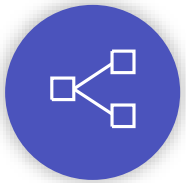
Module 2

Network Readiness

Objectives

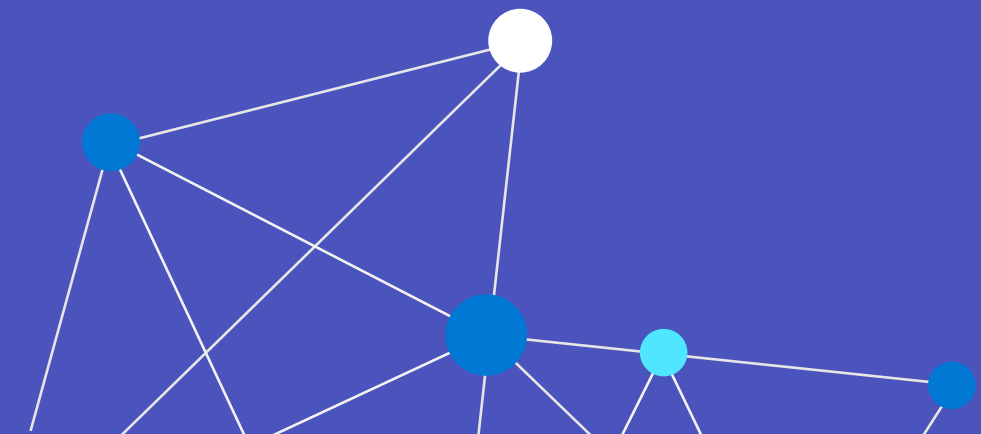
Learn about investments made to optimize network connectivity for Microsoft Teams

Have a better understanding of how media travels across networks



Understand how to optimize your network to best take advantage of Microsoft 365

Microsoft 365 Network Overview



Improvements from Skype for Business

New investments to improve

- Joining meetings including dial back
- Mid-call drops stay connected
- Audio and video quality
- Desktop sharing
- Low bandwidth network support

Cross company meeting simplification

- Simplify optional IP and port whitelisting
- Support full port 443 SSL/HTTP transport
- Web clients for all platforms

Making Meetings just work

Joining a meeting

- One click (or tap) join to audio conferences
- The right A/V device will be auto-picked while letting the user over-ride easily
- Easy meeting join from mobile phones (iOS and Android) – Wi-Fi, mobile
- Echo, echo, echo … howling prevention & echo cancellation while multiple devices are in the same room

Helping users

- Better user facing diagnostics – mic, speaker, audio quality, network connectivity
- Interactive troubleshooting – e.g. notify user when speaking while muted
- Video privacy leveraging background blurring

Microsoft Global Network and Next Gen Infrastructure

Global footprint

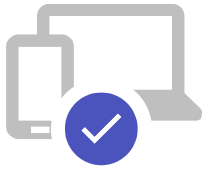
- Microsoft's global network is one of the top two networks in the world
- Hundreds of thousands of route miles of privately-owned dark fiber
- Peered with over 2700 ISPs globally in 190 locations and 38 countries
- Available for 90+% of the internet connected population with metrics comparable to the Tier 1 ISPs/Telcos
- Media processors & relays deployed to 50+ Microsoft data centers and edge sites with more being deployed

Optimized for media

- Fiber connections designed to reduce latency between regions
- Edge sites placed close to the users to reduce number of hops and latency
- Keep improving ISP peering performance based on call quality telemetry
- Audio traffic prioritized throughout the Microsoft Global Network
- Meetings hosted close to the participants
- Consolidated IP ranges and ports for calling and media

Microsoft's fiber optic network could stretch to the moon and back, three times over!

How we connect to Microsoft 365 over the Internet



Corporate Network
- Full control
- Full responsibility
- Higher costs for managed WAN connections

Internet
- Very limited control
- Can select ISP
- Usually higher BW at lower costs

This is not what's happening

Corporate Network → Internet

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MSFT Network
- Zero jitter & loss
- Latency only imposed by distance & Speed of light
- Part of Microsoft 365 & Azure

Corporate Network → Internet → MSFT Network

How to optimize your network

Corporate Network
- Full control
- Full responsibility
- Higher costs for managed WAN connections

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MSFT Network
- Zero jitter & loss
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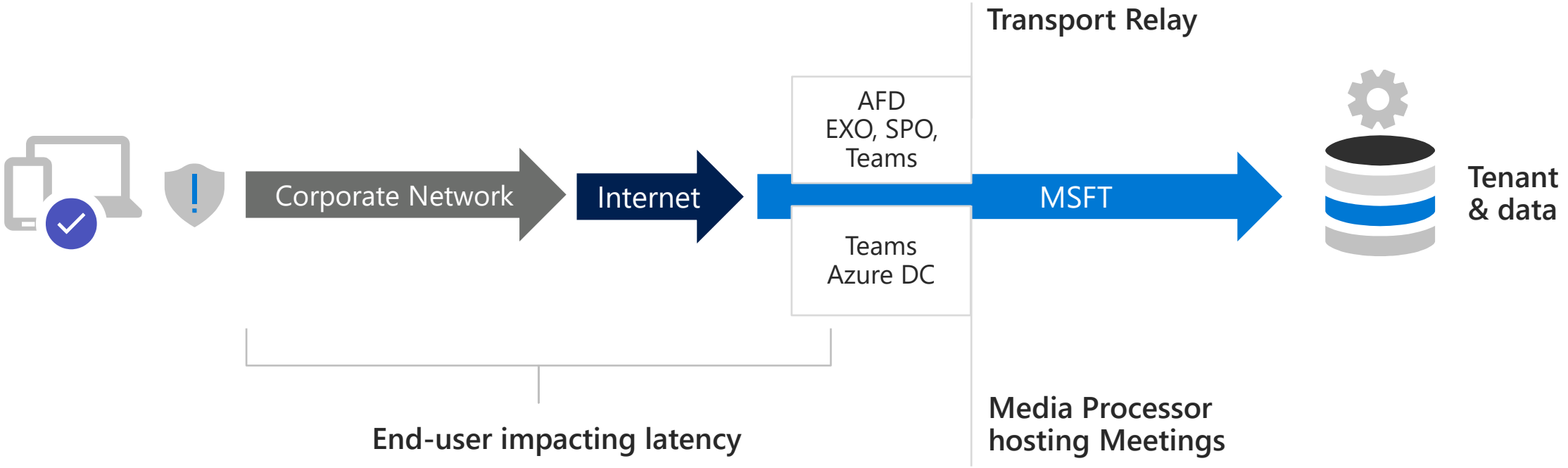
Traditional, centralized Internet breakout

Recommended: Local Internet breakout for O365 traffic

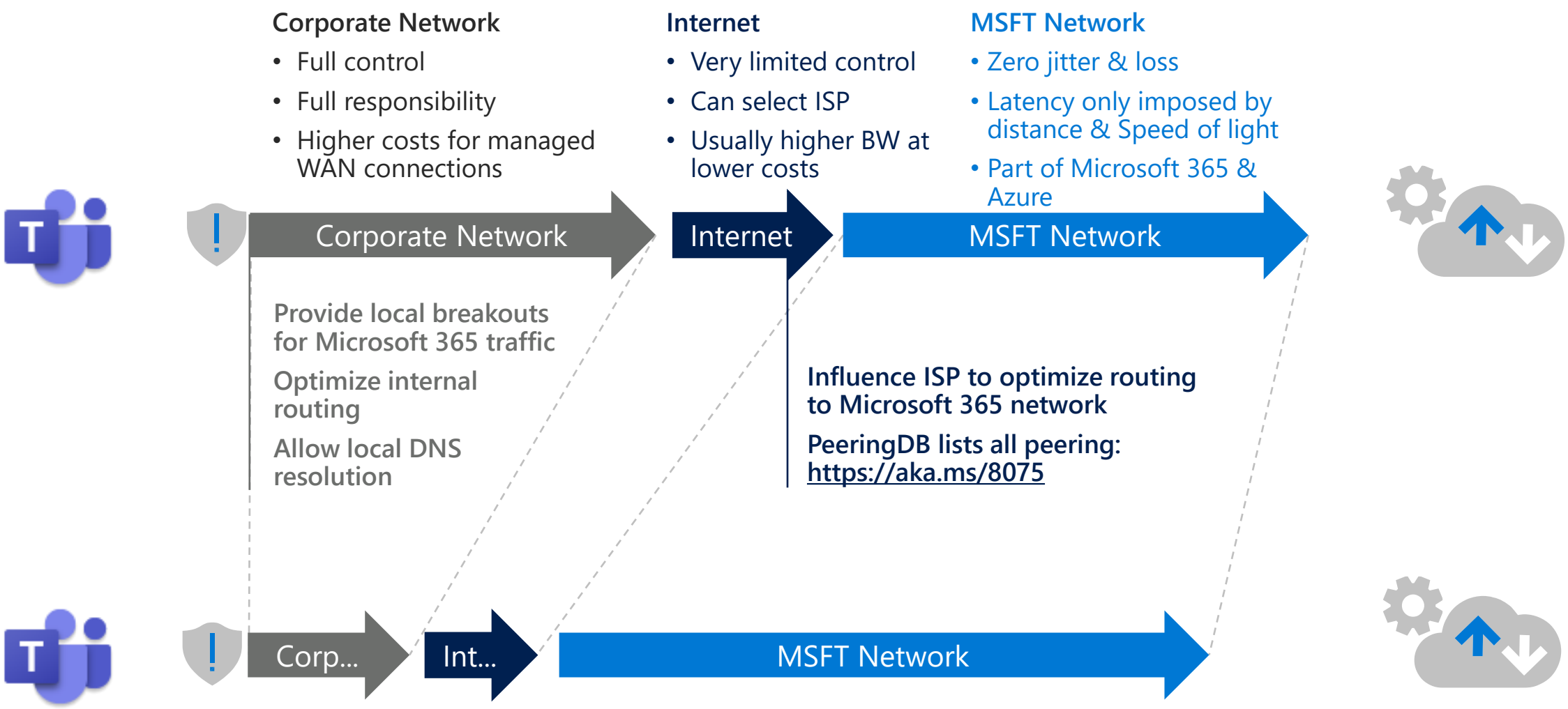
Low latency is the currency in a SaaS world

