Virtual Environments and their impact on the Network

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Agenda

- Which Virtual Environments?
- Platform by Platform Analysis
- Platform Comparison
- Architectural and Topological Considerations
- Recommendations

Which Virtual Environments?

There.com/Makena

- Traffic
  - Avg packets/sec: 50
  - Avg packet size: 280 bytes
  - Avg Bytes/Sec: 13020
  - Avg traffic: 110kbps
- Network Behavior
  - Login via TCP/ TLS- Standard Ports (443)
  - UDP is used for client content/texture updates
  - For Voice:
    - Uses RTP (no RTCP)
    - ~96byte UDP packets (G.729?)
    - Consistent source/destination based on location in world

Second Life

- Traffic

	Brian	Stefano
Average Packets/Sec	162	77
Average Packet Size	438 bytes	707 bytes
Average Bytes/Sec	70725	31384
Average Traffic	560kbps	230kbps

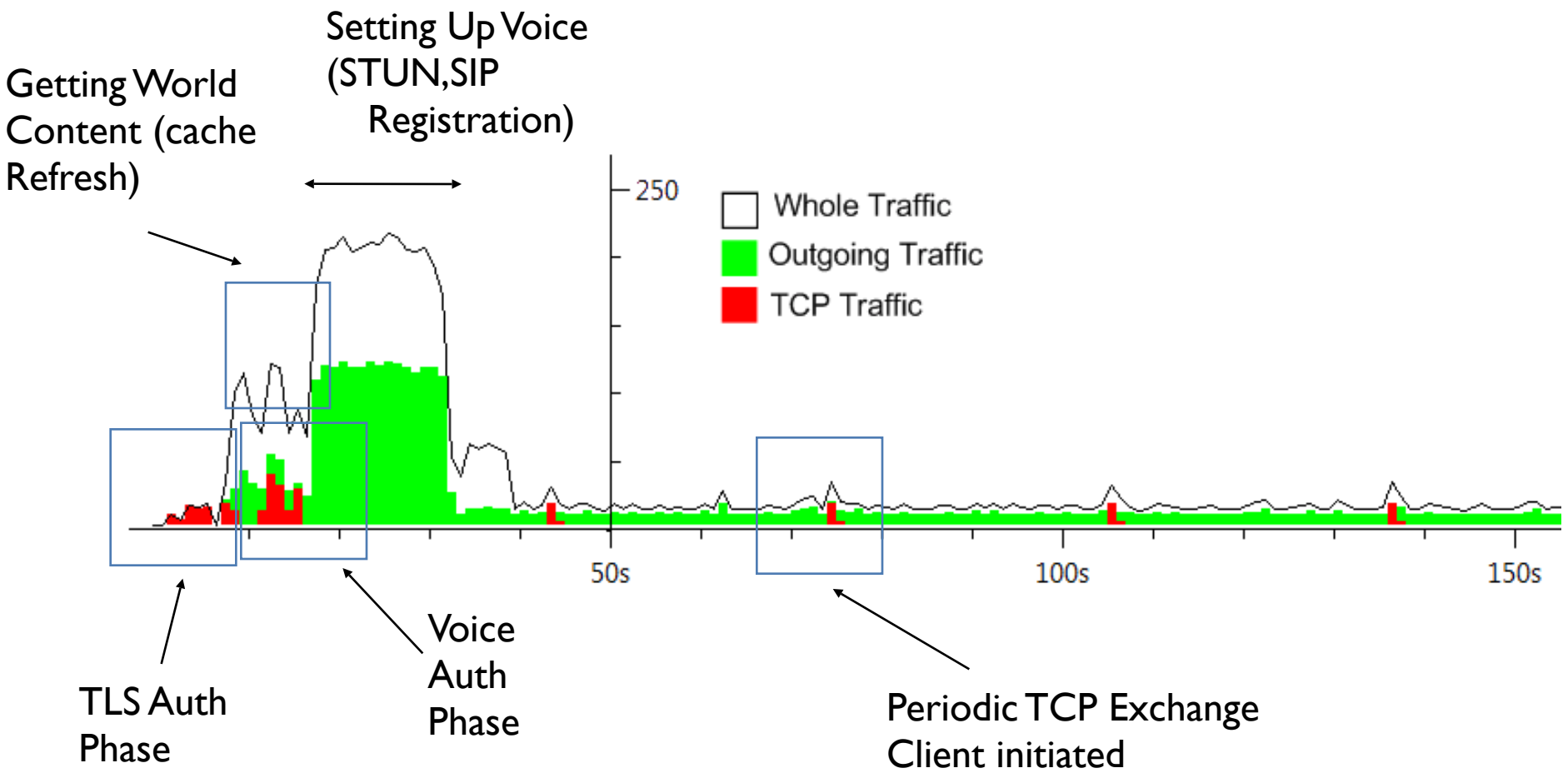
All traffic was heavily dependent on available bandwidth and server load

- Network Behavior
  - Login via SSLv2 and TLS- Standard Ports (443)
  - Separate SIP Signaling for voice
  - Combination of hosts, TCP and UDP

