III device and transfers it directly to the PC for display on the desktop or to the IP STB.

IP Set-Top-Box

The IP STB receives the IP stream, and decodes the stream for display on the TV. Typically, the IP STB receives the stream from the CPE. Some STBs can receive the IP stream directly from the DSLAM, and serve as CPE as well.

End-point Configuration

The TV/IP stream is fed into the CPE (Customer Premises Equipment), in most cases a modem. The modem transfers the MPEG-2 or MPEG-4 stream to an IP/STB which decodes the stream for display on a TV set. MPEG-4 streams can also be displayed on PCs using the Microsoft Media Player. If there is sufficient bandwidth between the central office and the end-point, two channels can be streamed to two IP STBs.

Middleware

Middleware refers to the software that integrates the various parts of the IP over TV solution. Currently, Optibase maintains strategic partnerships with iMagicTV and Myrio, two of the leading streaming middleware providers. Middleware is installed along the streaming media chain, starting at the head-end and reaching into consumers' homes in the form of software running on IP set-top-boxes. Middleware takes care of the following:

Media Asset Management

The software that enables rich media service providers to manage content, distribution and data rights control. Media asset management includes channel management and scheduling. Media asset management solutions also let operators customize programming line-ups and update viewing rates. At the end-point, media asset management solutions let consumers create customized viewing profiles, track viewing habits and account information and implement parental controls.

Billing

The entire business model of rich media and digital TV services rests on advanced billing capabilities. Billing solutions need to be able to track individual usage based on the delivery of customized interactive content. Billing solutions integrate with other middleware solutions.

Programming

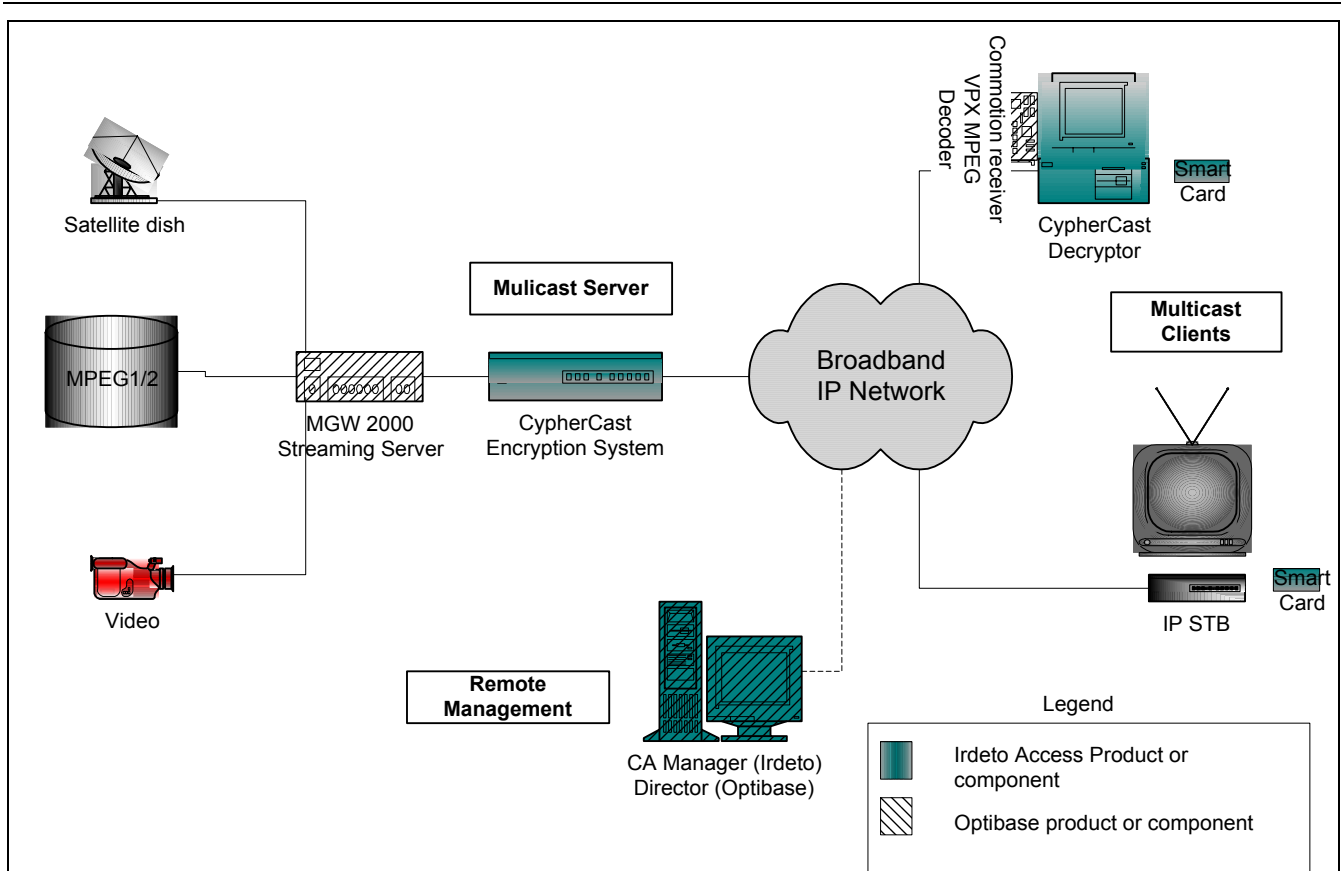
The management software controls the customized programming that is targeted at a specific user or group of users. Usually the program guide is downloaded and updated on a regular basis.