AFD = Azure Front Door

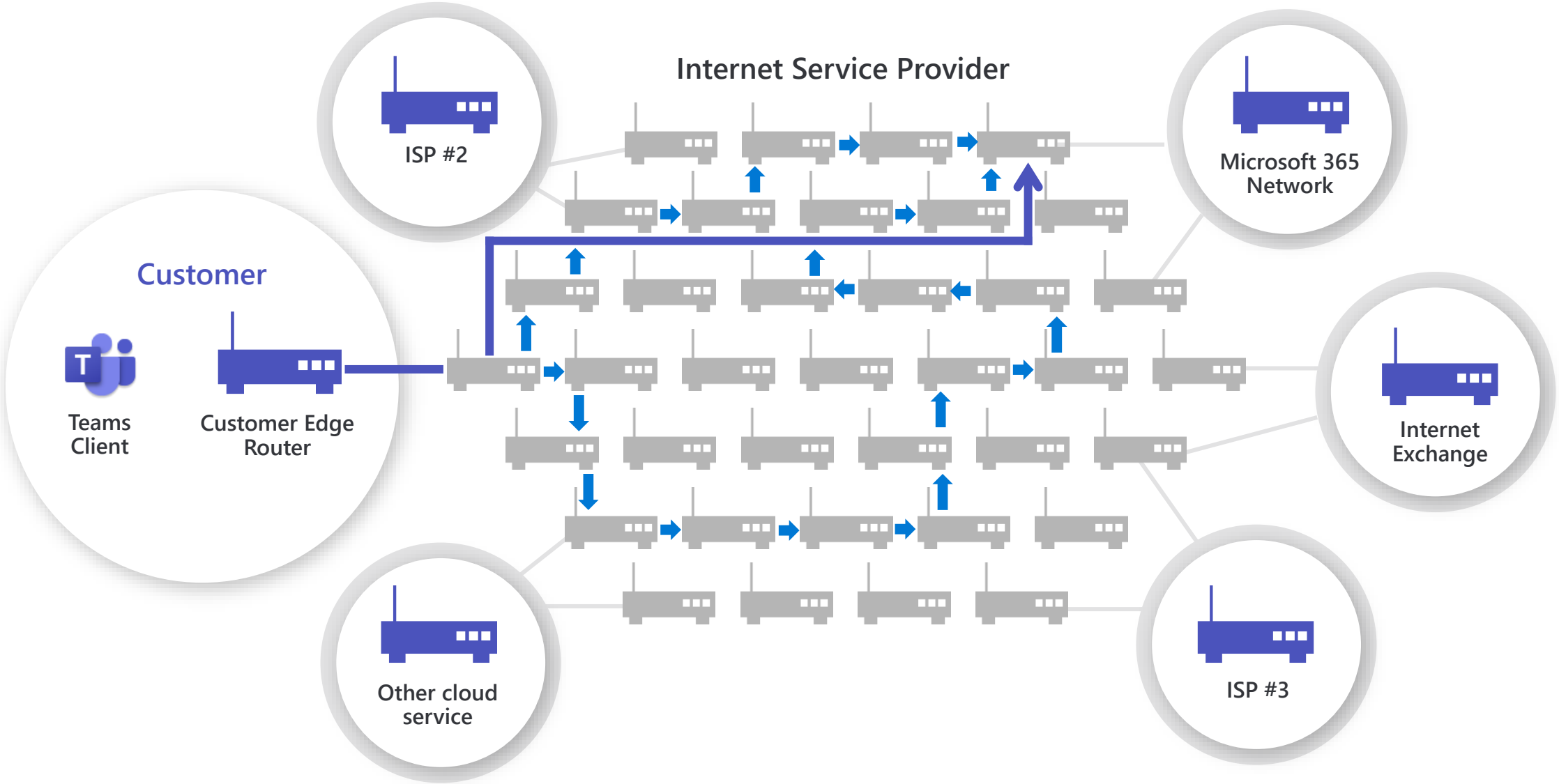
Services close to the user to minimize latency between user and the service