Second Life

- SIM / Virtual World
  - Periodic TCP (capabilities?) exchange with the server initiated by the client (50s)
  - Constant upstream UDP flow: 10Kb/s
  - Avg packet size: from 160bytes to 520bytes, more frequently around 300bytes
  - Avg packets/sec: 15 to 150, typical avg: 50
  - Leakage: teleporting from SIM1 to SIM2 then back to SIM1, SIM2 keeps sending UDP pkgs even after logging off from SL
- Voice
  - Starting voice consumes about 200Kb/s, half upstream, for 20s.
  - Avg packet size: 150bytes (little variance)
  - Avg packets/s: 13 to 30
  - Accounts for as much as 40% of the traffic when there is no Virtual World update

Second Life



Second Life

- For Voice:
  - (Vivox bhear) Uses RTP and RTCP
  - 30ms Samples
  - SIREN14-3D codec
  - 50-150 byte UDP packets
- Security and Firewall Considerations
  - For Virtual World: currently requires open incoming UDP packages on a wide range of ports, from non-fixed address set!
  - For Voice:
    - If you are behind a NAT gateway, STUN is used to establish connection and open ports
    - Different server address range (70.42.62.x (www or proxy.bhr.vivox.com)) than standard Linden servers (64.129.40.x, 66.150.244.x, 69.25.204.x)
  - In General:
    - Linden Says *"Second Life needs to connect to ports 443/TCP, 12043/TCP, 12035/UDP, 12036/UDP, and 13000-13050/UDP. You should configure your firewall to allow outbound traffic on those ports, and related inbound traffic."*
    - Cisco Says *"Don't!"*

Proton Media/Protosphere

- Traffic

	Intranet	Internet
Average Packets/Sec	19	14
Average Packet Size	186 bytes	172 bytes
Average Bytes/Sec	3564	2525
Average Traffic	29kbps	20kbps

- Network Behavior
  - Login via un-encrypted TCP
  - Signaling via standard TCP ports

Proton Media/Protosphere

- Voice:
  - 60 byte RTP (no RTCP)
  - 10ms samples
  - Codec uncertain (most likely G.711, non-spatial)
  - No signaling protocol
- Security and Firewall Considerations
  - Uses standard ports and functions fine within and through corporate firewall.

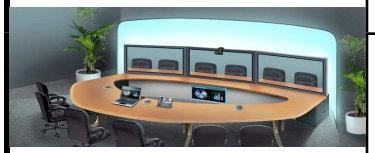
Multiverse

- Traffic
  - Mainly UDP (94%) and little TCP (~6%)
  - Avg packets/sec: 5
  - Avg packet size: 230 bytes (quite steady)
  - Avg traffic: 1300 Bytes/s (0.01kbps)
- Network Behavior
  - First logs into the main server, sending login/pwd in **plaintext**
  - Second log in is again in plaintext, but with no password authentication, and a 'fakeencryptiontoken' plaintext attribute.
  - 'DarkHorizon' world is extremely simple, and was empty

ActiveWorlds

- Traffic
  - All traffic is TCP – predominantly HTTP
  - Avg packets/sec: 50 (80 when starting with empty cache, 16 with full cache)
  - Avg packet size: 650 bytes
  - Avg traffic: from 8685 B/s (0.07 kb/s) to 59800 B/s (0.48 kb/s)
  - Avg traffic: 110kbps
- Network Behavior
  - As with SL, most of the traffic is due to downloading world content. Once the Cache is full, traffic drops considerably
  - The content server is a standard HTTP server with files containing textures (and probably other world data)

Platform Comparison and Contrast

Platform	Bandwidth	Architecture	Security
There	*Up to110k per client with voice*	Hybrid Client Server	Standard Ports- Possible FW
Second Life	*Up to 500k per client with voice*	Cache Intensive Client Server	Inconsistent- Air/ VLAN Gap
Proton Media	*Up to130k per client with voice*	Pre-Cached Client Server	Standard Ports
Multiverse — Changing the <Virtual> World	*100k per client*	Pre-Cached Client Client Server	N/A
activeworlds	*Up to 400k per client, 100k avg*	Pre-cached Client Server (HTTP)	Easier to deploy (TCP only)
	~100k *per client*	Hybrid C/S & P2P	Intranet
webex	500k per client	Hybrid C/S & P2P	Internet Encrypted
	15 Mbps *per location*	Hybrid C/S & P2P	Intranet or Extranet

Architectural and Topological Considerations

- Plan for widespread adoption within an Enterprise
- 'Screen Paint' architecture consumes considerable bandwidth per client (a la WebEx). Increasing cache within the client can reduce bandwidth consumption.
- Current virtual world platforms are either Intranet implementations or network-inefficient. Lobby your favorite virtual world provider for better network hygiene.
- Voice in virtual worlds has same latency/jitter requirements as most platform implementations (screen paint).

Recommendations

1. Separate VLAN or air-gap'd network for Second Life, There.com, Multiverse
   - Network-security-integrity-unfriendly implementations
   - Large potential security exposure
2. Potential solutions
   - Guest/Public WiFi network
   - SOCKS proxy (caveat-Voice)
   - Ad-hoc proxy (and STUN enabled firewalls)
3. Long Term Solution- Better VW software implementations and added support in network devices