VIAVI Solutions

Application Note

Palo Alto GlobalProtect VPN Emulation on TeraVM

What is TeraVM?

TeraVM is a software based L2–7 test tool running on Cisco UCS and in the Cloud (Amazon, Azure, Openstack etc.), delivering a fully virtualized application emulation and security validation solution to test and secure devices, networks and their services.

What's New?

- **PAN GlobalProtect VPN Client Emulation** - TeraVM now delivers Palo Alto Networks remote access GlobalProtect VPN client emulation at high scale, along with video, voice and data applications.
- **X86 servers and Cloud based:**
  - TeraVM runs on standard servers (e.g. Dell) and in the cloud – Amazon Web service, Microsoft Azure, Google Cloud, Oracle Cloud Infrastructure
- **Use TeraVM to:**
  - Test how many GlobalProtect VPN tunnels (ESP /TLS) can be established on headend
  - Test VPN tunnel establishment with both GlobalProtect Portal and GlobalProtect Gateway
  - Test how quickly can GlobalProtect tunnels be brought up/torn down
  - Test what happens with real video, voice & data applications in the GlobalProtect VPN tunnels
  - Test physical vs virtual GlobalProtect VPN headends functionality, scale and QOS
  - Test GP clients with different User-Agent Name/OS Name/OS Version
  - Test Split tunnel configurations
- **Centralized License Server/Elastic Test Bed:**
  - Scale with realism and grow on demand with license sharing across geographical locations
  - Sharing test resources and methodologies delivering the most cost-effective solution

Key Facts... TeraVM is 100% virtual

- PAN GlobalProtect VPN Client Emulation & measurement in real time at scale (eg >60,000 tunnels)
- Video, voice & other applications emulated & measured in real time over each individual GP VPN tunnel
- In GlobalProtect Client emulation – session establishment/authentication rate can be controlled, user name/password authentication supported, IPv4/IPv6, IPv6/IPv4 supported
- Configurable authentication rate
- Ability to do decrypted Wireshark capture of the GlobalProtect VPN client for debug
- Real time metrics per GP VPN tunnel & per application per tunnel
  - Time to set up a GP VPN tunnel
  - Number of attempted, completed, Errored, Established, Rejected GP VPN tunnels
  - Statistics giving the current authentication rate

Application Support

General
- System utilization reports (Location, User, Testbed, Licenses in use, Usage stats)
- License check-in default timer

Adaptive Engine
- Dynamically and Automatically find the maximum capacity of Devices Under Test
- Same test profile can be used for multiple platforms
- Faster setup, faster testing, faster results

Network Interface Support
- Support for 1/10/40/100 Gbps I/0

Data
- Jumbo Frame support with max MTU/ Segment configurable
- TeraFlowUDP Out-of-Sequence Statistics
- TCP / UDP, Teraflow, Ookla speed test
- HTTP / HTTPS
- HTTP 2.0
- SMTP / POP3 (incl. file attachments)
- FTP (Passive/Active), P2P applications, DNS
- FTP client session count limit
- DNS client (w/ HTTP/S applications, incl. IP address resolution)
- DNS Server

Address Assignment
- Configurable MAC
- DHCP, PPPoE (IPv4 & IPv6)
- Dual Stack (6RD, DS Lite)

Ethernet Switch
- VLAN Tagging (up to 8 concurrent tags)
- ACL, 802.1p, DSCP
- Enable path MTU discovery

Data Center
- VxLAN, GRE, SR-IOV

Automation
- REST, CLI, Perl, TCL, XML, Java API
- Python, Jython
- Cisco LaasNG , Qualisystems (CloudShell), Luxoft Software Defined Lab (SDL), Openstack, Cisco pyATS

Replay Application Repository
- Intelligent UDP & stateful TCP Replay: Ability to dynamically change content
- Replay large PCAP files: TCP, UDP and raw data playback
- IP Replay (w/ DHCP): multiple TCP/UDP streams
- Amplify and dynamically substitute data into PCAP files

Video
- CMTS, CDN, Multicast: IGMP v1/v2/v3 & MLD v1/v2
- Automatic Multicast Tunneling (AMT)
- Video on Demand (VoD)
- Adaptive Bit Rate (HLS, HDS, MPEG- DASH, Smooth)
- Video conferencing, WebEx, Telepresence
- HTTP based video
- H.265 codec support

