

# Deliver Cable TV over T1 & DSL

"MPEG4"

## THE FUTURE OF CATV PART 2

**CATV often misses real revenue opportunities for municipal government, public safety, education, healthcare and business. Here's how to leverage alternative transport methods like DSL and T1 to bring in new video revenue dollars.**

Face it, there they sit, over in no-man's land. Those customers who have been whining for connectivity since you came to town. You know them. City Hall, the Vocational Center, the Park District, the Bank... Maybe you're looking at a franchise that prohibits you from running data UNLESS there's also video in the sheath. Maybe your local TELCO is getting into your shorts by offering video over DSL. Maybe you realize that video isn't the exclusive market it used to be and that you have to fight to get and keep your customers.

Time to regroup. Time to rethink.

We can help you. The goal of Radiant Communications Company is to develop and support a complete set of solutions for operators like you. Our systems are in use in 85% of the headends in the USA and many overseas. We're pioneering value-added solutions so you can recover more profit from your systems.

**Our goal, in this Application Note**, is to describe the specific techniques of delivering video using alternatives to broadband and HFC. Namely, we'll show you how to craft a simple to install, simple to operate and simple to maintain video over DSL or Video over T-1 transportation system.

### Who Needs This?

1. This note is for you if you are constrained in your franchise from delivering DATA services because you also have to deliver VIDEO services in the same sheath.
2. This note is for you if you are LOW ON CAPITAL and cannot justify running physical plant to new customers.
3. This note is for you if in addition to owning and operating the local or regional CATV system, you're also a CLEC, delivering traditional telephony services and circuits

**Let's Talk Technology.** Before we get into the nuts and bolts of how this works, let's define a few terms:

1. **T1** – This is the Bread and Butter, Plain Vanilla circuit that's been around since 1956. Imagine that! It's a digital circuit. That means that the electrical pulses on the wire conform to an "On-Off" code as the input signal changes. Data is a series of voltage changes within a set time period. OK, that's the tekkie stuff. It operates at **1.544 Megabits per Second which we'll call Mbps from now on.** A T-1 is full-duplex with a dedicated link each for data transmission [Tx] and data reception [Rx].

T1s are used to connect PBXs [Telephone Switches] together and to connect routers.

2. **DSL** – This is the TLA [Three Letter Acronym] for **Digital Subscriber Line.** It's been with us since the 1980's but only in the last 5-10 years have the standards and products been adequate for the TELCOs to invest in adding to their Central Offices and rolling out DSL. Like any technology, it's had its fits and starts and it has certain physical limitations that makes it expensive to deploy system wide. It works by using an external input [your data] to change a signal operating on COPPER WIRE at a frequency far away from telephony signals. Your existing phone line is used to carry both your phone traffic and the DSL frequency. Just like a radio tuned to a particular station, the DSL modem is configured to listen and talk on these "above telephony" frequencies

DSL comes in many flavors to meet the needs of a wide variety of consumers.

- a. **ADSL – Asymmetric Digital Subscriber Line.** This is the most common residential and small business line. Asymmetric means that transmitting from your office is slower than receiving. The circuit is lopsided. ADSL was created because bandwidth is a precious commodity and most subscribers are Internet surfers, wanting more data coming in than they send out.  
  
ADSL speeds are typically sold at either 768Kilobits per second [Kbps] downstream [your "receive rate"] and 128 Kbps upstream [your "transmit rate"]. Or, for power users, you can buy 1.5Mbps Down and 256Kbps upstream.
  - b. **SDSL – Symmetric Digital Subscriber Line.** An SDSL circuit has the same transmission and reception bandwidth.
3. **IP – Internet Protocol.** IP is a set of rules that governs the management of packets of data over a physical infrastructure like Ethernet, SONET or ATM. When we say Video over IP, we mean that we're going to input Video at Baseband [Video & Stereo Audio] and digitize it then we're going to compress that digital signal. We'll then PACKETIZE the digital signal [break it up into little snippets] and when we packetize, we look up the rules [IP] and do the following:
    - a. Add a packet for origination address
    - b. Add a packet for destination address
    - c. Add a packet defining the type of data in the packet
    - d. Add a packet coding the priority the originator wants the network to set
    - e. And some more tekkie stuff only the engineers understand.

