

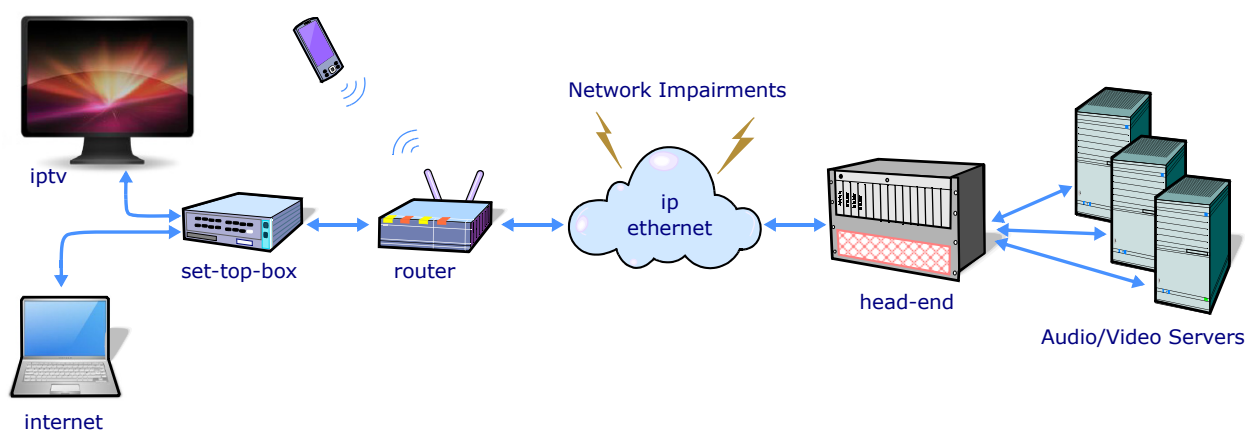
# IPTV roll-out & verification

## 1. ABOUT IPTV AND VIDEO QUALITY

Consumers demand high quality for the IPTV services but they can't describe the IPTV quality using technological terms when we know that when the IPTV service is degraded producing effect like the following:

- *No Service.* Frequent service interruptions, wrong formatting, very high latency, authentication problems to watch private programs like pay-per-view.
- *Video degradation.* Frame freezing, blurring, visual noise, loss of color, edge distortion, pixelation, tiling.
- *Audio degradation.* Drop out, bad lips synchronization, voice distortion, bad signal to noise relation, echo.
- *Interaction.* No zapping capability, loss of VoD functions like start/stop/fwd.

- Customer Premises Network - | - Distribution Network - | - Transport Network - | - Contribution Network -



**Figure 1** IPTV network with all the segments from the head-end to the Customer Premises.

## Network Impairments

Best effort networks, like the Internet, have difficulties to deliver differential QoS appropriate for each type of application. This fact is a serious inconvenience for all native IP architectures that, in general, need the aid of additional architectonic elements to support IPTV. These features are required to establish admission policies, to control congestion, or simply to manage different traffic priorities. The final objective is to guaranty the QoS required for each application and especially the most sensitive like real-time IPTV. New entrants may have the temptation to set up QoS just over provisioning resources whenever necessary, however we think this strategy is wrong, particularly for the middle and long term could be even more expensive and does not guarantee the result at all.

**Table 1**

*Events that modify the quality of the IPTV services and the segment of the network whereuse to appear.*

Contribution Network	Transport Network	Distribution Network	Transaction
<ul style="list-style-type: none"> <li>• Coding distortion</li> <li>• Server overload</li> <li>• Coder impairment</li> <li>• Encoder impairment</li> <li>• Error Indication</li> </ul>	<ul style="list-style-type: none"> <li>• PCR jitter</li> <li>• Continuity error count</li> <li>• Synchronization error</li> <li>• Interarrival jitter</li> <li>• Error on PSI table</li> <li>• Unacceptable latency</li> </ul>	<ul style="list-style-type: none"> <li>• Network contention</li> <li>• Packet loss, jitter, delay</li> <li>• RTP packet loss, jitter</li> <li>• TCP Retransmissions</li> </ul>	<ul style="list-style-type: none"> <li>• IGMP latency (IPTV)</li> <li>• RTSP latency (VoD)</li> </ul>

## 2. ALBEDO SOLUTIONS

The product portfolio offered by ALBEDO Telecom offers solutions for verification of video services over IP (IPTV) under different points of view, including the qualification of network equipment and codecs in the laboratory, the verification of the ability provide such services and data capture to determine possible sources of performance degradation.



