

albedo **Net.Storm** emulator



High Performance Generator of IP packet impairments



Triple Play QoS Requirements

- ◆ Convergence is moving **all applications to IP**
- ◆ However routers, and IP networks were designed **to transport Data**
- ◆ Video, Voice, TV, Internet, Data, etc.: all have **specific QoS** needs
- ◆ Can any network **support next gen** services?
- ◆ Are applications **tolerant enough** to real networks?
- ◆ Are routers, devices appropriate?

QoS	ITU-T Y.1541 - Applications	Delay	Jitter	Loss	Error	Order
Class 0	Real-Time, Jitter Sensitive, High Interaction (VoIP, VConf)	100 ms	50 ms	1×10^{-3}	1×10^{-4}	U
Class 1	Jitter Sensitive, Interactive (VoIP, Audio Streaming)	400 ms	50 ms	1×10^{-3}	1×10^{-4}	U
Class 2	Transaction Data, Interactive (Signalling)	100 ms	U	1×10^{-3}	1×10^{-4}	U
Class 3	Transaction Data, Interactive (Enterprise critical data)	400 ms	U	1×10^{-3}	1×10^{-4}	U
Class 4	Low Loss (Bulk Data, Video Streaming, VoD on local disk)	1 s	U	1×10^{-3}	1×10^{-4}	U
Class 5	Best Effort IP Networks (Traditional IP applications, www)	U	U	U	U	U
Class 6	Real-Time, Jitter Sensitive, High Interaction (IPTV, VConf)	100 ms	50 ms	1×10^{-5}	1×10^{-6}	1×10^{-4}
Class 7	Jitter Sensitive, Interactive, Low error (HDTV, IPTV, VTC, VoD)	400 ms	50 ms	1×10^{-5}	1×10^{-6}	1×10^{-4}

ALBEDO NetStorm

Requirements to verify Networks and Applications

◆ Realistic traffic

- IPTV, Streaming Video, Video on Demand,
- VoIP, Audio Streaming
- Web Browsing, Email, FTP
- Not synthesized traffic
- Line Rate Video 1G and 10G

◆ Realistic Network Impairments

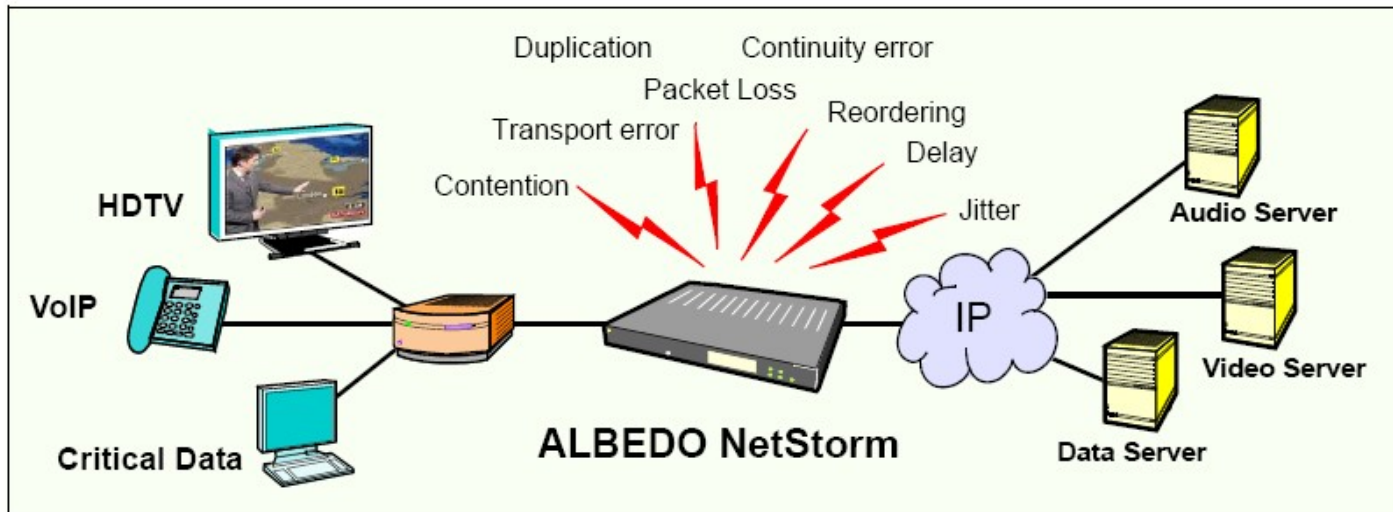
- Using ALBEDO NetStorm
- Generation of real network conditions
- Modifies QoS real traffic



