



Tvooverlan IP Network Performance Requirements

Issue 1.0

18 November 2008

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Acronyms & Abbreviations

Acronyms or abbreviation	Description
§	Section
DHCP	Dynamic Host Control Protocol
DNS	Domain Name Server
DVB	Digital Video Broadcasting
HNED	Home Network End Device
IGMP	Internet Group Management Protocol
IP	Internet Protocol
IPTV	Internet Protocol TeleVision
MPEG	Moving Picture Experts Group
MTU	Maximum Transfer Unit
NTP	Network Time Protocol
PIM-SM	Protocol Independent Multicast-Sparse Mode
RTSP	Real Time Streaming Protocol
SD	Standard Definition
STB	Set Top Box
TCP	Transport Control Protocol
TS	Transport Stream
UDP	User Datagram Protocol
VLAN	Virtual Local Area Network
VNC	Virtual Network Computing
VoD	Video on Demand
VPN	Virtual Private Network

Glossary

Term	Definition
Client	A STB or PC connected to the TvoverLan network
ThinPC	A client machine that relies on the server to perform the data processing. Either a dedicated terminal or a regular PC with thin client software, thin clients mostly send keyboard and mouse input to the server and receive screen output in return. The benefits are improved maintenance and security due to central administration of the servers in the datacenter.
Signage	A TvoverLan product. TOL-Sign enables a range of visual content to be combined in groups and displayed to a number of display devices on an IP network. TOL-Sign allows the customer to communicate the following concepts to its target audience: <ul style="list-style-type: none"> Advertising Real Time Information Live Video Recorded Video Textual and Images Brand Awareness Promotions

1 Introduction

This document specifies the details of the requirements of an IP network to implement TvoverLan's IPTV, video and signage products. This document covers general network performance requirements, multicast support, DHCP, and external connectivity.

The general requirements on the IP network are to provide a reliable, high-speed network, capable of supporting multicast.

A basic network layout is shown in Fig. 1. This is intended as a guide to identify the essential components only, since each installation will have different details, number of servers, switches etc. This network depicts a flat, single VLAN network. If multiple VLANs are used, or if routers are present in the network, then additional multicast support is required, which is beyond the scope of this document.