4. **Video Compression.** It would take about 210Mbps of bandwidth to carry an uncompressed video signal with the associated stereo audio channels. Obviously, this is unreasonable in a CATV system so we must find a way to shrink the bandwidth requirements while MAINTAINING a high quality signal. We call this Video Compression. The most popular and versatile method is called MPEG.
  - a. MPEG1 – VHS quality, the original, low cost method. Not suitable for most CATV applications. Good for PEG channels, city hall video, video arraignment
  - b. MPEG2 – Broadcast TV & DVD quality. The number of bits coded for Luminance, Brightness and Chrominance is indicated by 4.2.0, 4.2.2 or 4.4.2 for 6bit, 8 bit and 10bit coding respectively. 10 Bit is used in post production studios to produce TV commercials and HDTV programming. 8Bit is often used in TV broadcasting for commercials, and 6 bit is the standard definition [SD] found in DBS satellite, DVD disks and Cable TV.
  - c. **MPEG4 – Low Bit Rate Video. Used in Video Games, also for use over the Internet, DSL or T1 lines for real time video conferencing and video streaming. Uses a fraction of the bandwidth of MPEG2. THE NEW STANDARD FOR QUALITY IN LOW BIT RATE VIDEO**
  
5. **Radiant RM1100.** The Radiant RM1100 series is an MPEG4 Encoder and Decoder as well as a REMOTE CONTROLLER for centralized Set Top Boxes, Laser Disk Players, Security & Surveillance Systems, VCRs and any other device that can be controlled by an Infrared Remote Controller.
  - a. The RM1100 **breaks new ground** in providing Cable TV Systems Operators and Telephone Companies new opportunities to generate revenue by delivering video and audio over as little as 100kbps
  - b. The RM1100 is an **Ethernet Attached APPLIANCE**. It conforms to all industry standards and will work on any Local, Wide or Metro Area Network [LAN/WAN/MAN]
  - c. The RM1100 works with YOUR LAN and will **throttle back automatically** [this is user selectable] if the network link gets congested. Conversely, the RM1100 can be **configured to set priority** to all packets leaving the device, guaranteeing throughput in networks where Quality of Service [QoS] Packet Prioritization is available.
  - d. The User has the ability to CHOOSE what is more important, **Bandwidth or Quality**. Also you can configure the RM1100 to fix a set bandwidth, a set quality level or let the system run in automatic mode.
  - e. The RM1100 is designed to work with the **customer's own PC** [using Radiant **"RM-PC Vision™"** Software] or with the Radiant RM View Station.
  
6. **Radiant "RM View Station™"**

The Radiant RM View Station **includes a dedicated PC** that:

  - a. Allows the client to **view and control** the video & audio on the PC screen
  - b. Provides for connections to a **large screen TV Monitor or a Projector**
  - c. Is Ethernet attached and is assigned **an IP address on the customer LAN**
  - d. Controls an RM1100 in the Head End or Central Office
  - e. The RM View Station delivers Superior Quality since it is optimized for the system and the application and runs no other programs.