Optimize connectivity to Microsoft 365 network



About peering

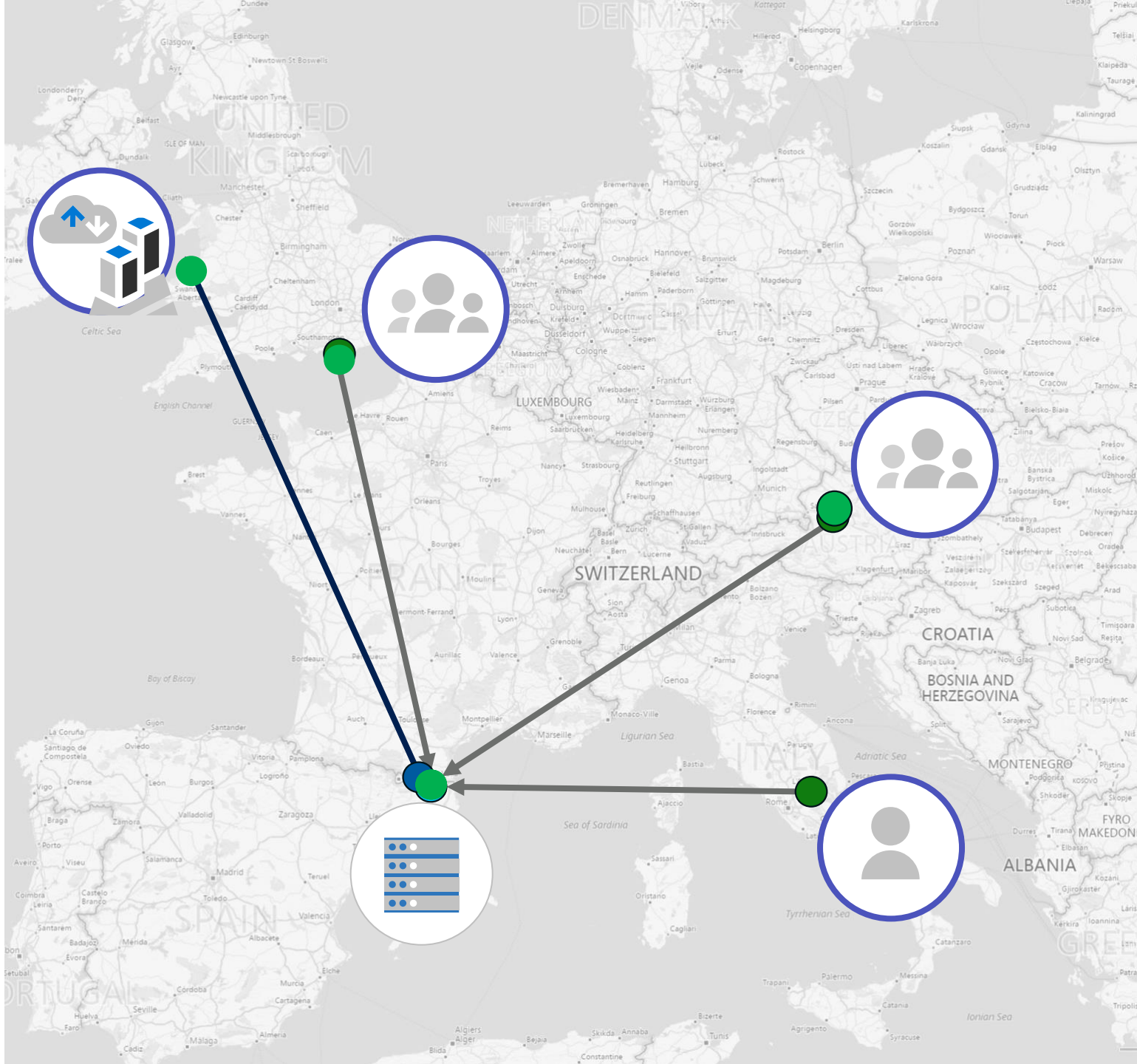


Centralized Internet: from your office to Microsoft 365

Corporate network

Internet access

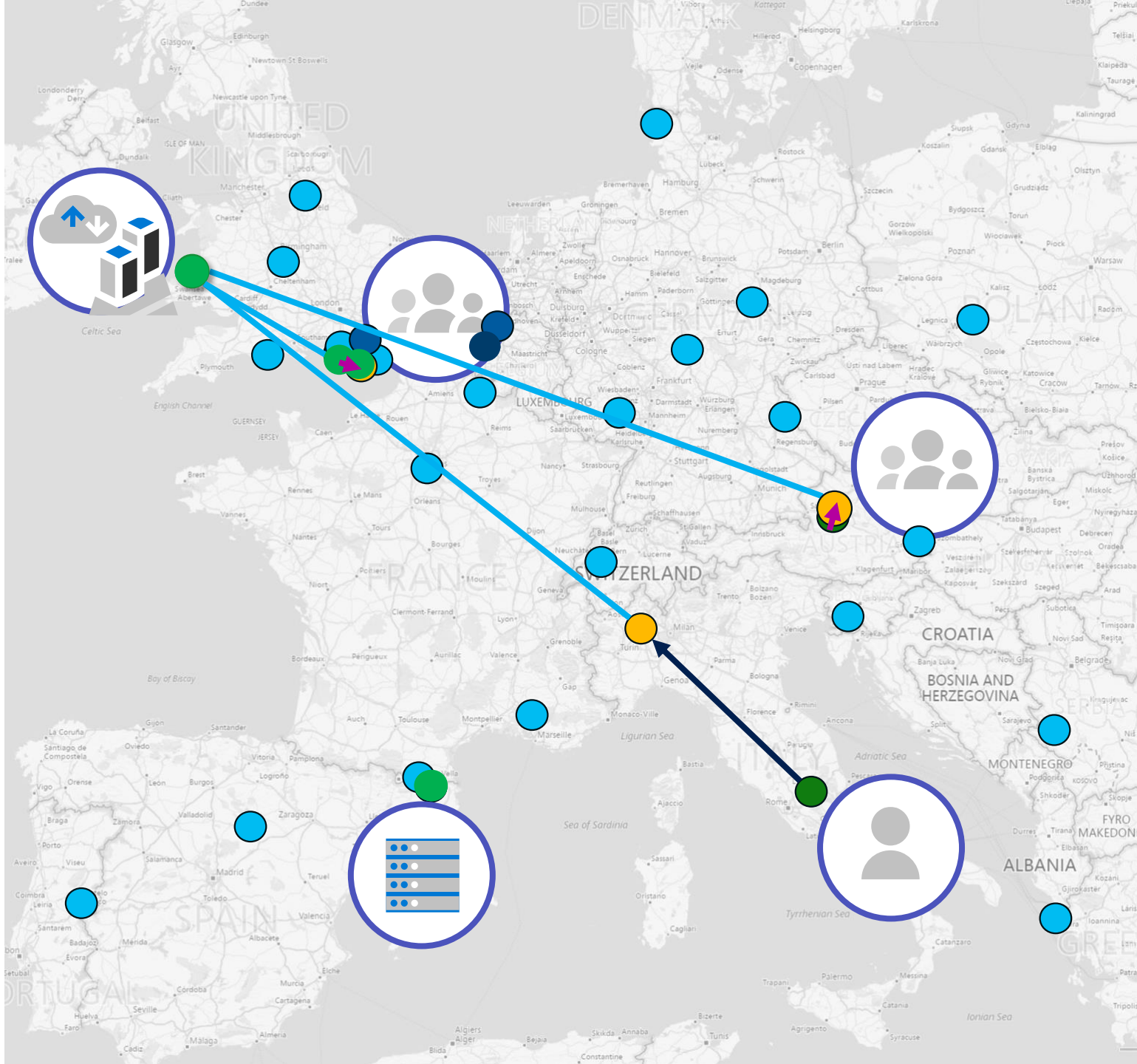
Office location



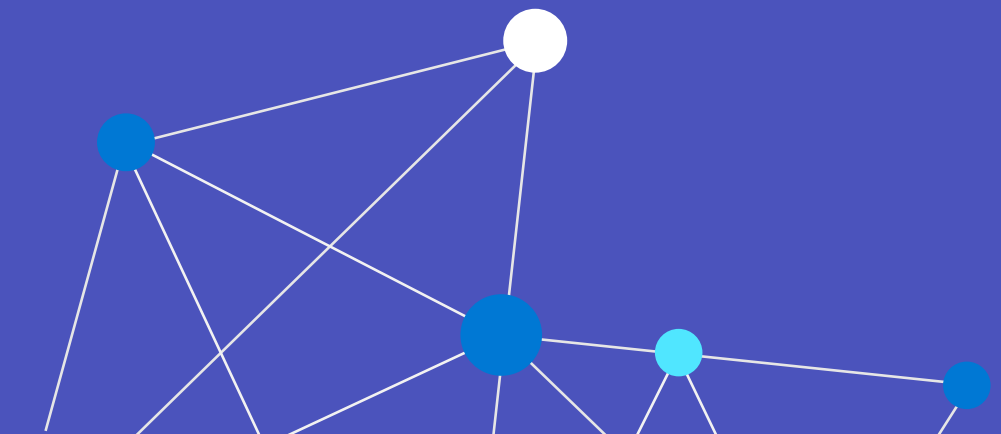
Local breakout: ideal connection to Microsoft 365

- Corporate network
- Internet access
- Microsoft network

- Office location
- Microsoft peering location
- Utilized peering location



Media flows



Types of calls

Direct calls

- Ad-hoc call with 2 users
- Media flows as directly as possible between end points

Meetings

- Ad-hoc call with more than 2 users
- Scheduled calls
- Media flows as directly as possible between end points and conferencing service
- End points will connect directly via random high ports if possible
- If high ports are closed, end points will connect via Transport Relay on 3478-3481 UDP