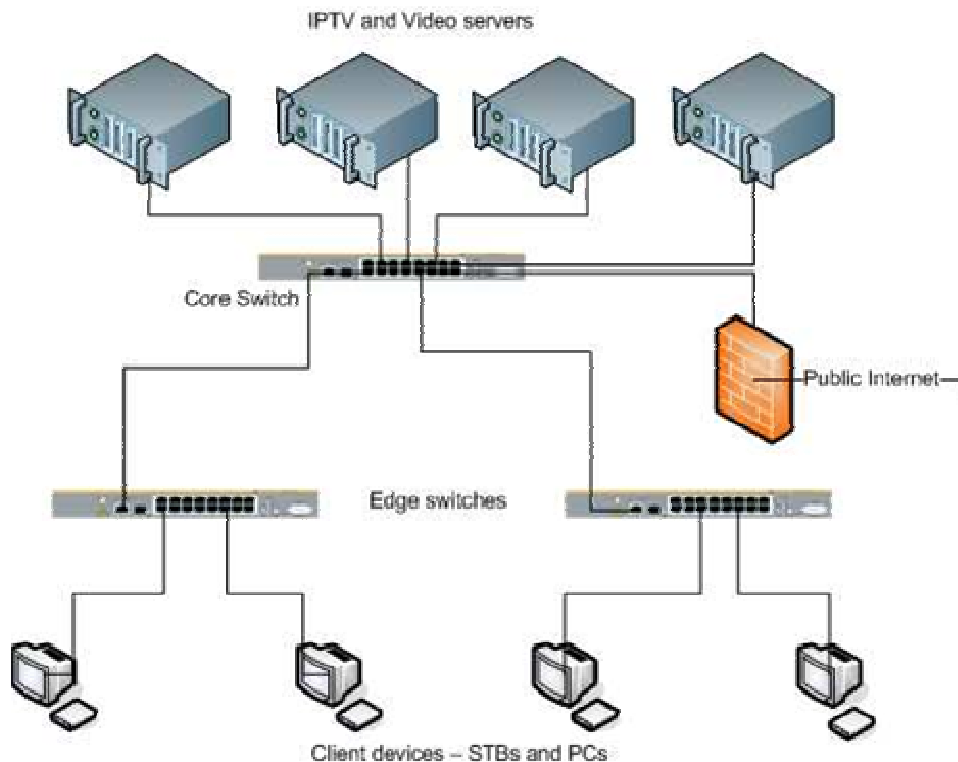


Fig. 1, Basic network layout for Tripleplay IPTV and Video systems

1.1 References

- [1.] ETSI spec TS 102 034 "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks".
- [2.] TvoverLan "TvoverLan Services System Security" document.
- [3.] TvoverLan "Windows Server 2003 DHCP Configuration" document

2 Network Parameters

The basic unit of transmission for IPTV/Video is a UDP packet with 7 Transport stream packets. Each TS packet is 188 bytes, giving 1316 bytes per UDP Datagram. Therefore to avoid UDP fragmentation, the core network should be configured with an Ethernet MTU of 1500.

The core switch should provide a Gigabit (1000Base-T) interface for each IPTV/Video server. Note that for some configurations, such as off-air video recording, or video processing, a significant amount of traffic will be flowing between the IPTV and Video servers, in addition to the media traffic being generated for the edge client devices.

1000Base-T or fibre is recommended between the core and edge switches although in small deployments where edge switches will receive less than the equivalent of 20 SD streams of 4 Mbps 100Base-T can be used.

The edge switches should provide a minimum of 100Base-T to the edge devices.

For very small deployments, for example where there are only a dozen or fewer clients, a single switch can be used. In this case, the switch should implement a querier and snooping to ensure that the client devices are not swamped with unwanted traffic.

3 Multicast Requirements

To efficiently distribute IP multicast traffic to the edge client devices, the network should support multicast. There are two main ways to support multicast – simple flat network using IGMP snooping, and routed or VLAN'd networks using PIM-SM. The use of PIM-SM requires advanced networking equipment and vendor specific configuration, which is beyond the scope of this document.

3.1 Switch requirements for IGMP snooping

In a network where IGMP snooping is being used to implement multicast support, the following features are mandatory:

There must be an IGMP V2 querier in the network, and it is recommended that this is located at the core switch to reduce the amount of traffic carried over links to the edge switches. A query period of 120 seconds is recommended.

The edge switches must support IGMP V2 snooping. It is recommended that an edge switch be configured with fast-leave in order to minimise the traffic presented to the edge devices during channel changes.

4 DHCP Requirements

DHCP is used by the TvoverLan system to provide addressing and configuration for the client devices, such as ThinPC clients or Amino STBs. There are two commonly used methods for providing this: TvoverLan's DHCP configuration, and the customer's DHCP configuration. The TvoverLan DHCP server is integrated into one of the servers deployed as part of an IPTV/video system. This is provided with configuration and management tools allowing the customer to manage the DHCP configuration.

The use of a customer's DHCP server is also supported, but there are fewer management options for STBs, and the ability to reconfigure them is reduced. For customers who have a Microsoft Windows Server 2003 DHCP server, TvoverLan have produced a guide allowing this to be used with the TvoverLan systems [3.].

5 TCP and UDP port usage

The TvoverLan servers expose a number of TCP and UDP ports in order to provide access to the services they provide. In addition, they use a number of TCP and UDP ports internally. Finally, they also require access to a number of external sources. This section describes the details of these ports.

5.1 Streaming media ports

The IPTV and VoD systems send the media to the clients using predefined ports. By default, the port number used is 1234, but this can be changed on a per stream (IPTV and VoD) basis.

The signage clients and STB clients use a default port number of 1234 for the reception of the media.

5.2 Ports used by the Amino STBs

The Amino STBs are managed using a number of predefined multicast addresses. These are described in Table 1.

Address	Port	Purpose
225.10.10.10	11111	Multicast management of STBs
225.50.110.1	11111	Bootstrap image for A110 STBs
225.50.110.2	11111	Upgrade image address for A110
225.50.111.1	11111	A110H bootstrap image
225.50.111.2	11111	A110H upgrade image
225.50.120.1	11111	A120 bootstrap image
225.50.120.2	11111	A120 upgrade image
225.50.130.1	11111	Bootstrap image for A130
225.50.130.2	11111	Upgrade image address for A130.
225.50.131.1	11111	A130H bootstrap
225.50.131.2	11111	A130H upgrade

Table 1, Ports used by the Amino STBs

Note: Only the streams required to support the installed type of STB will be enabled for a specific site. For example if the site has only A130 devices installed, then only those streams will be enabled.