## BENEFITS OF LOW BITRATE TRANSMISSION FOR CABLE TV

Adds a new source of revenue & subscribers

Puts the Control of Bandwidth vs. Quality in your hands

Provides “Video in the Sheath” compliance

Provides remote monitoring of analog and digital channel line-ups at your unmanned hubs & headends

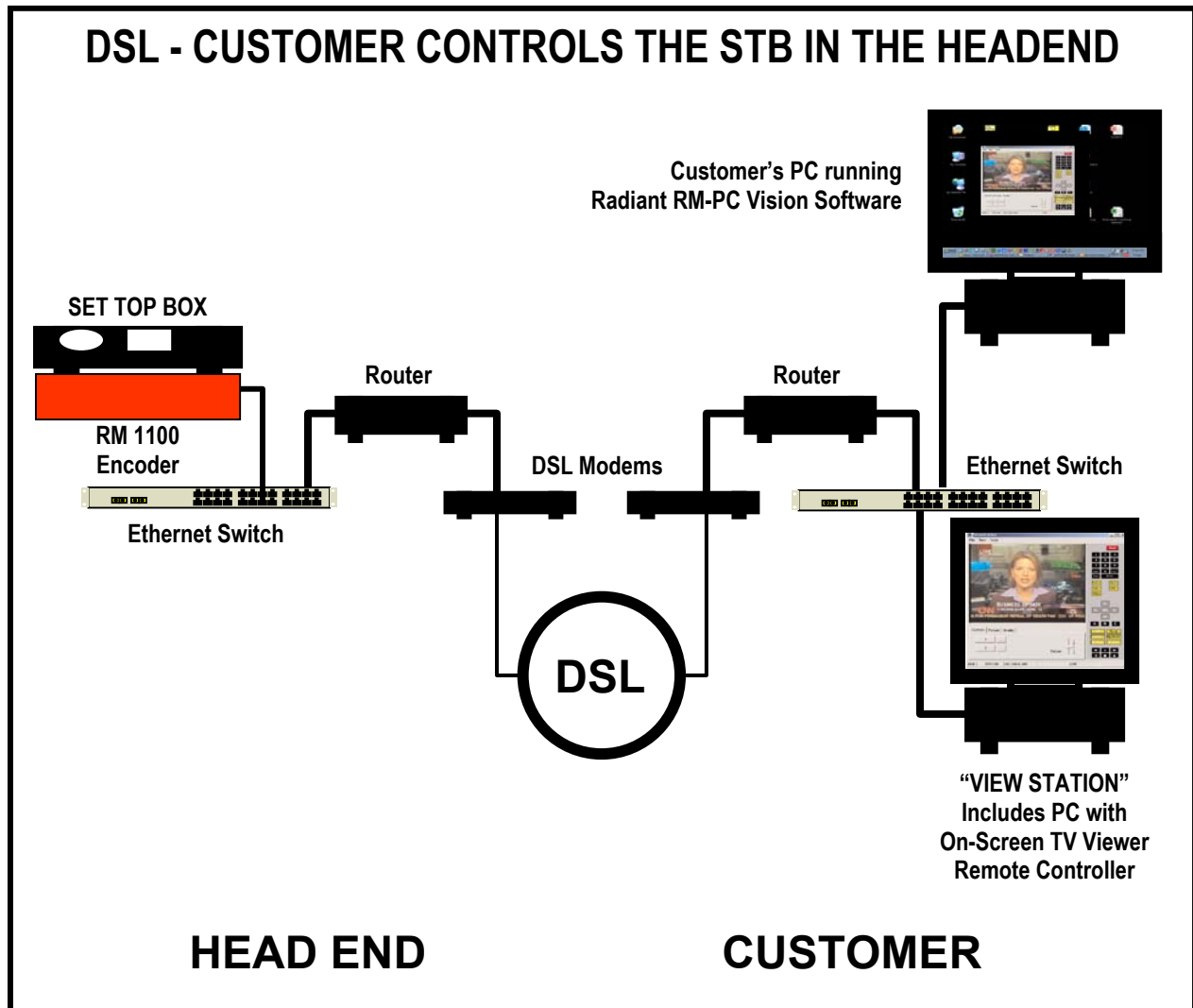


Figure 1. In this diagram, we show how DSL can be used to transport Cable TV one channel at a time. With the Set Top Box [STB] located in the Head End and the Customer “RM PC Vision” software loaded on a dedicated PC, the customer can control the STB and the Radiant RM1100 Video Encoder from his remote site. One channel at a time is transported over the DSL channel.