**Figure 2** ALBEDO Net.Storm generates those perturbation typical of IP and Carrier Ethernet to test applications, devices and protocols that should be tolerant with packet delay, jitter, loss, duplication, reordering, error and bandwidth variations

### 3. CODECS AND STB ACCEPTANCE

Before video service deployment, you must verify that everything works as planned. Service providers should emulate the network in a controlled environment where they can be easily determined the cause of any issue.

A test model for a video service unicast or multicast can include most of the elements used in the target environment, including STBs, modems, switches / routers, and servers. Another aspect that is necessary to simulate, is the behavior of the network under ideal conditions. For example, you may need to know what will happen to the video signal if packet loss ratio is above certain threshold, how interactivity affects a VoD session network latency or what is the maximum amount of jitter that can absorb the input buffer of a STB.

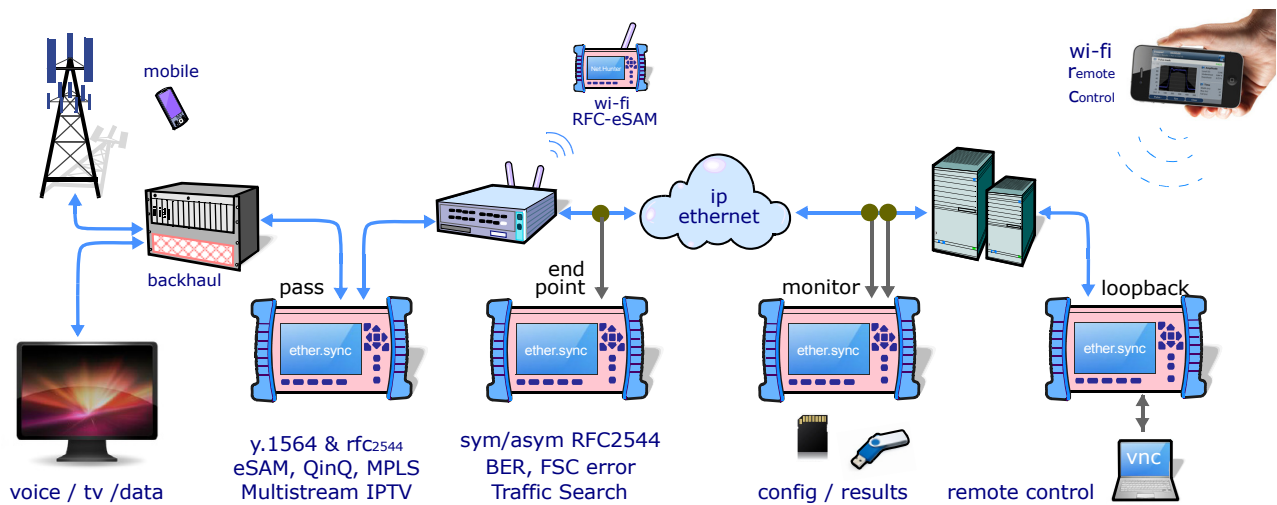
#### Net.Storm: compact WAN emulator

Net.Storm is a handy device that could emulate different types of impairments often found in an Ethernet / IP. With this capability, Net.Storm is useful for determining if a device or a network application is appropriate for network operation. Below are some of the most relevant features of Net.Storm:

- Deterministically can generate impairments such as delays, random packet loss, transmission errors, packet reordering and duplication.
- It simulates up to 16 variable capacity links for each port as allow you -for instance- to check the operation of the video application in different types of access: ADSL, VDSL, PON...
- Allows some traffic filter to apply only to a service disruption or protocol leaving the rest unchanged.
- Generates statistics on network traffic and can generate reports on the characteristics of this traffic.



**Figure 3** ALBEDO Ether.Giga is an Ethernet & IP tester equipped with all the features of legacy testers such as BER and RFC2544, plus the new ones like Y.1564, Y.1731, and FCS error insertion in pass mode.



