

IP Video and its bandwidth requirements.

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### IP Video idea

The plan is to migrate video away from RF broadcast video and move to broadcast video over the IP network. This allows use of all RF spectrum for data and removed the need of sharing the RF plant between video and docsis.

### IP Video design

The design is broken up into a few components. These are:

1. Back office
2. Origin
3. Transcoding
4. Market/Caching/Streaming servers
5. Set Top Box (STB)

The back office, origin and transcoding are all located at the same location under the current design. After the video is transcoded it is pushed out to the market streaming servers. These servers get one push of this video for each bit rate. The broadcast video is sent out of the transcoding servers via multicast, over NG-MVPN LSPs, to the Market servers/Streamers. The VOD content is sent via Unicast.

The Market servers and Streaming servers will be located in each Hub H location. These servers store the VOD and they supply VOD to the STB when it is requested. They will send the broadcast video directly to the STBs viewing that stream as soon as it arrives from the transcoders. There will be buffering of this video in the streaming servers to accommodate trick play. These servers will send the video streams to the STB and will be the sole source of streams to the STBs they service. At this point this is a unicast operation. The vendor is looking into Multicast for the broadcast video streams to the STB.

The STB located at customer sites will be the source of the customer request for video. The request will be passed up stream from the STB to the market servers at the local Hub H. The market servers will connect to either the billing system or the Back Office to authorize the playback. Assuming the playback is authorized then the Market server, which is also the streaming server, will begin sending the stream. The stream will consume 5Mbps to each set top box on average, with bursts up to 6Mbps. A hub, with 500 Sw!vel homes and 3 set tops each, can generate 7.5Gbps of traffic to that hub site and out to the CMTS Customers. This process and the results are similar for both VOD and broadcast video playback.



### Network Use

With a 5% customer penetration of Sw!vel, each 10K households equates to 500 Sw!vel households. 500 households can amount to 7.5Gbps of unicast traffic sourced from the streaming servers. So a market with 5 hubs plus the head end would have 5 x 7.5Gbps leaving the Head End cache cluster and another 7.5Gbps going directly into the docsis plant at the head end itself. This amounts to 45Gbps from the streaming server cluster and 37.5Gbps, in aggregate, leaving the Head end going to the hub sites.

### Network Impacts

In most cases this network growth will require a network augmentation in the markets. Our current growth plan included a 60% growth over the current year and this would more than double that in most cases.

In most cases we are comfortable with a growth of about 400 Sw!vel STBs in a given market/Head End before we will want to be augmenting capacity.

Each 2000 STBs planned at a hub will need an additional 10G of redundant capacity to that hub from its Head End.

### Capacity Planning

Overall, there will be many markets where the connectivity from the head end to the hubs will need to be increased ahead of normal organic growth. A ring market such as Huntsville will need 10G added to the ring for each 2000 STBs at any hub. A hub and spoke market such as Pinellas will need an additional 10G on each of its redundant paths for each 2000 STBs.

### Management Network

Management of these servers will be based on an L3 VPN. At the Head End this will be represented by an L3VPN connected to a vlan on the primary EX stack. Each server will get a management port. We should start with each Head End having a /27 worth of space for the management of the eVUE servers. This can be rfc1918 space. The core equipment within the MDC should have a /25.

This L3VPN should be connected to either the corporate firewalls in Columbus, Oh and West Point, Ga or new firewalls should be rolled out for this type of management network. This needs to be discussed as a long term issue for this and other projects. These firewalls will need to allow certain corporate users as well as corp VPN users access to the management L3VPN but also point to Point VPNs to the manufacturers offices for their access.

### Content Network

The content interfaces of these servers will be 10G ports directly attached to MX routers. These servers are running Linux and using IP Tables to protect themselves. Each of these interfaces is capable of running a full 10Gbps, so they need line-rate interfaces. They should be accessed only by STBs within the market. But they can be accessed from any of the markets hubs and will be load balanced based on server load. They will also be sent content updates and Broadcast video streams from the VOD and Encoding servers based in the MDCs. So there will be a number of unicast pushes nightly, during scheduled off-peak hours, to these servers from the MDC servers and 24/7 there will be a multicast push for the broadcast video streams.

### Security

The management L3VPN will be secluded behind a pair of firewalls. The only access to the management interfaces of this equipment will be through those firewalls. This will include both outside access and internal access.

The communications on the public side of the systems will be handled and filtered by the servers themselves using IPTables. This will be managed through the eVUE gui. Largely this should be automated.