## VIEW STATION WITH EXTERNAL TV MONITOR OR PROJECTOR

The On-Screen IR Remote will control ANYTHING a Physical IR Remote can control.

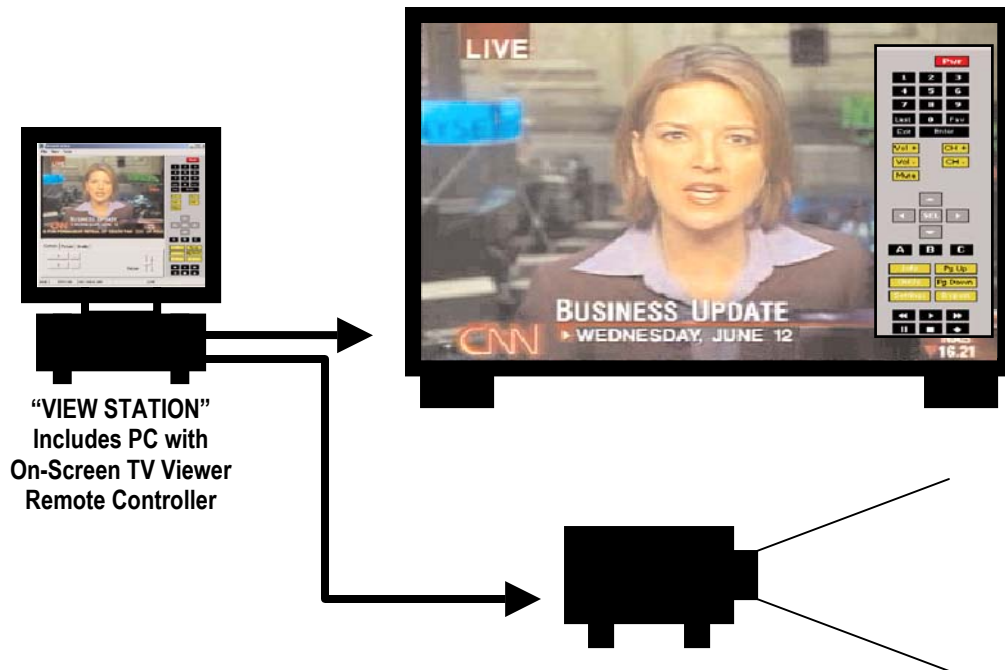


Figure 3. The View Station Dedicated PC is an IP addressable device sitting on the Customer’s Local Area Network. It can be used in Stand Alone Mode or as a Controller for an externally attached [Composite Baseband Video w/ Stereo Audio] TV Monitor or Projector.