**Figure 4** *Ether.Giga is test solution that seamless adapts operating needs without sacrificing portability, speed or cost. Perform multiple test including eSAM, RFC 2544, traffic test and many more.*

## 4. LINK VERIFICATION

In video applications over IP networks -such as IPTV and VoD- is essential to ensure that the parameters of Quality of Service (QoS) in terms of delay and packet loss are under control. It is also necessary to transmit traffic at the required rate while observing that there is no an appreciable loss of quality.

The method used by experts to determine the quality offered by an access to a packet switched network is eSAM test, which is based on ITU-T Y.1564 standard, and available in Ether.Giga a traffic generator / analyzer.

Ether.Giga is a tester specifically designed for the generation and analysis of Ethernet traffic. It is *multistream*, has electrical and optical interfaces, and speeds up to 1 Gb / s. It also includes RFC 2544, cable testing, protocol analysis performed on the data received, lists of addresses and VLANs most used among a large set of features. Ether.Giga can be powered externally but also supplied with batteries that provide high autonomy without connection to the mains. This is the reason why Ether.Giga is well suited for field and laboratory operation.

eSAM test is characterized by fully automated execution and ability to obtain link performance results depending on the network load in just a few minutes. Some of the essential features are:

- **Fast execution:** a normal eSAM test is made of by a short configuration test wilts the performance test takes longer. If the configuration test fails, no need to run the performance test. The result is that network administrators have time to correct any configuration problems without waiting for the end of the test run.

eSAM CIR test					
Load (Mbit/s)	IR (Mbit/s)	FLR	FTD (ms)	FDV (ms)	
8.000	7.997	3.840E-04	0.050	0.000	

eSAM Policing test					
Color	IR (Mbit/s)	FLR	FTD (ms)	FDV (ms)	
Green	7.998	2.720E-04	0.051	0.001	
Yellow	2.003	0.000E+00	1,863	163.713	
Total	10.001	2.175E-04	1,863	163.713	

eSAM EIR test					
Color	IR (Mbit/s)	FLR	FTD (ms)	FDV (ms)	
Green	7.998	1.920E-04	0.051	0.001	
Yellow	2.003	0.000E+00	1,329	0.091	
Total	10.001	1.536E-04	1,329	0.091	

Figure 5 Test results as eSAM are shown by ALBEDO Ether.Giga

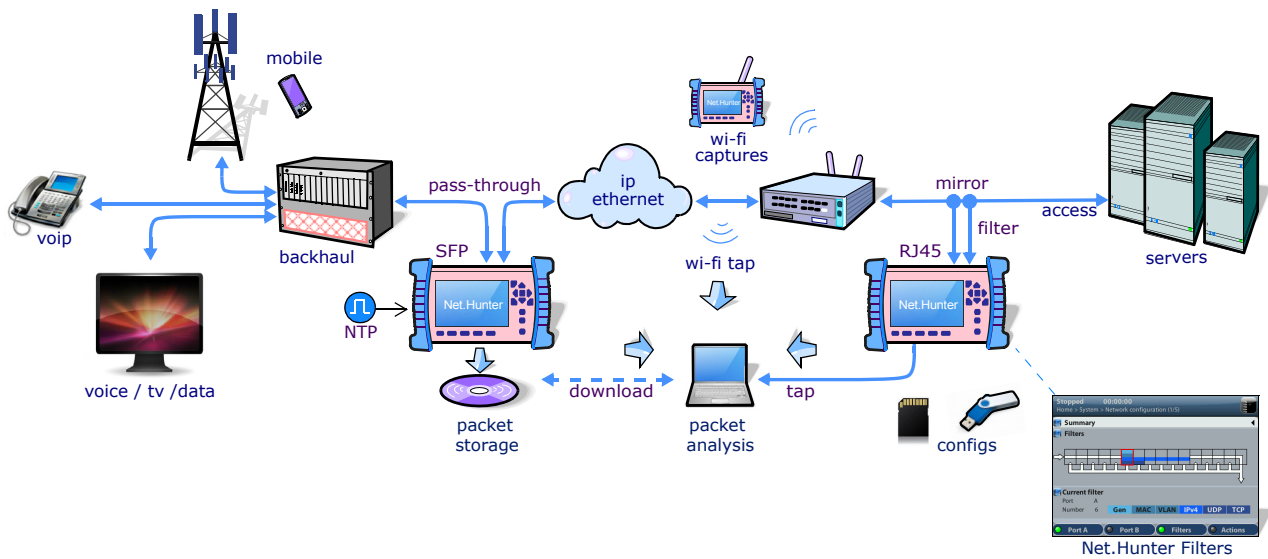
- **FDV results:** The frame delay variation (FDV) is a critical measure for evaluating the quality of a network used for providing video services. The FDV is very sensitive to the effects of congestion and other impairments affecting end to end performance of the network and therefore is an important parameter to characterize.
- **Multi-service compatibility.** Many operators use the same access to provide different services. It is common to add to the Internet services, video services and mobile and fixed telephony. ESAM test has been specially designed to work in these cases and is able to provide performance results for each service separately.
- **PASS / FAIL results.** When discharged a link, it is necessary to obtain results that can be readily interpreted to permit the service provider determine whether the network is ready for video streaming or not.

