



Ethernet Network Emulators GEM, XGEM

Delay and Impairment Emulation for Ethernet Traffic

Benefits

- Test products and characterize end user experience under real world conditions
- Discover and fix network related issues early
- Speed time-to-market
- Increase effectiveness of validation, performance and interop testing
- Precisely reproduce and quickly resolve issues occurring in the field

Applications

- Networked Applications
- Corporate LAN/WAN Emulation
- Real time Apps: IPTV and VoIP
- Circuit Emulation, Timing over Packet
- WAN Acceleration
- Business Continuity
- Disaster Recovery
- Server Consolidation/ Migration
- Storage Extension
- Wireless / Mobile
- Satellite Network
- 10Gig FCoE, iWARP
- Interoperability testing
- SLA planning and verification



Overview

Anue Systems Network Emulators enable users to test products and services against the delay, impairment, and bandwidth conditions that occur on real production Ethernet networks. Emulators are used in the lab to test applications, protocols, and end user experience under real world conditions prior to deployment. A wide range of features, line speeds, and protocols are supported to meet your current and future needs.

Anue Network Emulators offer a rich feature set to make testing accurate and convenient.

TrueNetwork™—on-chip emulation technology for accuracy and precision

- True line-rate performance and repeatability at 10GigE and 1GigE
- Industry leading precision when emulating delay, packet jitter, packet corruption, drop, reorder, duplication, and fragmentation
- Powerful impairment flexibility includes dynamically changing impairment profiles, filtering on specific impairments, and Router mode operation

MyNetwork™—quickly create a test bed that matches your real network

- Record and replay the dynamic conditions found on the live network
- Leverage thousands of industry-standard models and test suites
- Quickly build your own custom network conditions

AnyNetwork™—flexibility to meet your current and future needs

- Simultaneously run multiple unique network conditions to emulate different classes of service or multiple paths through a network
- Multiprotocol support for SONET, SDH, OTN, Fibre Channel, CPRI, Ethernet
- All proprietary and standard L2-L7 protocols and any frame size supported
- Application specific solutions for IPTV, multimedia, Carrier Ethernet, CES/ ToP and storage



Solutions for a Wide Range of Applications

IPTV / VoIP

Anue provides a comprehensive set of unique capabilities for evaluating IPTV and VoIP solutions. End user quality of experience can be realistically characterized before deployment. Post deployment issues can be quickly reproduced in the lab for troubleshooting.

- Record network conditions directly from a live network for playback in the lab
- Save time by leveraging over a thousand standards based network models (TIA-921 / ITU-T G.1050)
- Selectively impair MPEG I, P and B frames

Carrier Ethernet

Anue Emulators are essential tools for making EOAM and carrier-class Ethernet services a reality. Applications include: validating OAM capabilities; evaluating fail-over protection performance; and comparing alternative protocol implementations.

- Reuse and build proprietary or standard based Layer 2-7 protocols with the Customizable Filter Library
- Use modification/corruption for precise functional and negative testing
- Cause outage and degrade scenarios triggering fail-over protection

Networked Application Performance

Anue emulators are indispensable when rolling out a new application, moving or virtualizing an application server, evaluating WAN optimization technologies or opening a new remote office. Now application performance can be easily and realistically tested in the lab prior to roll out.

- Determine the minimum bandwidth required to meet Service Level Objectives (SLO)
- Record network conditions directly from a live network for playback in the lab
- Quickly reproduce post-deployment problems for troubleshooting and improved MTTR

Circuit Emulation Services & Timing over Packet

Testing against mock-up networks is not repeatable or realistic and is costly and inefficient. With Anue's industry leading GEM emulators you can realistically and repeatably test your CES and ToP solutions with confidence.

- Validate prior to certification testing with MEF-18 and G.8261 Test Suites
- Characterize clock recovery performance under realistic delay variation
- Record and playback delay characteristics from live network with nanosecond accuracy

Satellite

Anue emulators give you the ability to characterize application performance over Satellite networks prior to deployment. Perform proof of concept testing from the comfort of your lab saving time and money by avoiding the need for expensive and complicated field trials. And reduce downtime by allowing you to quickly reproduce and troubleshoot network issues in the lab.