## ADD VIDEO TO A CUSTOMER DATA NETWORK

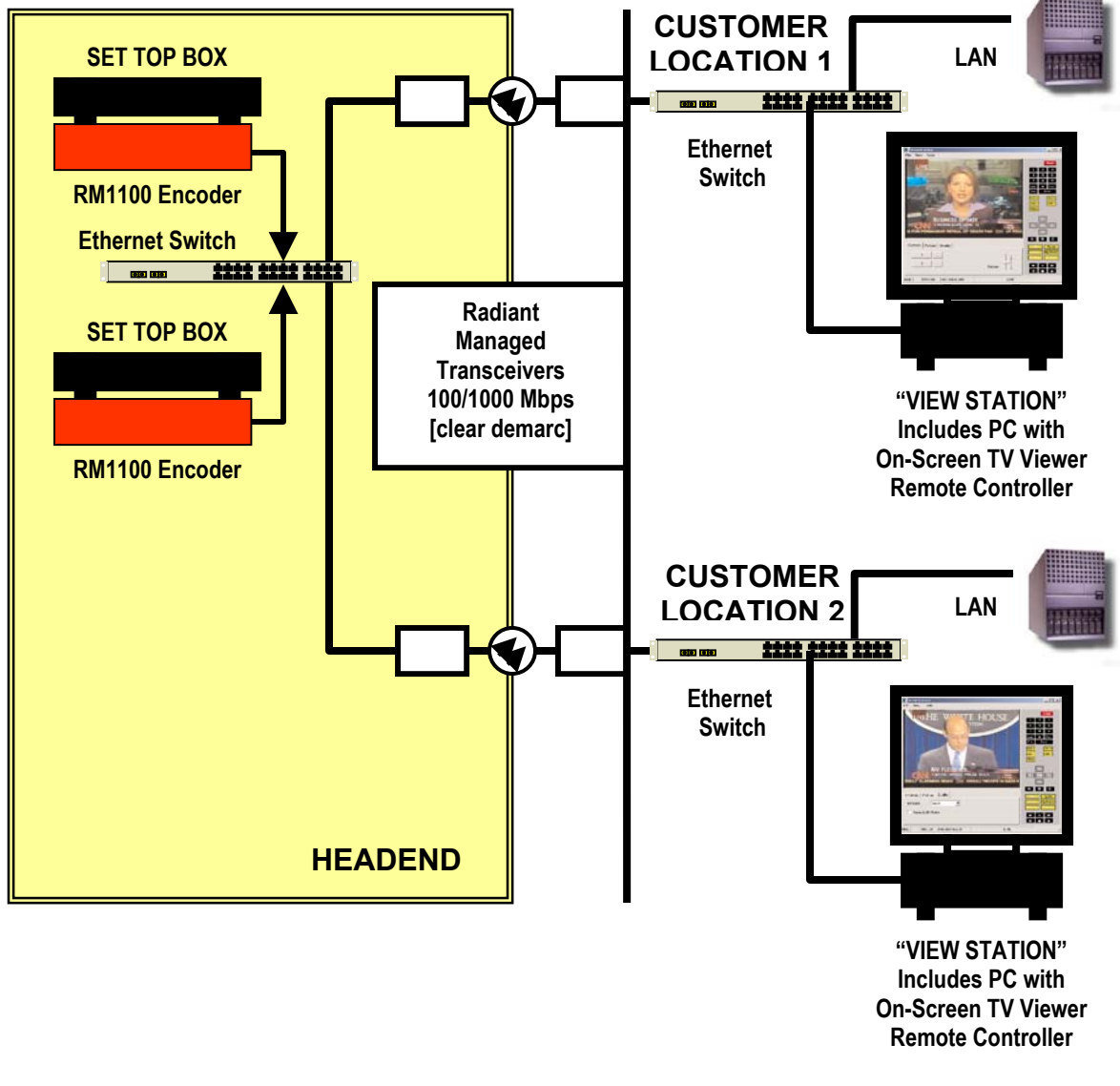


Figure 4. This diagram shows how an entire line-up of CATV can be transported **ONE CHANNEL AT A TIME** along with the data traffic for a client's data network. In addition to creating a managed Ethernet Metropolitan or Wide Area Network [MAN/WAN] to connect your client's Local Area Networks [LANs], you can add Video to their data network and use as little as 100Kbps of bandwidth to comply with "Video in the Sheath" requirements.

Each View Station is assigned an IP address on the Customer's Local Area Network. Their networks can span multiple Head Ends and even use the Public Data Network.

## SERVING MULTIPLE CUSTOMERS USING HEADEND ETHERNET VLAN PORTS

A VLAN [Virtual LAN] is a way to deliver security within a single Ethernet Switch or across a Metro Area Network. Each port or any selected ports can be configured to become "Members" of a secure LAN. In this example, we show three VLANs.