Security and Conditional Access

Security is a critical part of the streaming solution when it comes to conditional access (ensuring that content is viewed by the audience it was intended for only) and protection against piracy. Conditional access solutions use algorithms to encrypt and scramble content. Content is encrypted at the head-end and decoded by smart cards installed in set-top-boxes at end-points.

Optibase has an alliance with Irdeto Access, a leader in content protection and management. Irdeto's CypherCast™ secures and manages content, and can be used in combination with any streaming application such as streaming video and streaming data. It is independent of network equipment, and can therefore be integrated with any IP router such as a satellite IP encapsulator or standard IP routers.

At the playback station, Irdeto's Decryption System consists of software supplied on CD by Irdeto Access and multiple client PCs supplied by the customer. The customer installs the Decryption System software on the client PCs and configures the Decryption Systems. The following diagram shows how Irdeto's security solutions integrate in a streaming solution.



Application Architecture

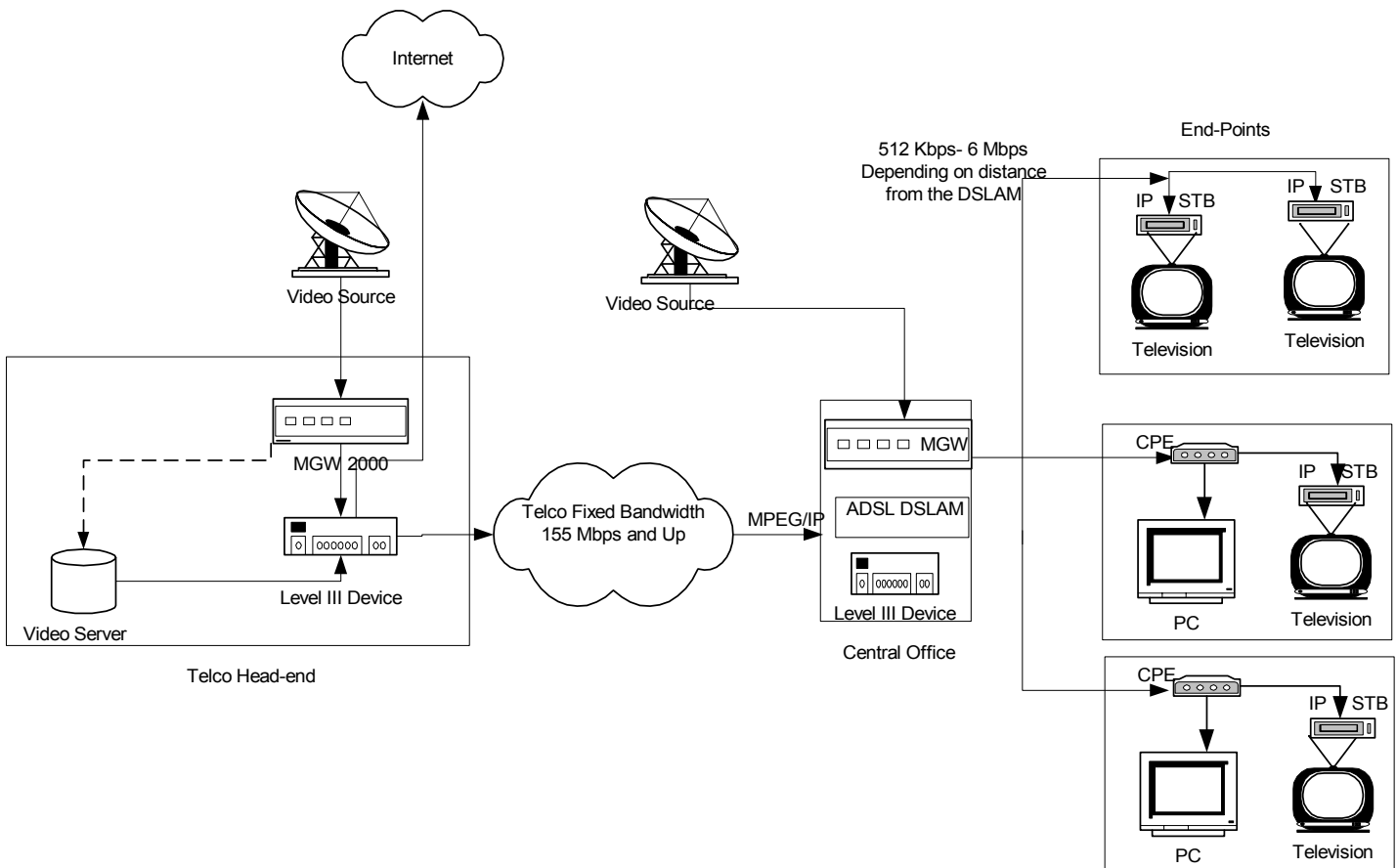
This section illustrates how to set up TV over IP applications using various network infrastructures.

TV over IP using ADSL

ADSL can support last-mile bandwidths between 512 Kbps and 6 Mbps. The actual bandwidth available depends on the distance between the end-point and the ADSL DSLAM. Depending on the last mile bandwidth available, users can receive 2 channels of video. In this case, two IP STBs will reside at the end point (one STB for each channel).