Meeting locations

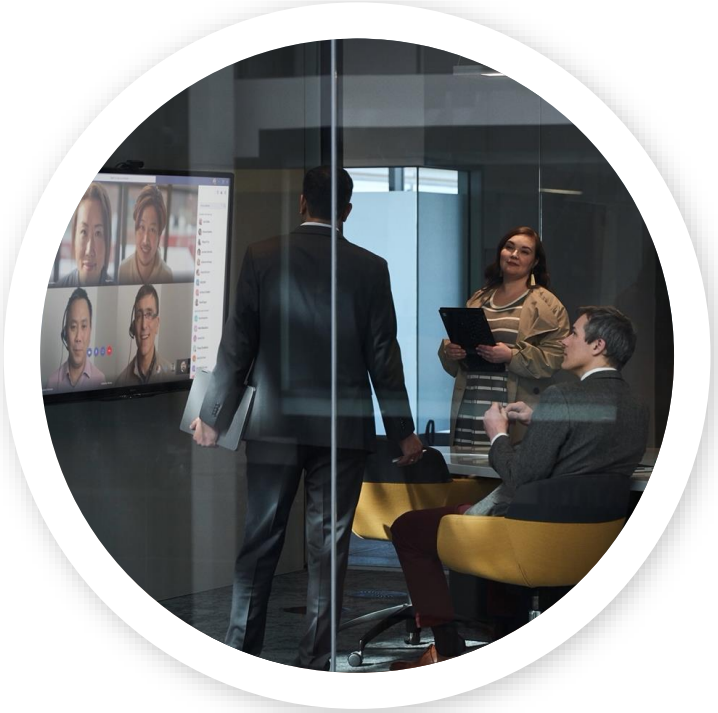
Teams provides local meetings

To minimize latency and provide better user experience

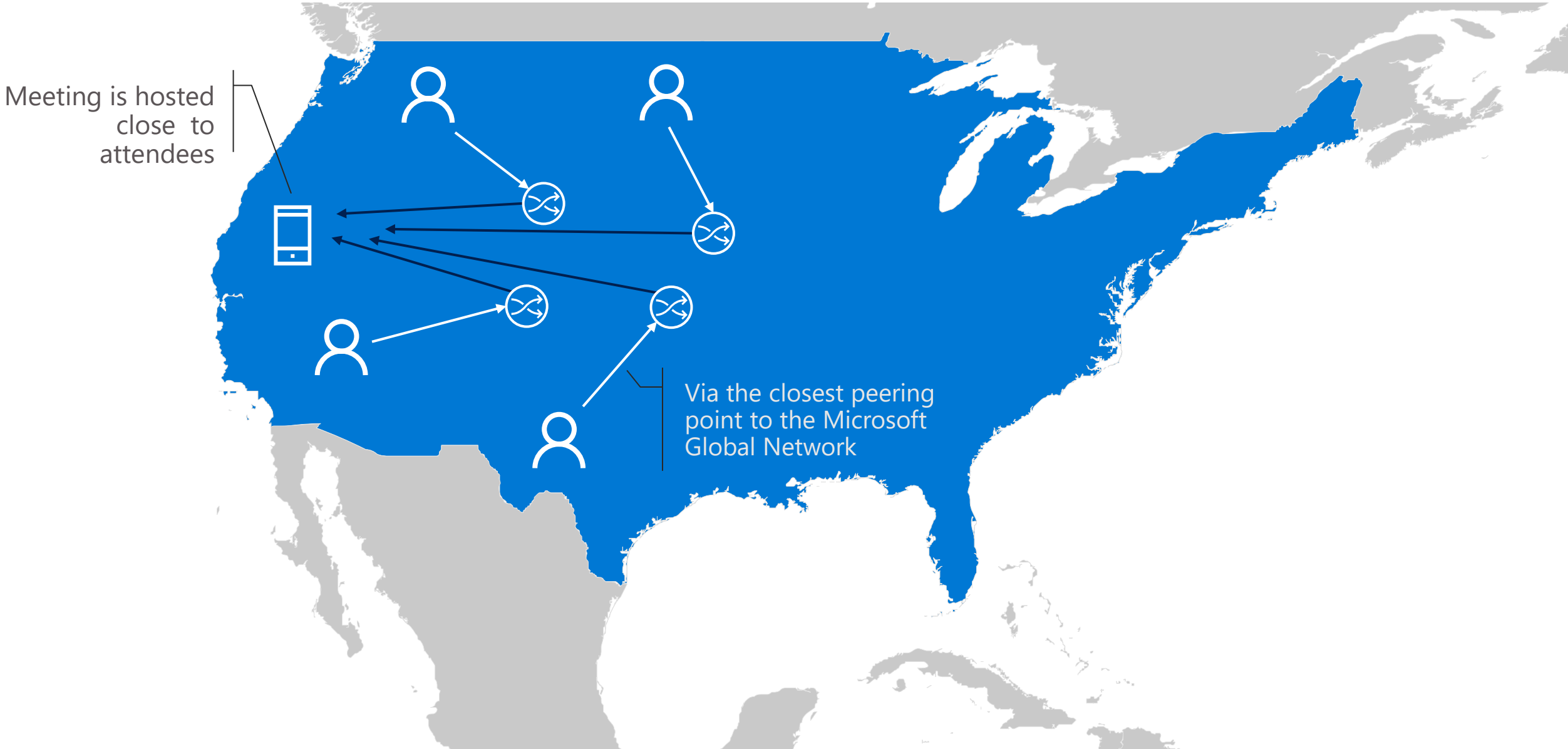
Meeting located in user region

Based on the first user who joins the meeting

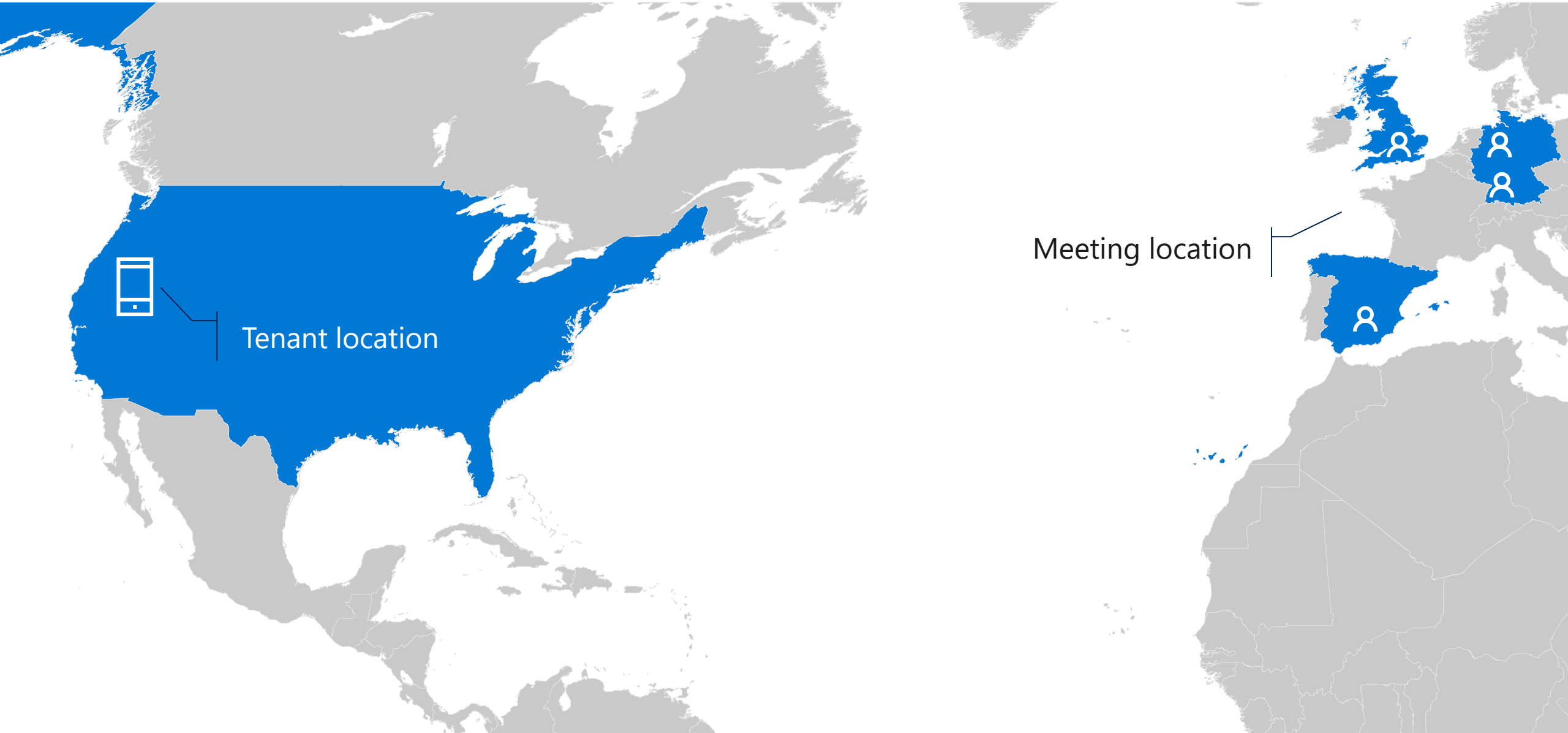
Minimum number of hops to datacenter



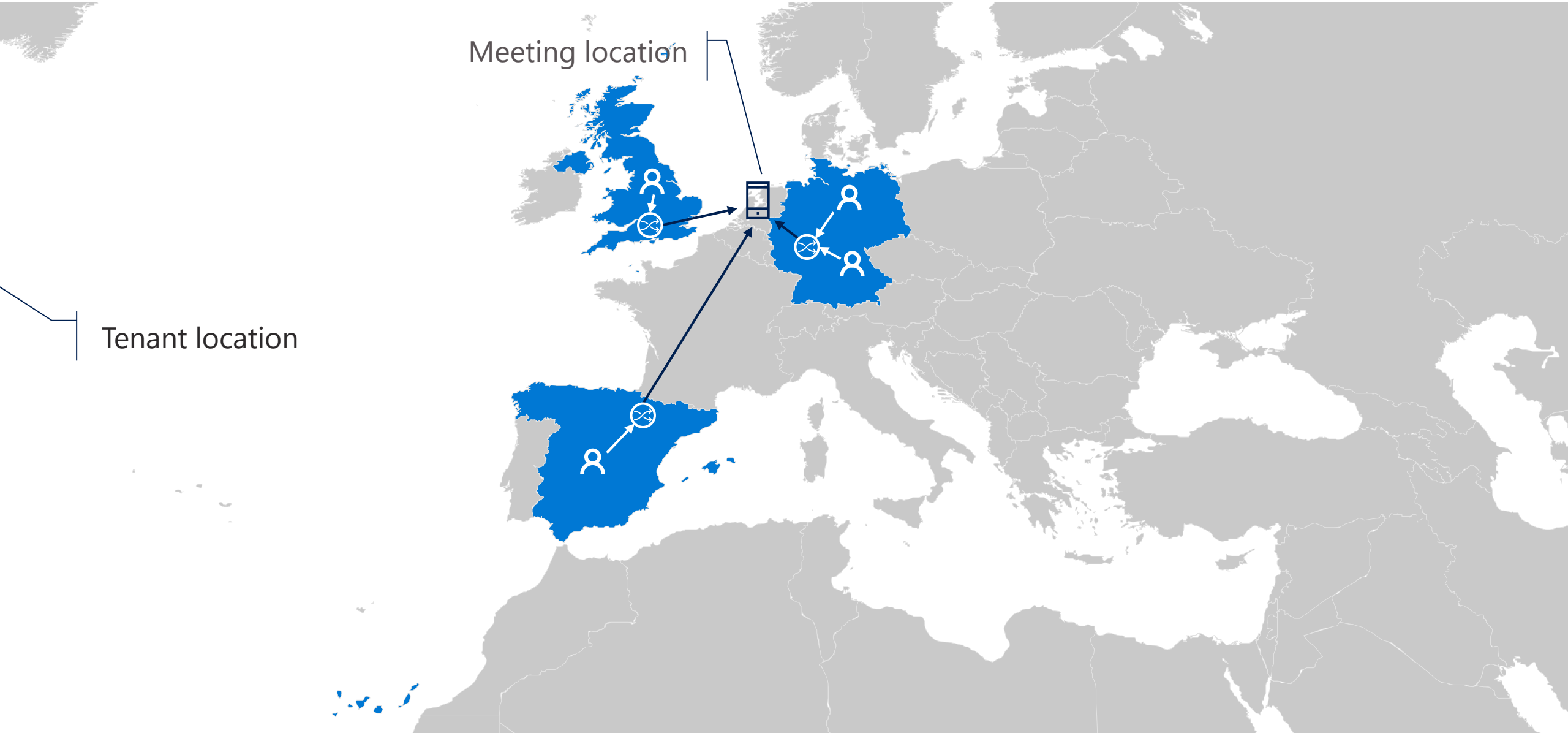
Example 1: US tenant with US users



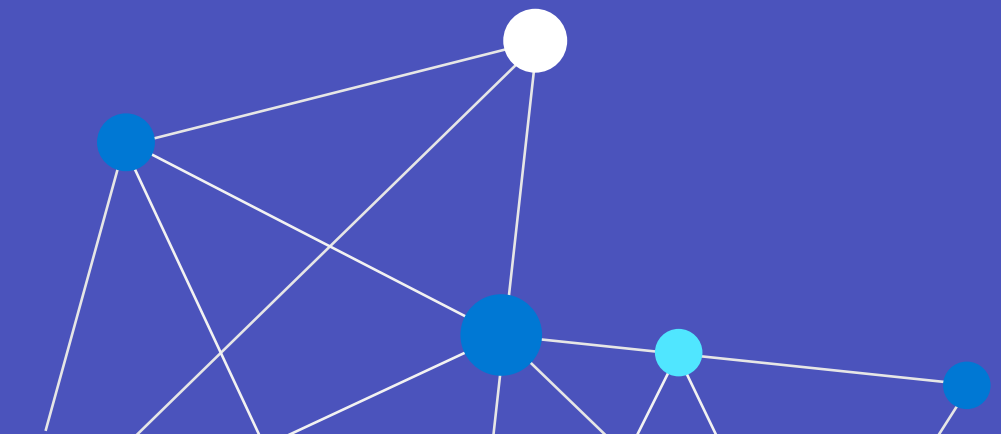
Example 2: US tenant with European users



Example 2: US tenant with European users

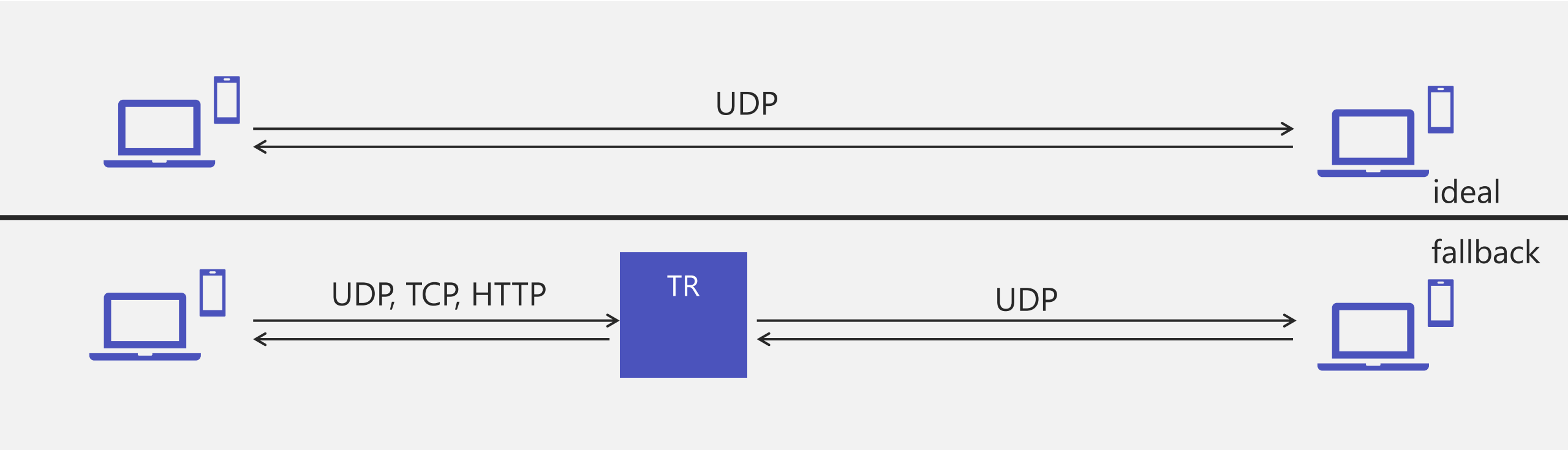