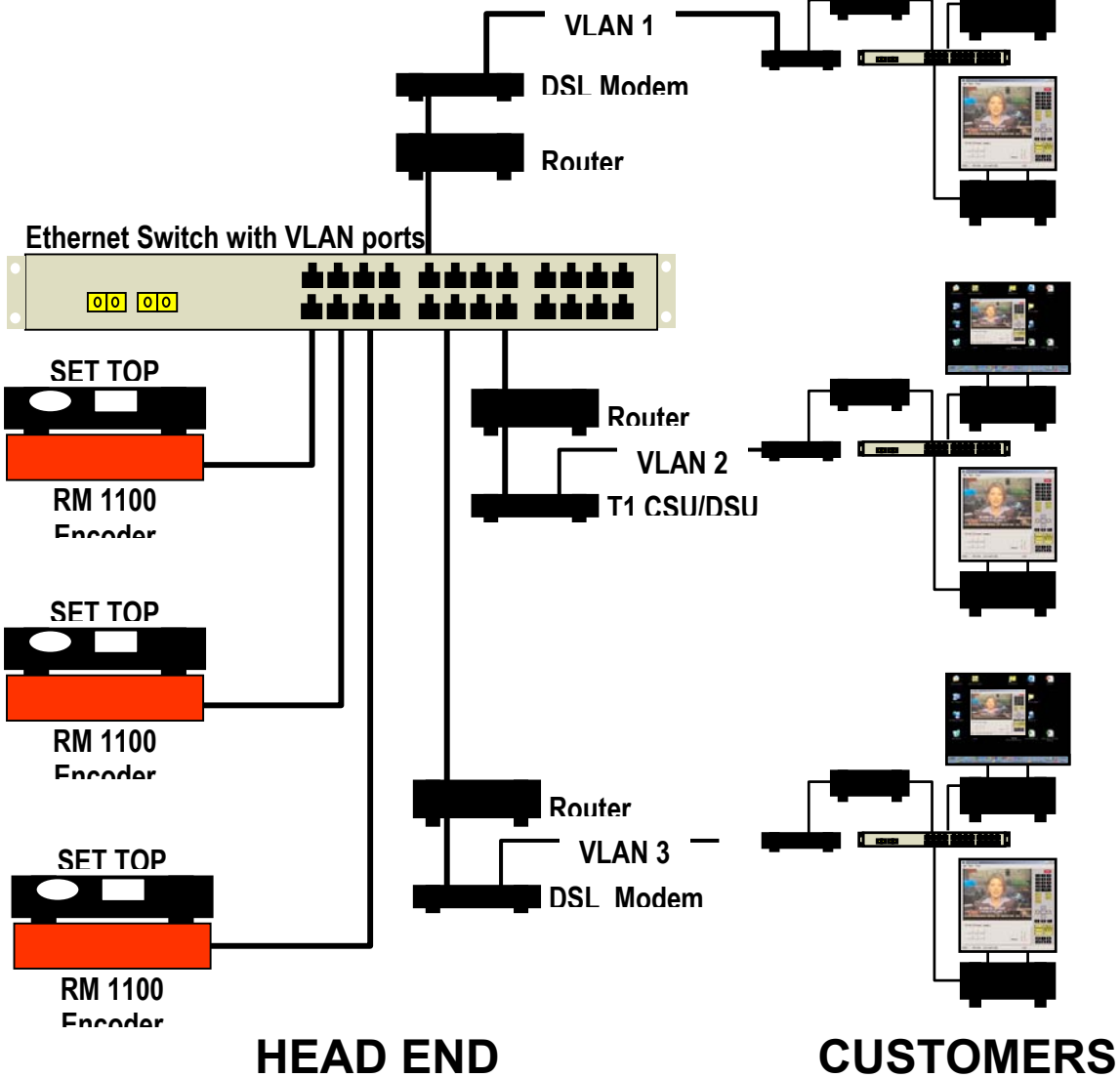


Figure 5. In this diagram we illustrate how a Cable TV system operator can deploy multiple "Low Bit-Rate" Video Transmissions using one Ethernet switch. By using a switch feature called VLAN, we can segment the switch ports into SECURE, INDEPENDENT, and VIRTUAL Local Area Networks. The benefit to the operator is lower capital costs to deploy the service and the benefit to the client is security.