Teredo @ Microsoft
Present and Future

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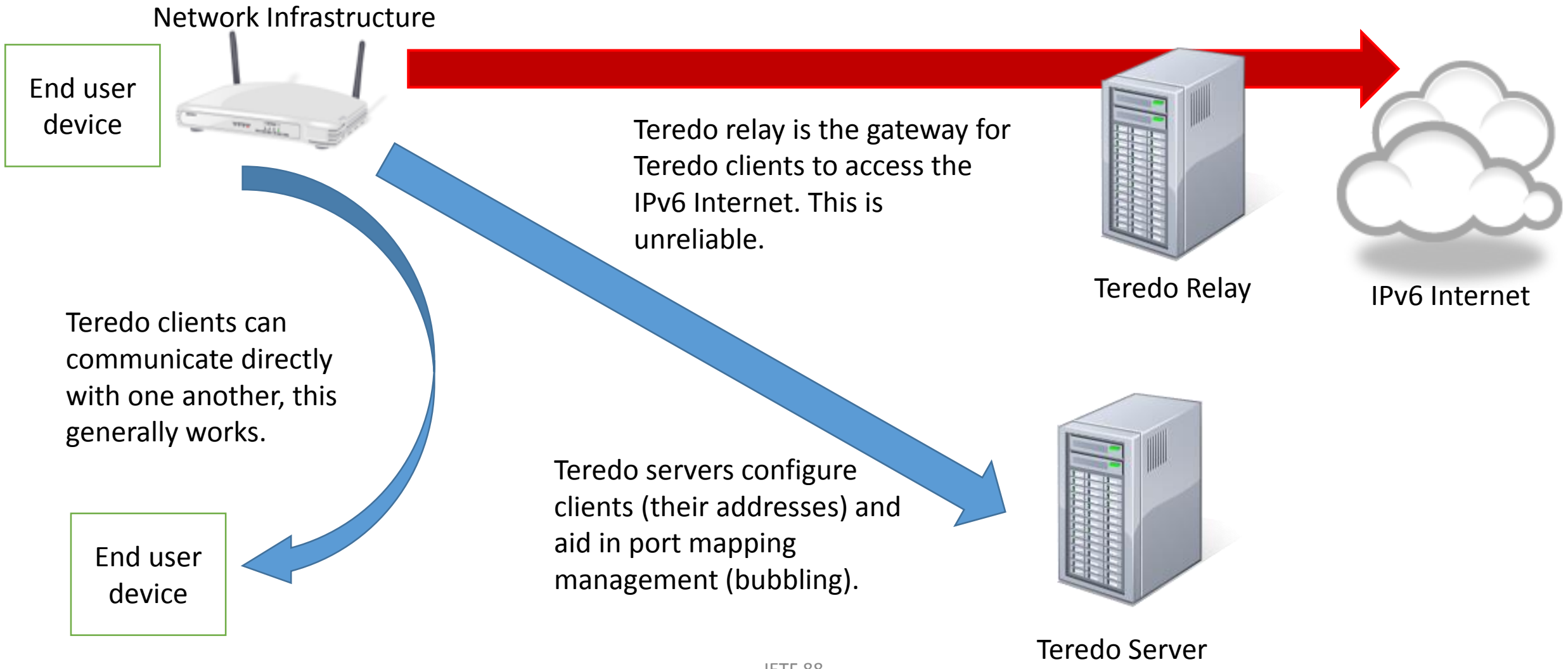
Overview

- Teredo is an IPv6 transition technology that provides IPv6 addressability and connectivity for capable hosts which are on an IPv4 network but with no native connection to an IPv6 network.
  - RFC 4380, 5991, and 6081
- Microsoft has included Teredo functionality in a *default* configuration in Windows Vista, 7, and 8/8.1.
- We are simultaneously:
  - Sunsetting Teredo service for Windows Vista and Windows 7 hosts.
  - Extending Teredo support for Xbox One gaming scenarios.

Teredo – Servers and Relays



Teredo – Two Sides of the Coin

The Bad

- Teredo as a technology to reach the IPv6 native Internet lacks operational reliability.
  - Geoff Huston has considerable data on this reality.
  - http://www.potaroo.net/ispcol/2011-04/teredo.html
  - 40%+ effective failure rate
- Should not affect users because of RFC 3484/6724.