Transport relays & media processors



Transport Relay principles

- UDP is king when it comes to latency, direct connection is preferred
- Transport Relay (TR) is used as fallback to establish connection to second endpoint
- Client to TR can be UDP, TCP, or native HTTP for proxy support
- TR will only offer UDP candidates even when you establish session over TCP or HTTP



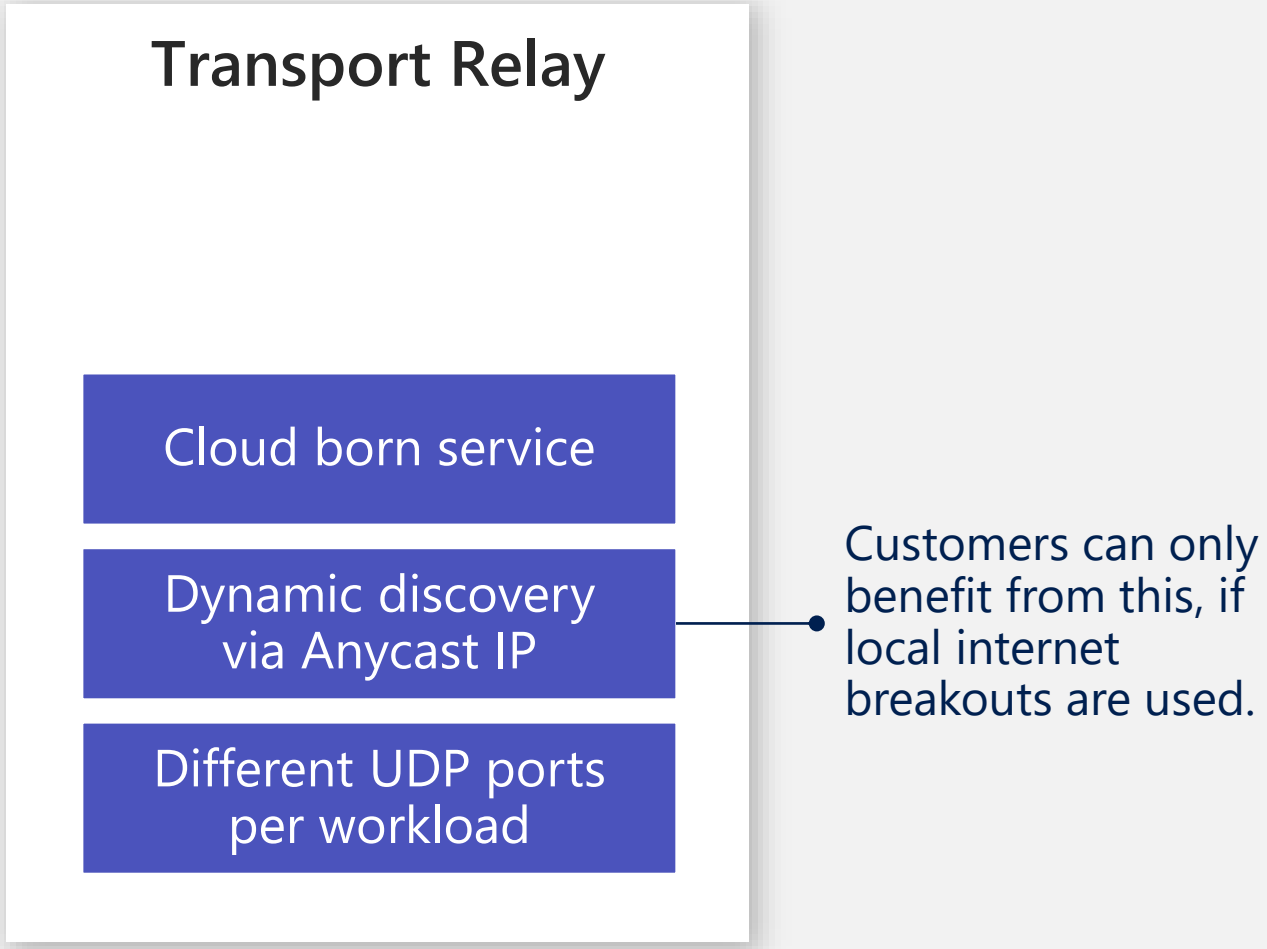
Transport Relay

Anycast IP address

- Same IP assigned to geographical dispersed servers
- IP routing ensures to always use the “closest” instance