End-to-end Real Traffic Conditions

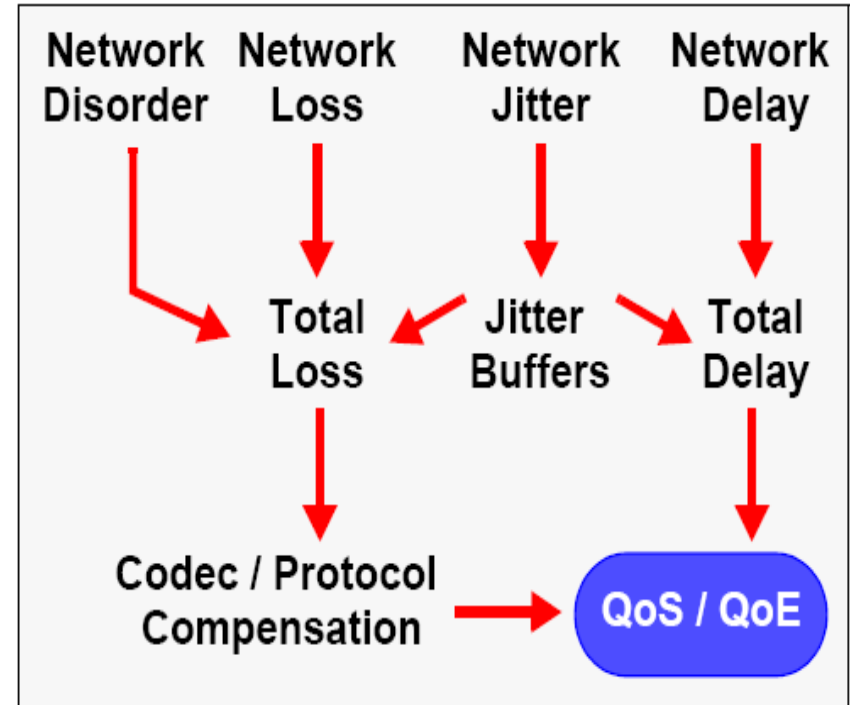
ALBEDO NetStorm emulates real IP actual network conditions

- ◆ **Managed, Partially Managed, Unmanaged**
- ◆ **Real traffic pass-through** then
 - Packet Loss, Error, Duplication, Reordering,
 - Packet Delay, Jitter, Bandwidth shaping, and Throttling
- ◆ Control per **traffic flow and filters**



Testing requirements

- ◆ **Quality of Service** (min bandwidth, max latency) are harder to test, compare than simple best-effort delivery
- ◆ **Nodes, Terminals, Protocols, and Applications** are harder to "pin down" and test thoroughly
- ◆ **Some features** such as multicast delivery require larger, more complex test environments
- ◆ **Access technologies** (HFC, xDSL, FTTH, WiMax, PLC, WiFi) can be highly asymmetric and expensive to test



Three Methods for testing IP applications

(1) Simulation

- Can be cheap and quick to prepare
- Given sufficient resources, can do large-scale tests
- Tests are controlled, reproducible
- *Simulation implementation may differ considerably*
- *Synthetic environment may also poorly represent real one*

(2) Live testing

- Real code in real environment
- *May only be possible very late in development cycle*
- *Difficult or expensive to create a real test environment*
- *Tests not reproducible, it's difficult to analyze found issues*

(3) ALBEDO Network Emulation

- A controlled, reproducible environment for running live code
- Emulates any *real-world badness* in a small, laboratory
- Provides a means for simulations to interact with a live network
- Implemented via "hooks" into a real, networking implementation



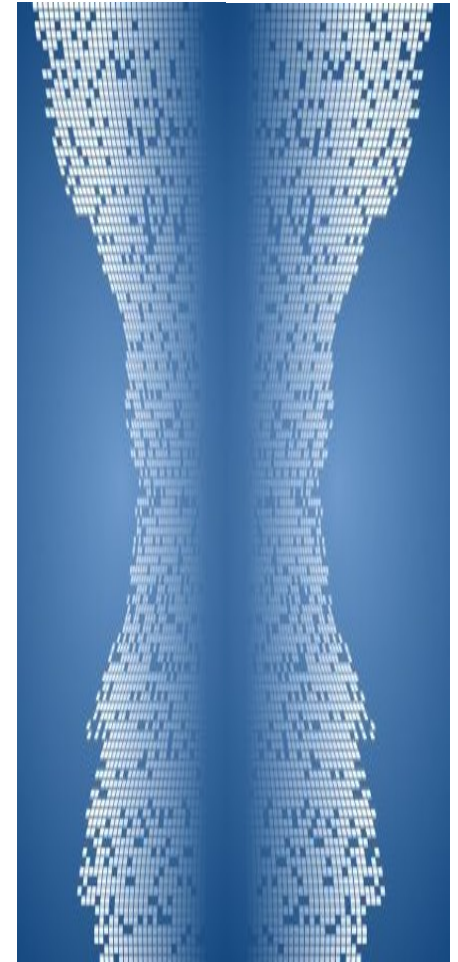
Net Storm Features

- ◆ **Simple user entry of network parameters (packet loss, delay)**
 - Allow record/playback of network conditions
 - Suitable for testing multicast, high-bandwidth applications
 - Emulate a wide range of network types with a small lab set-up
 - Emulate asymmetric networks over symmetric ones
- ◆ **Appropriate for Triple Play Design + Planning + Deployment**
 - Excellent for VoIP verification
 - Appropriate for IPTV applications (MPEG4, MPEG2, VC1)
 - Suitable to test protocols including SIP, H323,
 - Accurate enough to test Router, Switches, CPE



Network conditions emulated (I)

- ◆ **Packet delay**
 - Fixed
 - Variable (probability distribution, settable mean/variance)
- ◆ **Packet jitter**
 - Fixed
 - Variable (probability distribution, settable mean/variance)
- ◆ **Packet reordering**
 - Through large delay variances
- ◆ **Packet loss**
 - Uniform probability
 - Congestion-dependent (Gilbert Elliot algorithm)
- ◆ **Packet duplication**
 - Uniform probability
- ◆ **Bandwidth limitation**
 - Use in conjunction with congestion-dependent packet loss



Testing Market

ALBEDO NetStorm tool can:

◆ Scalability Check

- Tolerance to Network Impairments
- Response time, stream integrity, and video quality
- Accuracy and response time of error correction
- Control plane performance and scalability

◆ Unicast and multicast performance

- Quality of video transport, control and content
- Client transaction fulfillment, through transaction tracing

**the 35% users abandon IPTV
after a bad quality experience**

**only 55% of users are satisfied
with the new VoIP service**



That's all



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