Teredo with relays != Reliable

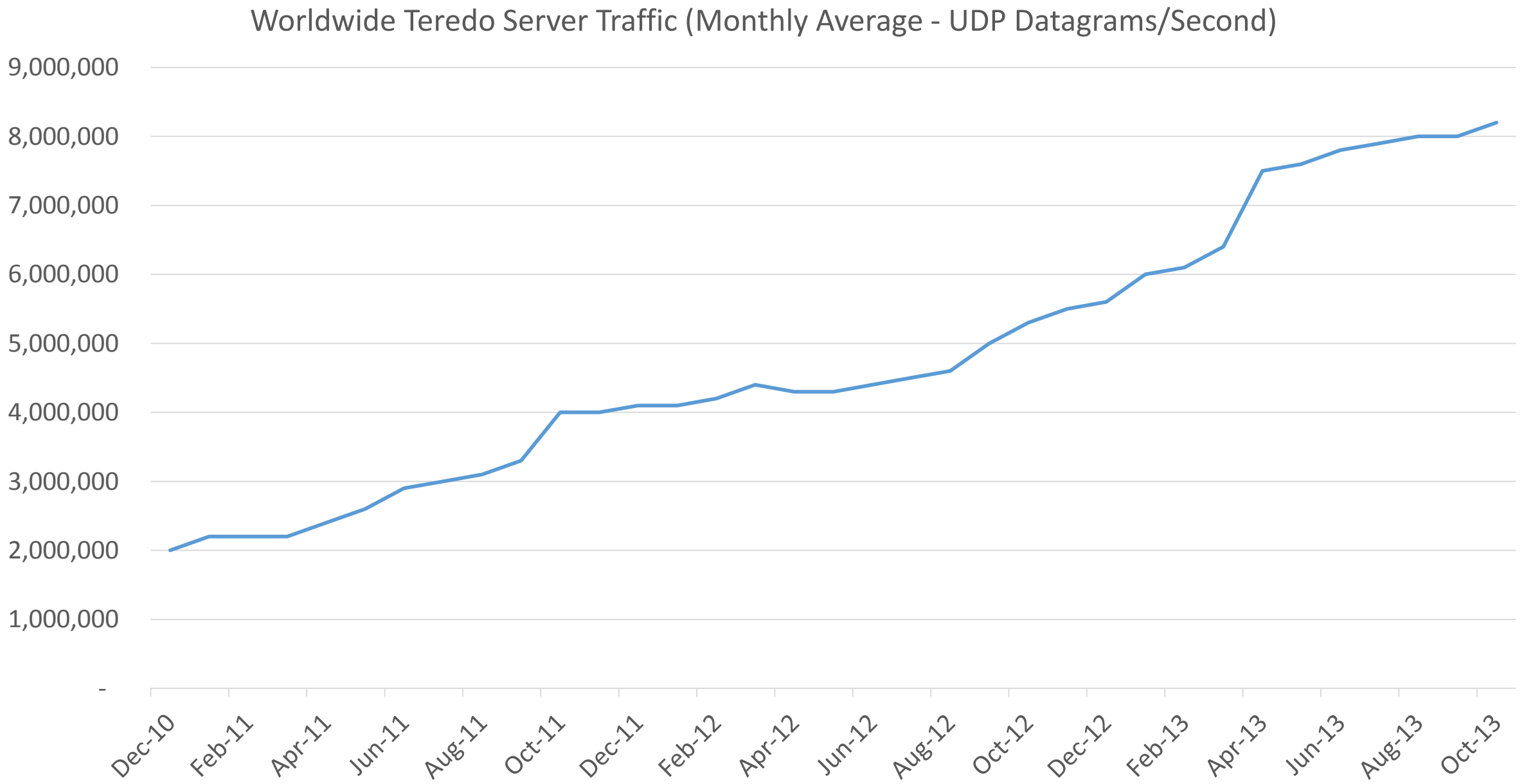
The Good

- As a technology for enabling connectivity between IPv4 peers, Teredo is pretty good.
- With basic matchmaking, able to achieve connectivity between Teredo clients about 90% of the time.
- Teredo has seen successful usage in “controlled” environments such as DirectAccess (a Microsoft remote access technology).

Teredo without relays = Usable

The Teredo Service

- We don’t have very specific telemetry on Teredo usage (privacy is important).
- We do know that Teredo server load had a dramatic increased - correlated to a popular BitTorrent client activating Teredo/IPv6 support.