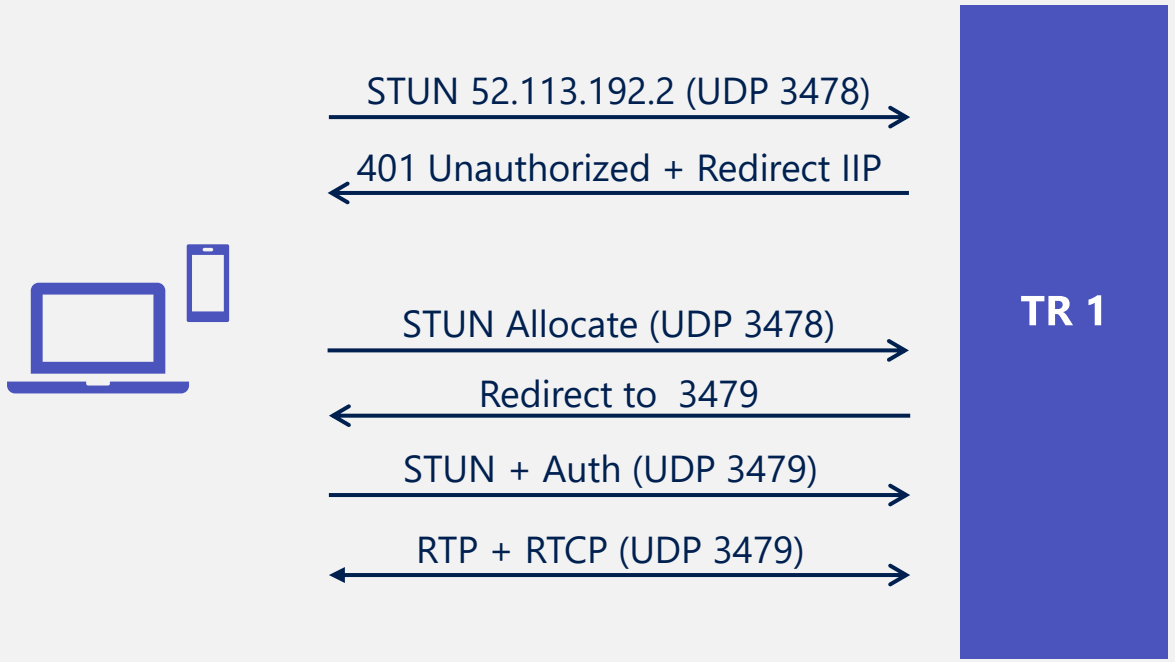
Closest available transport relay will receive traffic

- Based on actual endpoint location
- And based on privacy boundaries
- Sovereign tenants' users use local infrastructure



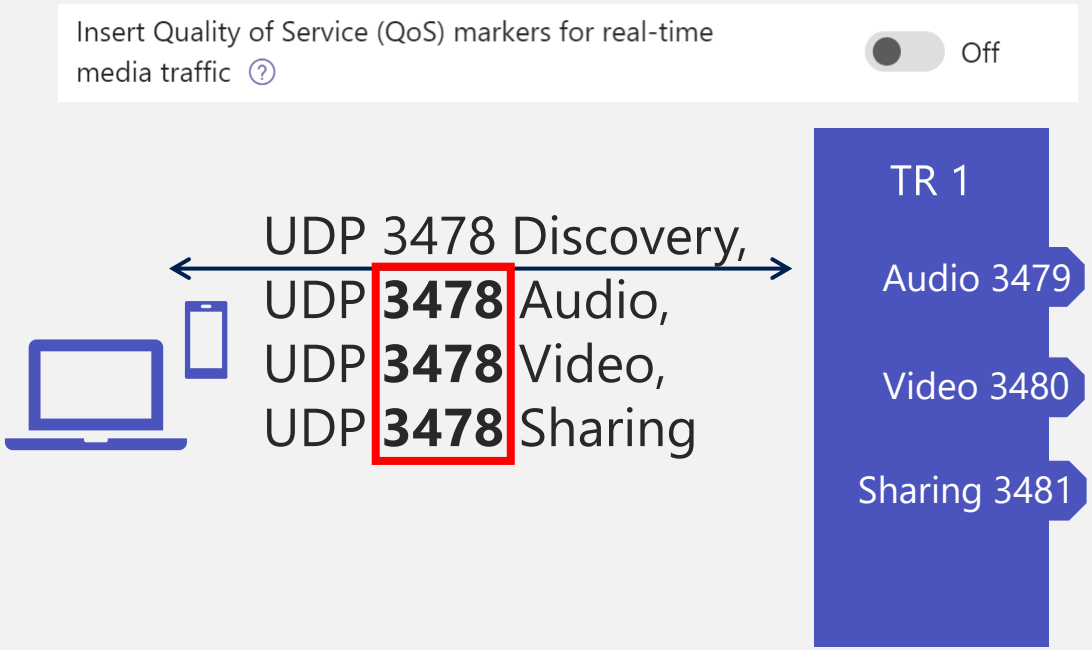
Transport Relay discovery + candidate allocation

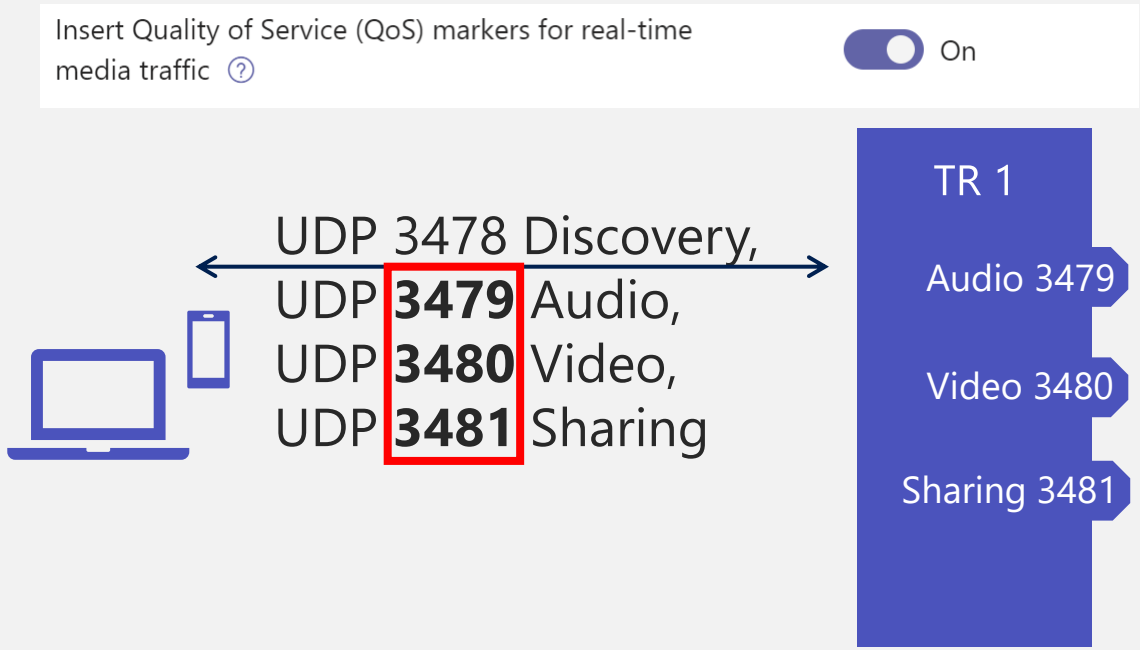
- Client connects to TR's anycast IP 52.113.192.2
- Routed to next TR presence
- An available TR answers, redirects from Anycast to individual IP (IIP)



UDP ports 3478 - 3481

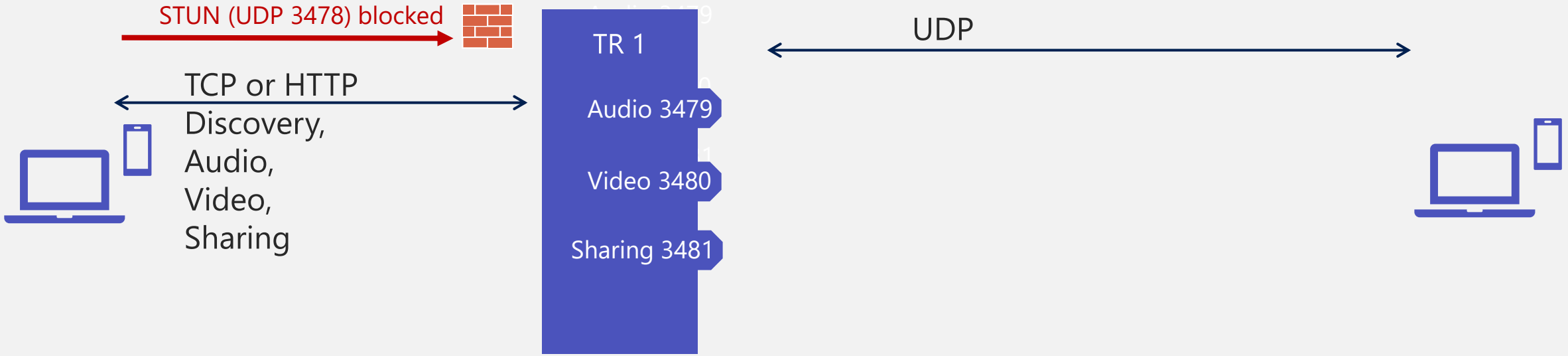
- UDP 3478 is always used for initial communication with TR
- TR always allocates workload specific UDP ports
- Client-to-TR uses service-specific workloads only if QoS is enabled