DC Migration and Disaster Recovery

Minimize risk by proving a storage solution will work as required in the real-world prior to deployment. Evaluate performance of disaster recovery measures under failure scenarios

- Recreate real-world bandwidth congestion, delay, errors, frame loss, link failure

Storage – FCoE, FCIP

Anue provides the only inline solution for functional testing, negative testing, and performance characterization of FCoE, FCIP and Data Center Ethernet

- Leverage FCoE and FCIP filter libraries
- Perform protocol negative testing with FCoE checksum correction
- Supports Ethernet and Fibre Channel 4x, 8x, 10x

Wireless / Mobile

Anue emulators are ideal for evaluating new mobile services, applications or 4G technologies under real-world conditions. Quickly and accurately characterize quality of Voice, Video and Data applications and validate next generation backhaul technologies.

- Reuse and customize over a thousand standards based network models (TIA-921 / ITU-T G.1050)
- Supports both Ethernet and CPRI

"We tested with software based network emulation and we discovered that it did not represent our network. With Anue's FPGA based solution we what we see in the lab is what we see when we finally roll out to production."



Feature Overview

Supported Interfaces

Line rate performance supported from 10Mbps through 10Gbps Ethernet regardless of incoming packet size.

- GEM – 10/100/1000 Base-T and optical GigE
- XGEM – 10Gig Ethernet with Optical and Copper CX4

Network Profiles – GEM and XGEM

Network Profiles support emulating multiple “network clouds” per interface. Emulate different paths through a network or different classes of service.

- Each profile is defined by any combination of VLAN tag, MPLS label, MAC/IP address (IPV4 , IPV6), TCP/UDP port or any data up to 2000 bytes within the Ethernet frame
- Define unique bandwidth, delay and impairments per profile

Filter Libraries – GEM and XGEM

Filter Libraries allow you to customize the emulator for your specific protocol requirements.

- Advanced Protocol Filter Suite provides a growing list of filters including PPP, PTP, RSVP, IP, FCoE, FIP, OSPF, MPEG and many others
- Build your own filter libraries for any new standards based or proprietary protocols

Delay

- Emulates static or variable delay occurring during transmission of Ethernet data through a network
- Introduce frame or packet delay variation (jitter)
- Optional delay extenders are available for extra delay

Impairment Highlights

- Fixed and random impairment distributions
- Random and filtered or targeted impairments
- Loss of Signal, Loss of Frame Synchronization
- PCS, MAC and higher layer bit errors, CRC

Capture and Replay – GEM and XGEM

Enables inline capturing of user specified test traffic for further viewing and analysis of the data packets. Users can upload and replay standard data files for traffic generation as stand alone or background traffic source.

- Bidirectional time-correlated capture
- Filtered or unfiltered data capture at up to 10GigE line rate
- Capture entire packets or first select number of bytes
- Trigger capture on incoming or outgoing event
- Replay any PCAP file with control over bandwidth, with or without impairments
- Independent Capture & Replay controls per Network Profile

Record Live Network Conditions - GEM

PROFILER

- Agentless application records conditions of your live production network for playback in the lab.
- Record delay, jitter, loss, route flaps conditions for 30 days
- Supports 50 simultaneous log sessions per instance
- Repeatable playback of Profiler logs in lab with GEM

DELAY CAPTURE

Hardware based capture of live network delay characteristics using GEM Capture Replay feature.

- Nanosecond delay precision
- Direct save to Network Playback format
- Replay delay scenarios in lab with GEM

TIA-921 & ITU-T G.1050 Network Models - GEM

Standards based network models designed to test multimedia applications. Based on statistical information gathered from leading Service Providers around the world.

- Characterize performance your solution against more than a thousand dynamic scenarios for increased confidence
- Create custom scenarios

MEF-18 and ITU-T G.8261 Test Suites – GEM

- Complete set of network tests based on ITU-T G-8261-2008
- Repeatable network models for MEF-18 certification testing
- MEF-18 synchronization tests 6.1-6.8

Network Playback - GEM

- Provides ultimate control and flexibility in creating dynamic custom network impairment scenarios.
- Create any impairment distribution needed with per packet control.
- Define custom impairment table with delay, drop, reorder and other impairments
- Table entries are assigned on a per packet or time basis
- Upload extremely large impairment tables for multi-day scenarios or low frequency impairment content