Voice
- Secure VoIP & WebEx calls in HTML5 UI
- Dual-Stack VoIP Gateway emulation
- Cisco CUCM, CUBE
- VoIP: SIP & RTP (secure & unsecure), SMS
- VoIP client scaling with auto generated unique
- VoIP with EVS (Enhanced Voice Services)
- AKA authentication request per client
- VoLTE Emergency calls support
- Dual Hosted UACs, SIP Trunking
- Voice & Video quality metric (MOS simultaneously supported)
- EVS codec support, various bit rates, silence suppression
- G.711 Support for SID – RFC3889
- SIP Updates for IMS including PANI information
- MCPTT group calls (including KPI support)

Secure Access / VPN
- SSLv2/3, TLSv1.0/1/2/3 and DTLSv1.0/2
- TLS Client-side Cipher Suite Selection
- Dynamic IPv6 Assignment for AnyConnect VPN Client
- Clientless VPN (SSL/TLS/DTLS), IPSec (IKEv1/ v2 (DH groups 31 & 32)), Generic remote access, CSFR support
- Cisco AnyConnect SSL & Cisco AnyConnect IPsec VPN Clients
- Cisco Umbrella
- SAML, SSO, Active Directory based login
- 802.1x EAP-MD5, EAP & PEAP with MS CHAPv2 Authentication
- RADIUS client support with configurable custom AVPs.
- 802.1X Accounting Start and Stop Records
- Site to Site VPN - IPV6/V4
- Additional security to limit access to public IP address assigned to TeraVM in public cloud environments
- Cisco AnyConnect SSL and IKE certificate based authentication with multiple user provided ECDSA EdDSA certificates
- PPTP VPN Client and Server supported
- Cisco AnyConnect emulation with SAML based authentication
- Cisco AnyConnect STRAP (Session Token Re-Use Anchor Protocol)

Security
- 40,000+ Malware attacks & Cybersecurity threats, updated monthly
- Spam / Viruses / DDoS / Malware
- Malware Application Profiles
- TCP CUBIC congestion control
- DDoS attack applications:
  - Flood: SYN, Reflective SYN, Reset, UDP, Ping, ARP
  - Attacks: Teardrop; UDP Fragmentation; Configurable Rates, Start and Stop
  - Spoof Mac addressing
- Good and Bad mixed traffic flows
- Statefully scale Cisco specific threats
- Ability to use 3rd party threat libraries
- Ability to turn on /off Extended Master Secret (RFC 7627) support flag to test Cisco FTD, ASA and other security solutions
- Support for TLS 1.3, TLS 1.2 simultaneously on Client and Server
- Configurable TLS record size
- TCP delayed ack (timer based)
- HTTP Strict Transport Security (HSTS) header support
- TLS SNI support incl. unique certificate per FQDN

SLA Monitoring
- TWAMP-RFC 5357, PING-RFC 792
- Cisco Netflow Records/Exporter emulation at scale

Mobility - 5G, 4G, 3G, 2G
- Core and RAN: 3GPP Rel.8, 10, 11, 13, 15
- vRAN emulation:
  - 5G-NR, 4G-EUTRAN, 3G-UTRAN, 2G-GERAN at 1,000s of RANs
- Core Emulation:
  - 5G (NSA & SA), 4G-LTE, 3G, 2G with Mobility at millions of UEs and Bearers
- 5G, 4G, 3G, 2G Core interface testing
- Error Injection over 5G-N2 (AMF), 4G-S1 (MME)
- Encrypted RAN load for SecGW
- GTP tunnel support; GTPv2 (4G) S11/S5; GTPv1 (3G) Gn (4G) S1-U
- VoLTE (secure/unsecure), ViLTE
- ePDG Wifi Offload (EoGRE)
- VoWiFi (functional testing)

Internet of Things (IoT)
- Client emulation
- CoAP-RFC 7252
- NIDD over SCEF, S11-U, S1-U
- SCEF Emulation Including Protocol Relay

Cloud Platform Support
- Amazon AWS
- Google Cloud (GCP)
- Oracle Cloud (OCI)
- Microsoft Azure

Hypervisors
- VMware ESXi
- KVM Ubuntu
- KVM Redhat
- Citrix Xenserver
- Hyper-V
- Openstack

Kubernetes Cloud Platforms (Containerized TeraVM)
- Google GKE
- Amazon EKS

NetSecOPEN Tests
- NetSecOPEN Test Suite

VIAVI Solutions

Contact Us **tvm@viavisolutions.com**

To reach the VIAVI office nearest you, visit viavisolutions.com/contacts.

paloalto-vpn-an-wir-nse-ae
30191219 900 1120