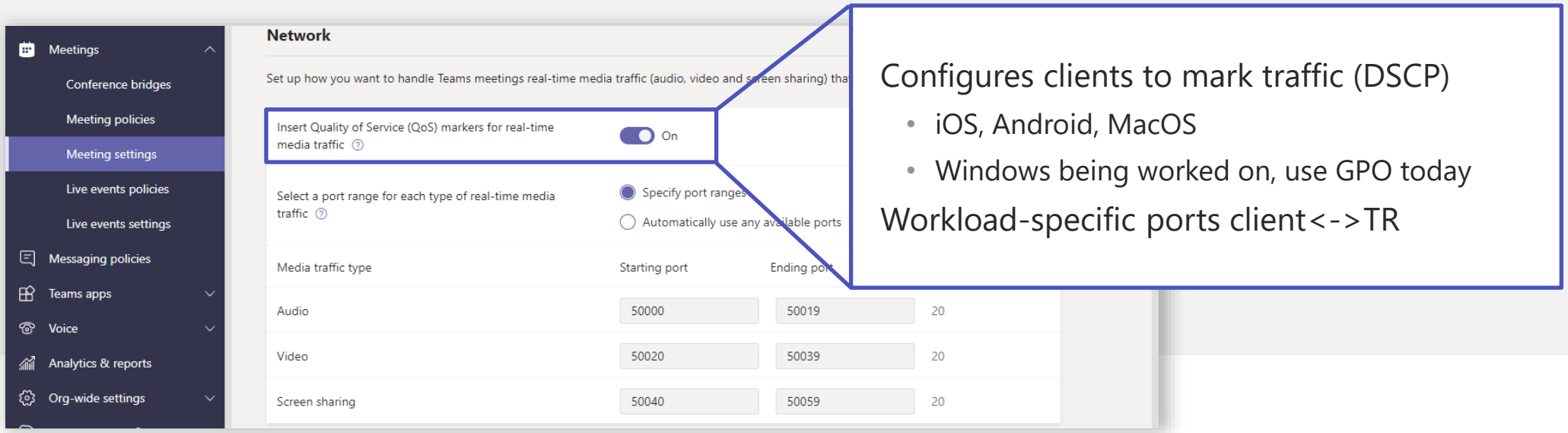


TCP blocked on one side

- User cannot reach his TR via UDP
- Fallback to TCP or HTTP
- Allocated candidates remain UDP, call leg to TR remains UDP



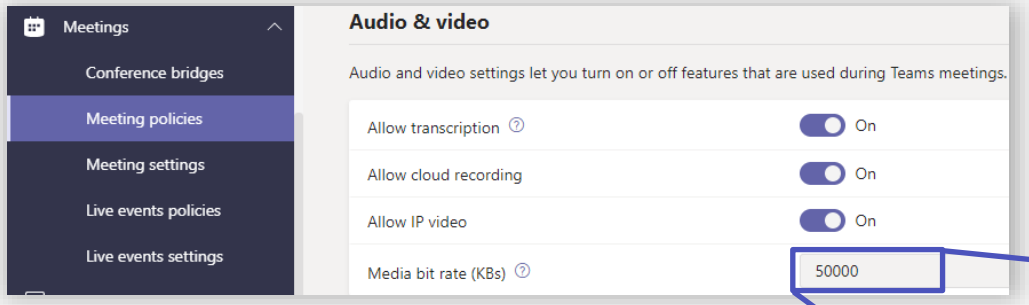
QoS



- Capitalize on SfB investments, Teams uses SfBO client port ranges
- Minor updates & changes required for SfB server environments
- ACLs for return traffic
- Local breakouts help to reduce the importance of QoS.
- Don't use TR destination ports, TRs are not always used!

→ http://aka.ms/QosinTeams

BW controls - why & when to use



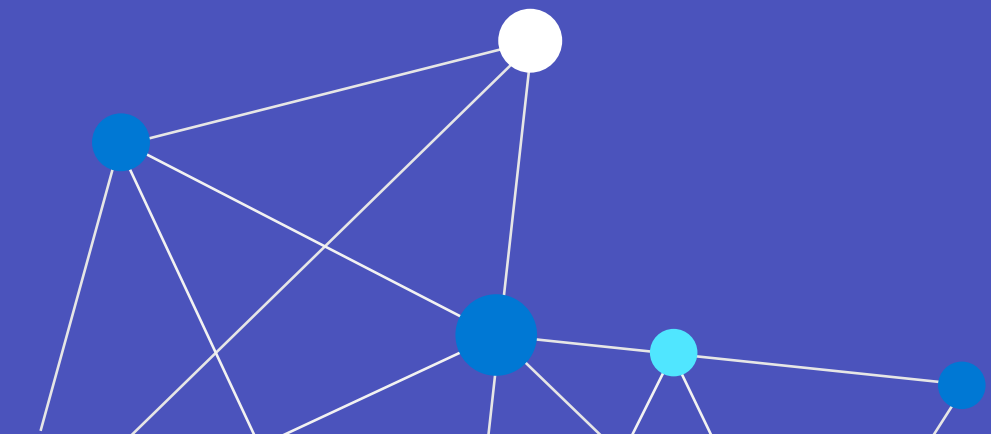
Controls average, cummulative BW consumption (Audio, Video, Sharing)

- Media Stack optimizes for end-user experience under given conditions, no direct control over codecs etc.
- Limit is on average consumption, not peak.
- Sharing may have peaks above this rate limit.

Bandwidth(up/down)	Scenarios
30 kbps	Peer-to-peer audio calling
130 kbps	Peer-to-peer audio calling and screen sharing
500 kbps	Peer-to-peer quality video calling 360p at 30fps
1.2 Mbps	Peer-to-peer HD quality video calling with resolution of HD 720p at 30fps
1.5 Mbps	Peer-to-peer HD quality video calling with resolution of HD 1080p at 30fps
500kbps/1Mbps	Group Video calling
1Mbps/2Mbps	HD Group video calling (540p videos on 1080p screen)

→ https://docs.microsoft.com/en-us/microsoftteams/prepare-network

Let’s talk about your network



Network discovery

Topics to discuss

- Number of sites
- Local or centralized Internet
- QOS
- Bandwidth per site
- Firewall ports and URLs
- Local or centralized DNS
- VPN / proxy