## 5. DATA CAPTURE

Video requires higher bandwidth than other applications. For example, the bandwidth requirements for an application of Voice over IP (VoIP) are of the order of 100 kb/s, but in the case of high-quality video requirements increase to several Mb/s for a single program and more for HD video



Figure 6 Net.Hunter is a stream-to-disk appliance capable of monitoring live traffic to capture and record selected TCP/IP flows at wire speed. It includes an embedded tap with triggers and programmable filter conditions.



**Figure 10** ALBEDO Net.Hunter is a compact, cost-effective solution to manage quality, troubleshooting threats, incidents, hackers and malware.

Net.Hunter is an instrument to capture data at very high-speed for later analysis making it particularly suitable for IP video applications. Captured data is stored on an internal disk SSD type, then the user can filter data before storing using many different criteria based on IP addresses, MAC addresses, UDP / TCP, VLAN and many others.

One possible application is capturing Net.Hunter IGMP multicast video applications to check properly generated. However, any network protocol associated with the video application is able to be captured. It is feasible even capture several video streams to be analyzed later in a laboratory capable of performing a playback of the captured flow. Some of the most important features of ALBEDO Net.Hunter are:

- **High-speed Data Capture** -which is fully controlled via hardware- permits capture rates up to 1 Gb/s + 1 Gb/s without data loss.
- **Filter before capture.** Flow can be identified pre-filtering by Port, Protocol, VLAN or many other criteria.
- **Full frame Capture** -including errored ones- in order to determine the causes of a problem detected.
- **Timestamps** inserted in each of the captured frames are generated by the computer hardware are highly accurate with a maximum error of 10 ns.
- Ability to copy part of the traffic to a secondary interface (*port mirroring*) for analysis by an external device such as a protocol analyzer.





## ALBEDO Telecom

ALBEDO Telecom designs, manufactures, and delivers solutions that enable Telecom organizations of all sizes to test, measure, troubleshoot, monitor, and migrate mission critical networks and multiplay applications.

On local segments and across distributed networks, ALBEDO enable Organizations, Installers, Operators, Service Providers and Suppliers to quickly check the health of Network Architectures, Service Agreements (SLA), IP Quality (QoS), or fix any issue.

### Your Business Partner

**Results.** ALBEDO Telecom helps the industry to make the most of the investment on infrastructure.

**Expertise.** ALBEDO Telecom engineers and consultants provide industry leading knowledge in hand-held TAPs and WAN emulators, IPTV, VoIP, Carrier-Ethernet, Synchronization, Jitter, Wander, SyncE, PTP, E1, and Datacom to address customers unique needs.

**Integration.** ALBEDO Telecom integrates disparate telecom technologies and applications, facilitating new business efficiencies.

**Agility.** ALBEDO Telecom increases the ability of customers to respond quickly to new market opportunities and requirements.

**Coverage.** ALBEDO Telecom offers solutions that facilitates the migration and the roll-out to new architectures.

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Joan d'Austria, 112 - Barcelona - 08018 - SP

Chalfont St Peter - Bucks - SL9 9TR - UK

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