5.3 Open TCP and UDP ports

Open TCP and UDP ports are used by external systems to communicate with the TvoerLan servers. They need to be made accessible to all clients wishing to manage the servers or to access the media services — See Table 2.

Port	Direction	Protocol	Comments
21	Listening	TCP	FTP server used for content upload from CDMS and signage.
80	Listening	TCP	HTTP: Used for accessing the portal, and for the signage clients.
443	Listening	TCP	HTTPS: Used for the management interface.
22	Listening	TCP	SSH: remote access.
5801	Listening	VNC	Used for remote management.
5901	Listening	VNC	Used for remote management.
8554	Listening	RTSP	Used to control the VOD streaming server

Table 2, Open TCP and UDP ports

5.4 Internal TCP and UDP ports

Internal TCP and UDP ports are used internally for the operation and management of the platforms and access is not needed by any external entities — See Table 3.

Port	Direction	Proto	Comments
25	Listening	TCP	Internal port for use by sendmail.
3306	Listening	TCP	MySQL database.
5114	Listening	TCP	The TOL-Lock license server.
9900-9999	Listening	TCP	Used for the management of the IPTV streamer processes
8654, 8655	Listening	TCP	Used internally by the RTSP subsystem.
11000-11009	Listening	TCP	Used to control TOL-Shift recorders.

Table 3, Internal TCP and UDP ports

6 External Connectivity

External connectivity is required to provide NTP synchronisation and to allow the TvoverLan servers to connect to the TvoverLan VPN network for remote monitoring.

To provide external connectivity via the VPN, a connection to the Internet via a firewall should be provided. The firewall should prohibit all incoming Internet traffic reaching the TvoverLan servers. Outgoing port TCP/8000 should be opened to allow the TvoverLan servers to connect to the VPN. Port 123 (TCP & UDP) should be opened to allow the TvoverLan servers to connect to an NTP server in order to maintain accurate time. In addition, a DNS that can resolve Internet addresses should be available to resolve the VPN server address. This is summarised in Table 4

Port	Direction	Protocol	Comments
8000	Outgoing	TCP	VPN connection to TvoverLan VPN server
123	Outgoing	TCP/UDP	NTP time servers
All	Incoming	TCP/UDP	Blocked for all incoming traffic.
DNS	Outgoing		The TvoverLan servers must be able to access a valid DNS server that can resolve public Internet addresses.

Table 4, External Connectivity

The TvoverLan Security document [2.] provides details of the VPN and TvoverLan's security policies.

7 Network Performance

For IP video services carried over IP networks, ETSI spec TS 102 034 "Digital Video Broadcasting (DVB); Transport of MPEG-2 TS Based DVB Services over IP Based Networks". [1.] Specifies the network's requirements. The following is an extract from this document, giving the general network performance requirements in terms of jitter and packet loss. In order to provide reliable and error free video, these limits apply to the total network from IPTV/Video server to the edge device.

“The IP network shall comply with the mandatory network requirements to guarantee successful delivery and decoding by compliant HNEDs” where an HNED is defined as “Home Network End Device (HNED): device that is connected to a home network and which typically terminates the IP based information flow (sender or receiver side)”.

The packet jitter has a maximum of 40ms p-p. “Packet jitter is defined as the variation in delay between the source of the stream and the end device. The peak-to-peak jitter, J , implies that the deviation in network delay, d , is bounded by $-J/2 \leq d \leq +J/2$. To be more precise, the HNED shall comply with the MPEG-2 Real Time Interface Specification (ISO/IEC 13818-9 [64]) with $t_{\text{jitter}} = 20 \text{ ms}$ ”.

For packet loss, it's recommended to be a “MAXIMUM one noticeable artefact per hour” and “The IP packet error rate that results in this quality level depends on the transport stream bit rate. For a 4 Mb/s transport stream with seven transport stream packets per IP packet, one error per hour is equivalent to an IP packet error rate of less than 1×10^{-6} .”

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