Worldwide Teredo Server Traffic (Monthly Average - UDP Datagrams/Second)
9,000,000
8,000,000
7,000,000
6,000,000
5,000,000
4,000,000
3,000,000
2,000,000
1,000,000
-
Dec-10
Feb-11
Apr-11
Jun-11
Aug-11
Oct-11
Dec-11
Feb-12
Apr-12
Jun-12
Aug-12
Oct-12
Dec-12
Feb-13
Apr-13
Jun-13
Aug-13
Oct-13

The Overall Value of Teredo

- Teredo's value is best realized when coupled with supporting infrastructure for peer discovery, selection, and security.
  - As in, the infrastructure and API support we have for Xbox One.

- Having a tunneled IPv6 address, by itself, provides little value and causes pain for developers and end-users (because of random bad app behavior).

Proposed Sunset Plan

- We plan to deactivate our Teredo servers for Windows clients in the first half of 2014 (exact date TBD).
- Aligned to that, we encourage the deactivation of publically operated Teredo relays.
- We will maintain separate Teredo services for special-purpose scenarios that do not require public Teredo relays – like Xbox One.

- We deactivated the Teredo service earlier this year for a test. (see IETF 87 presentation)
  - Folks in the technical community seemed quite happy.
  - There were some app compat issues that we are following-up on.

Xbox One and Teredo (and IPv6)

Xbox One and Teredo

- Teredo provides an IPv6 abstraction for peers.
- Combined with IPsec, this can provide straightforward, application-transparent, secure P2P connectivity.
- Xbox One uses Teredo for this purpose.

Quickly…
Going to review Xbox One behavior

IPv6 Networks: IPsec and Transparent Operation

Allow users to disable firewall capabilities (transparent operation)

Allow unsolicited inbound IPsec and IKE

Sometimes Teredo is more reliable for P2P than native IPv6

Xbox will consider the following peer pairs:
Teredo Client -> Teredo Client
IPv6 -> IPv6
IPv4-> IPv4

NO Teredo Client -> Native

IPv4 Networks: Allow Teredo

Support outbound UDP with long port mapping refresh intervals (60 seconds +)

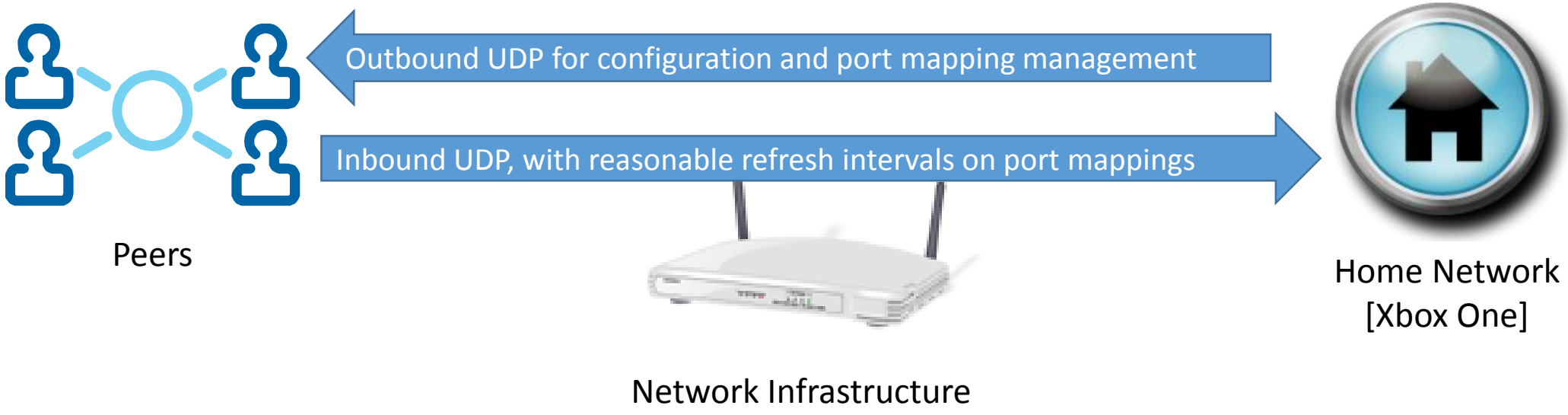
Teredo traffic will ***prefer*** port 3074 for peer traffic. Port forwarding for 3074 is helpful but not necessary (usually).

The more “open” the NAT behavior, the better.