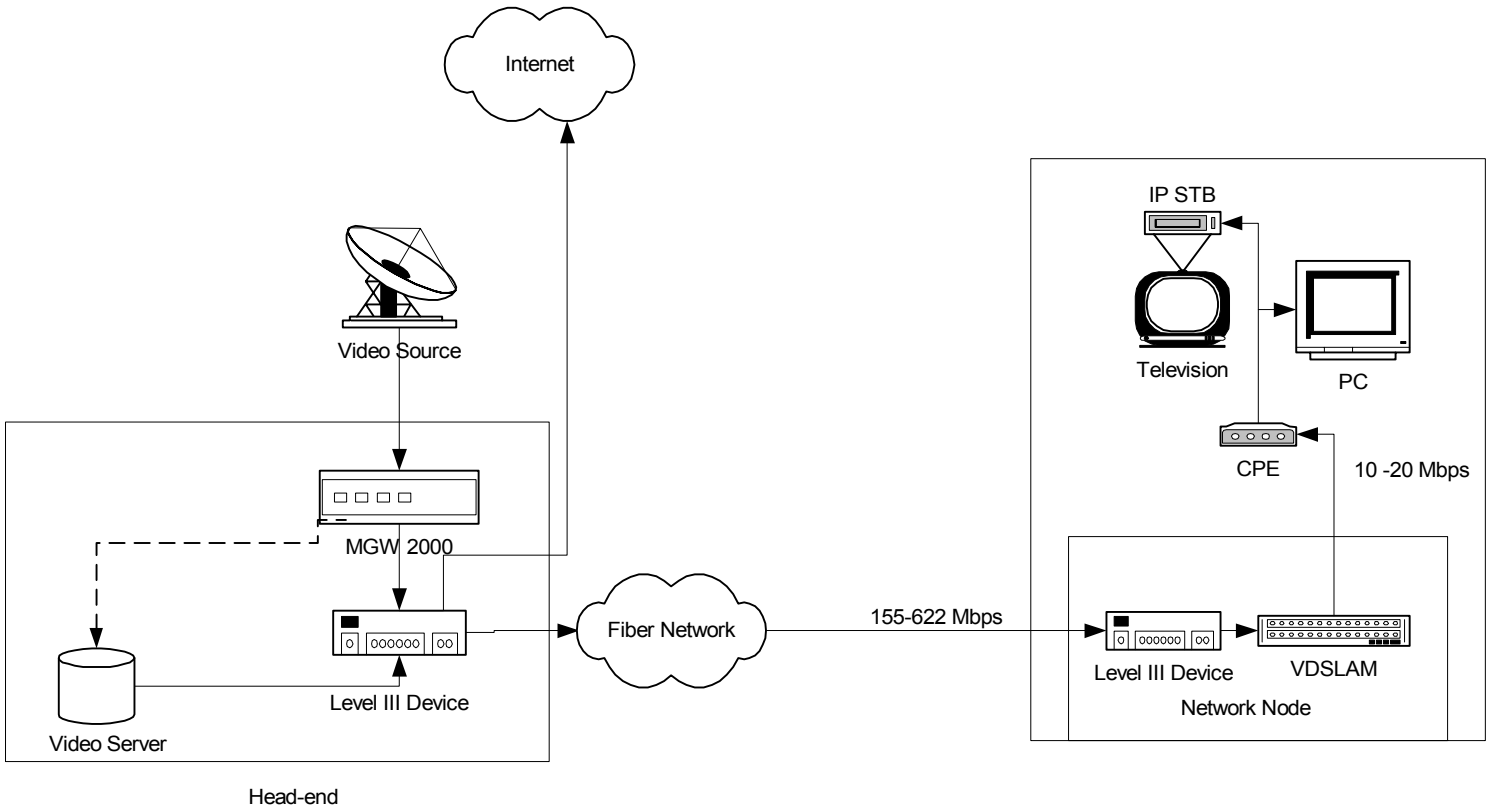
An important part of the central office configuration is making sure that the ADSL DSLAM supports multicast. If it doesn't, then the level III device has to replicate all streams for each channel requested. This is liable to cause congestion at the DSLAM. For example, if the DSLAM at the central office services 20 end-points and all end-points request channel 3, then the level III device has to feed channel three into the DSLAM 20 times. If on the other hand the DSLAM supports multicast, it would receive one stream of channel three and replicate it for each end point.

In the diagram below, one MGW 2000 is located at the head-end, and one at the central office. The MGW at the central office receives additional satellite feeds that comprise local content for distribution to a specific area or group of users.