IPTV - GEM

- Selectively drop H.262/H.264 I, B and P frames over IPv4/6
- Corruption
- Drop, Reorder, Duplication, Modification, IP Fragment
- Bandwidth Policing per MEF and Shaping
- IP, TCP/UDP, RSVP, FCoE checksum correction enables higher layer impairments

**Available Impairments are Emulator Load specific.*



Dynamic Search Filter (DSF) - GEM

- Search entire TCP/UDP payload for a user defined string pattern (up to 64 bytes) to trigger an impairment event
- Define an impairment counter (prevents a TCP timeout)

Statistics/Alarms

- Real time RX stats - disparity, code, sync and block errors, invalid block IPG and idle errors, bandwidth stats and more
- Stats for impairments introduced at output port
- Indicates alarms for Loss of Signal (LOS), Loss of Lock (LOL),
- Loss of Frame sync (LOF), Code and disparity errors
- Detailed logging of blade and Network Profile statistics
- Graphical reports can be generated to pdf for review

Specifications

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Network Profiles

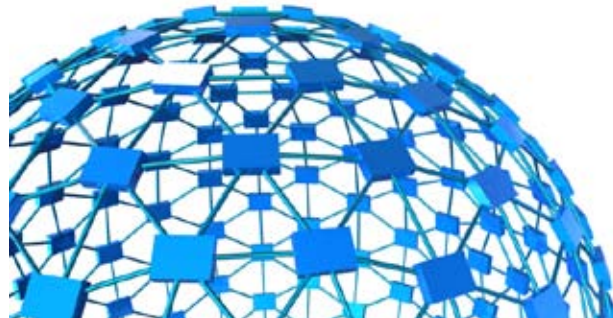
GEM, XGEM

Configure unique throughput, delay and impairment settings for each Network Profile. Emulate different classes of service (CoS) or different paths through a network or target specific packets for impairment

- GEM available with 1, 4, 8 or 16 profiles
- XGEM available with 1 or 4 profiles
- Classify on up to any 32 bytes within an Ethernet frame. For example MAC, IP address (IPV4 and IPV6), VLAN tag, MPLS label, or a fixed byte offset or all of the above simultaneously
- Classify up to 2000 bytes deep with GEM and 255 bytes deep with XGEM
- Bit wise filtering

DELAY

- Static or Variable (jittered) Delays
- Fully transparent operation: delayed output is logically identical to input signal
 - Static delay leaves inter frame gap unchanged
 - No modification of transmitted code words
- GEM provides up to 2 seconds of delay for Gigabit Ethernet and 20 seconds for 10/100Mbps Ethernet
- XGEM provides up to 250ms of delay
- Extra delay available



IMPAIRMENTS

- Emulate loss of signal (LOS) and loss of framing sync (LOF)
- Impairment rates: 100% to 3.73e-9 for GEM or 5.96e-8 for XGEM
- Impairment distribution: Periodic, Poisson, Uniform or Gaussian
- Create impairments on selected packets:
 - Packet/Frame Drop
 - Reordering – within 255 packets
 - Duplicating up to 15 times (255 with XGEM)
 - CRC corruption
- Data Corruption or Bit Errors and Modification
 - Logical bit-errors at either the PCS and/or MAC layers
 - Higher layer error insertion with checksum correction
 - 1-bit to 32k-bit error burst – invert, all ones, all zeroes
 - Inject bit-errors from 10-12 to 10-3 rates
- Data Modification – up to 48 bytes per Network Profile
- Checksum correction: IP, TCP/UDP, RSVP (GEM)
- Checksum correction: FCoE (XGEM)
- Impairment changes are dynamic and hitless (traffic not interrupted) and stop/start of test never required
- Multiple impairments allowed on a single packet

BANDWIDTH CONTROL

- Throttle bandwidth or police traffic bandwidth: 1kbps to true full line rate in 1kbps step sizes
- Individual Traffic Shaping and Bandwidth controls for each Network Profile
- Optionally generate Pause Frames

EXTERNAL TIMING REFERENCE INPUT

- T1 BITS, E1 MTS RJ-48C
- 10MHz BNC

ADDITIONAL XGEM FEATURES

- RX and TX IPG histogram
- RX Frame Length Histogram