Address-Independent > Address-Dependent > Address-and-Port Dependent > UDP Blocked

with older nomenclature

Open > Address Restricted > Port Restricted > Symmetric > UDP Blocked

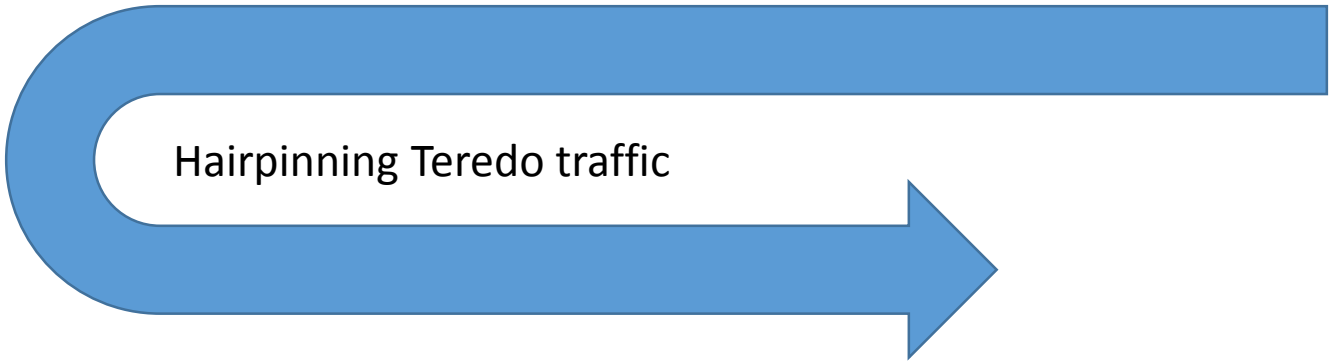


IPv4 Networks: Be Mindful of Hairpinning

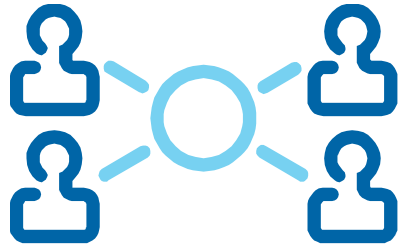
With CGN, multiple peers may be behind the same NAT device

Hairpinning allows those peers to communicate

Network Infrastructure



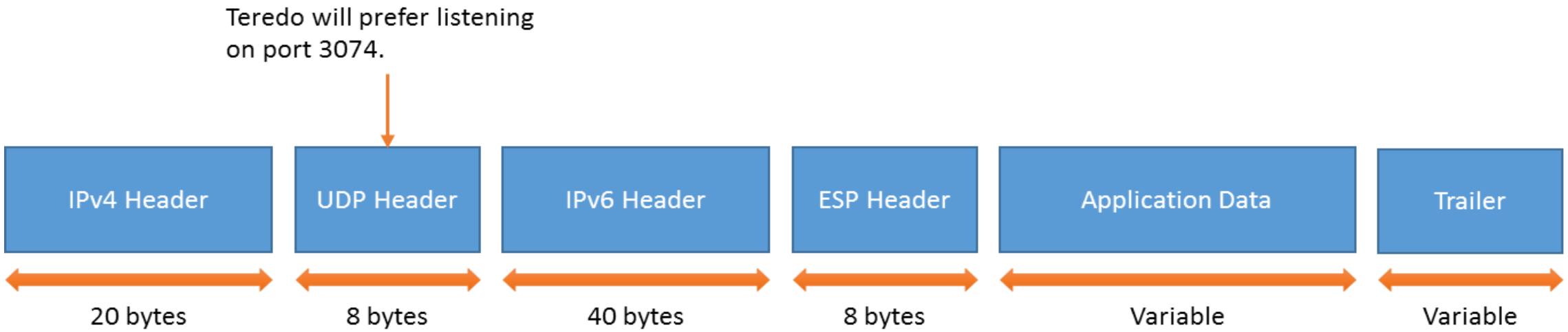
Home Network
[Xbox One]



Peers

Packet Format and Native IPv4

- P2P traffic will use the ESP option for IPsec
- Native IPv4 will be used if available, generally for link-local peers.



Questions?

We will send v6ops/NANOG notice about exact Teredo service dates.

- More detailed documentation aligned to this presentation is available at www.microsoft.com/IPv6.

- Relevant RFC's
  - RFC 6092 for IPv6 security recommendations
  - RFC 4380, 5991, and 6081 for more information on Teredo
  - RFC 4787 and 6888 have recommendations for NAT behavior