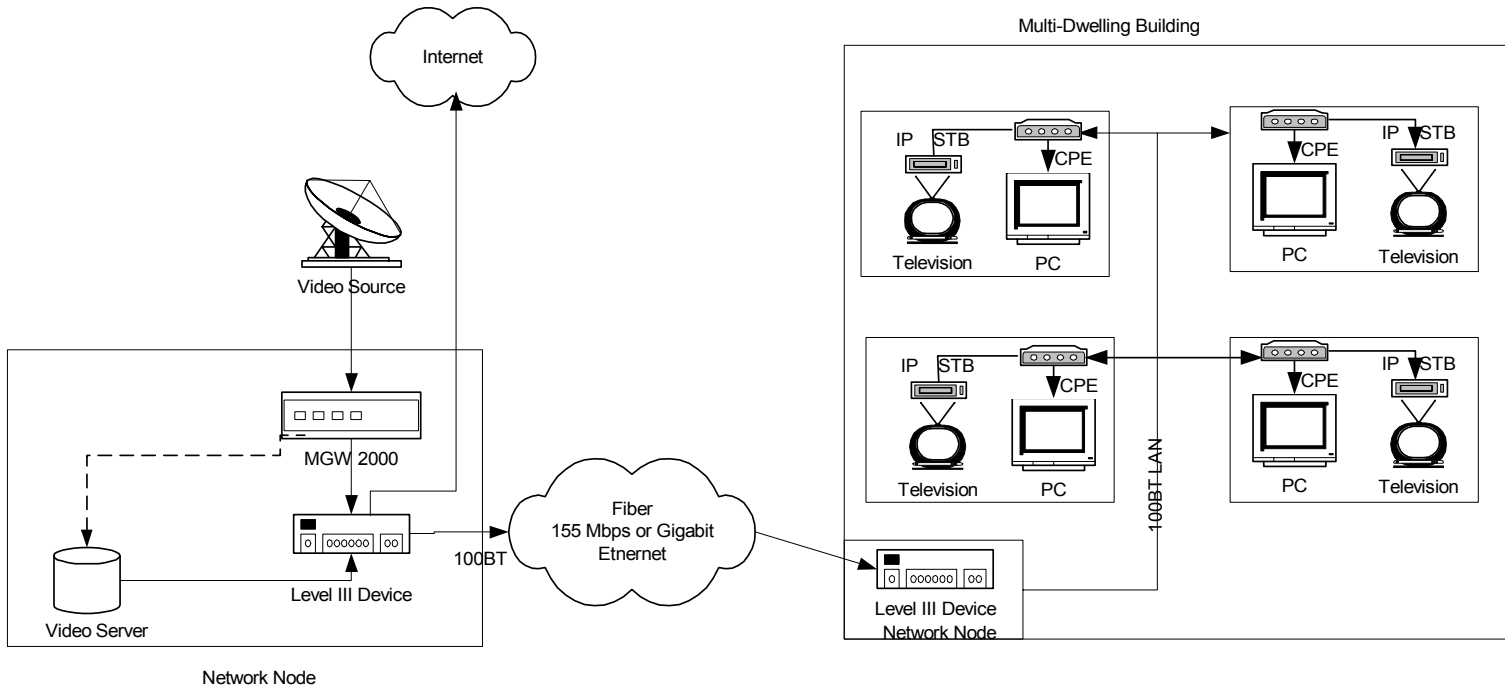
TV over IP using VDSL

VDSL configuration rests on fibre connectivity over the backbone at bit rates of 155 Mbps and up. Transmission from the last mile network node to the end point is at bit rates of between 10 and 40 Mbps. The high bandwidths supported by VDSL enable consumers to receive multiple channels for playback on multiple TV sets. With VDSL, the backbone infrastructure is based on fibre to the curb/basement while the last mile solution uses VDSL over the telephone copper line.



TV over IP using FTTH (Fibre to the Home)

FTTH configuration rests on fibre connectivity from the head-end to the end-point. In this configuration video is transmitted over a fibre backbone at more than 155 Mbps. Last mile configuration consists of a 100BaseT network. Such wide bandwidths allow users to receive multiple channels, which are played back by IP/STBs.



Optibase Solutions for TV over IP

Optibase's MGW 5100 carrier grade streaming platform is designed for TV over IP entertainment applications.

[Full MGW 5100 Product Sheet](#)

This integrated carrier grade TV over IP streaming platform streams multiple channels of broadcast-quality TV over IP and IP over ATM networks.

- Streams 24 concurrent encoded channels plus multiple DVB to IP converted program transport streams.
- Encodes MPEG-1, MPEG-2, WMT, MPEG-4 ISMA
- Transcodes 24 MPEG-2 sources to all formats: MPEG-2, MPEG-1, WMT and MPEG-4 ISMA
- Converts MPEG-2 over DVB-ASI or DHEI to MPEG-2 over IP
- Supports FTP, Unicast, Multicast and Multi-unicast outputs
- Supports IP over Gigabit/100BT Ethernet and IP over ATM (IpoA) OC-3/STM-1 interfaces
- Supports real-time upload to standard video servers
- Carrier grade cPCI platform with hot-swap, hot-insertion of all removable components and VxWorks real-time OS
- Integrated solution with no single point of failure