Network discovery

User types

Office

Remote

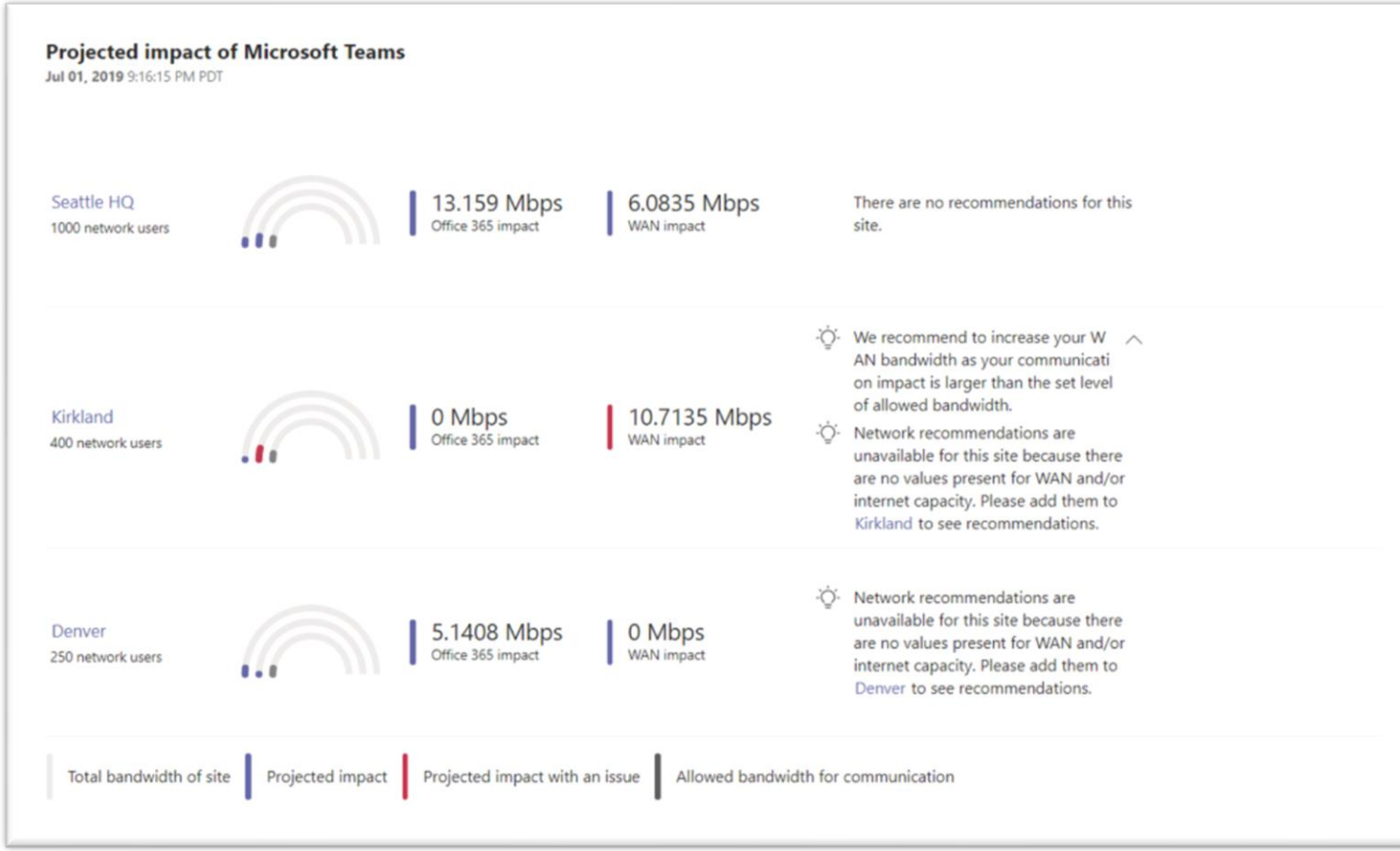
Hybrid

External vs guest

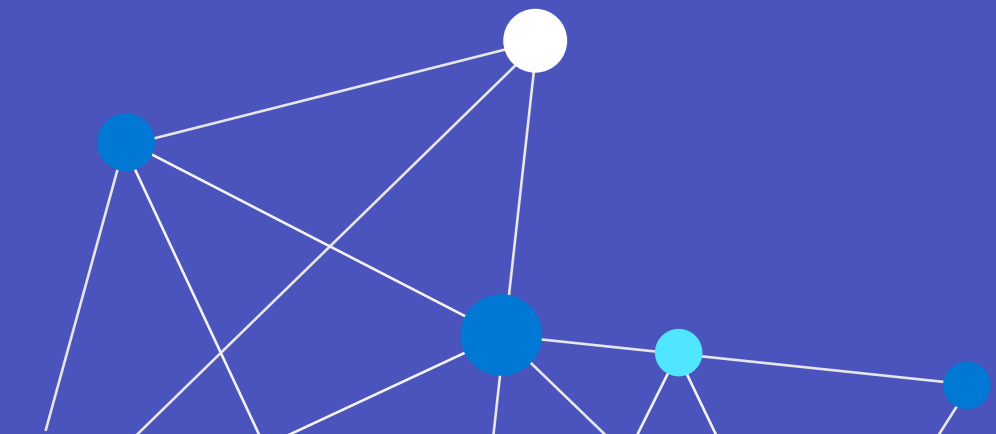
Network Planner in Teams Admin Center

Microsoft Teams users across your organization

When your network details and Teams usage is provided, the Network Planner calculates your network requirements for deploying Teams and cloud voice across your organization's physical locations.



Proxy servers and firewalls



Proxy servers

Proxy servers should *always* be bypassed with Teams Rooms devices

Microsoft Teams Rooms is designed to inherit proxy settings from the Windows OS.

If you must define a proxy, do this via the Admin account

For full details: https://docs.microsoft.com/en-us/MicrosoftTeams/rooms/rooms-prep#proxy

Never do deep packet inspection or break/inspect on real time media.

Ports and URL's

Skype for Business Online and Microsoft Teams

Windows Update

Intune:

Manage.Microsoft.com

Graph.Windows.net

Windows Store:

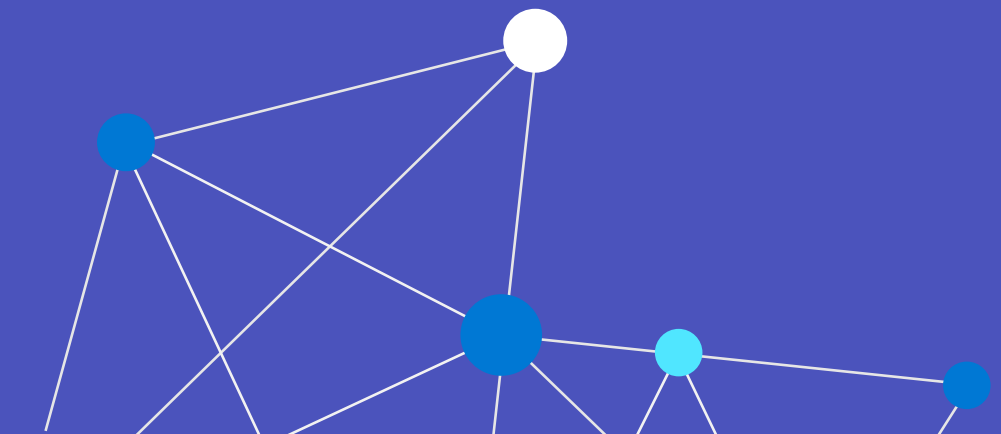
https://*.ws.microsoft.com

http://*.ws.microsoft.com

Time Server:

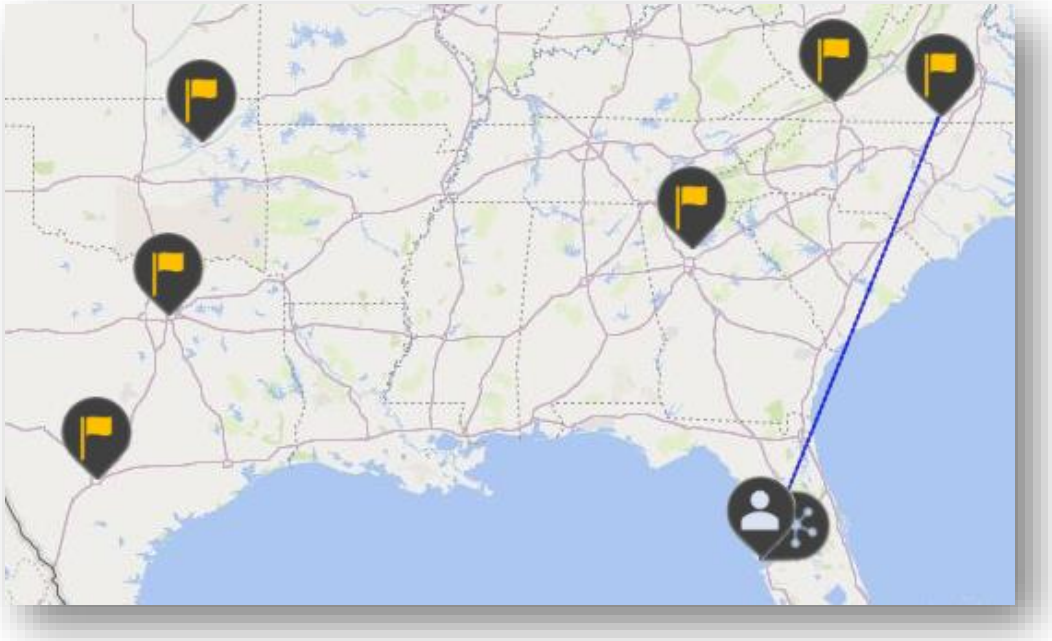
Pool.ntp.org

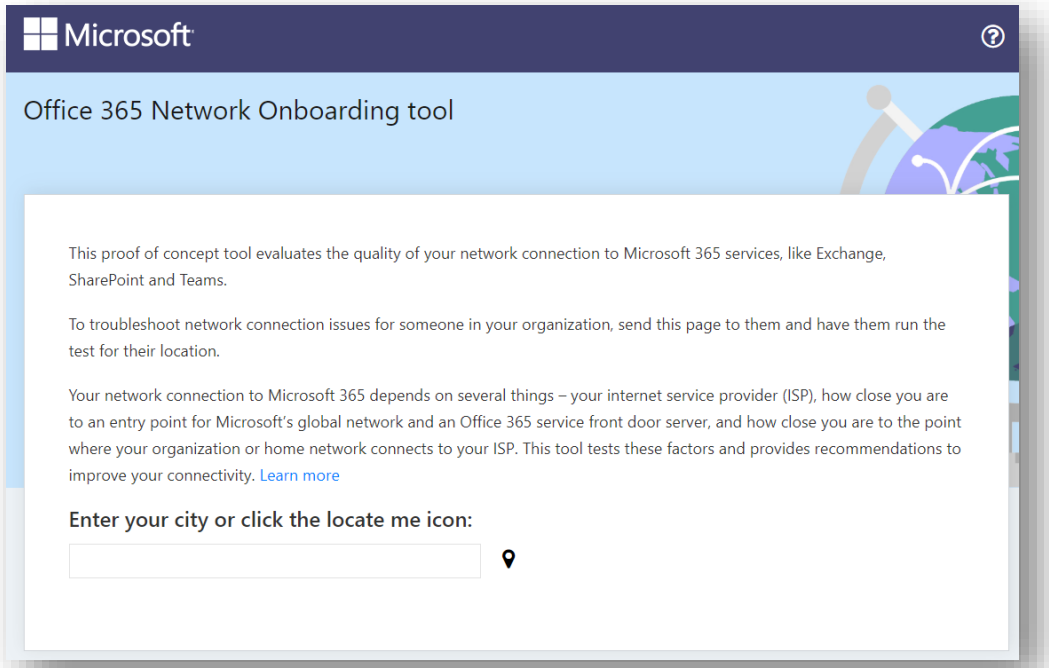
Tools

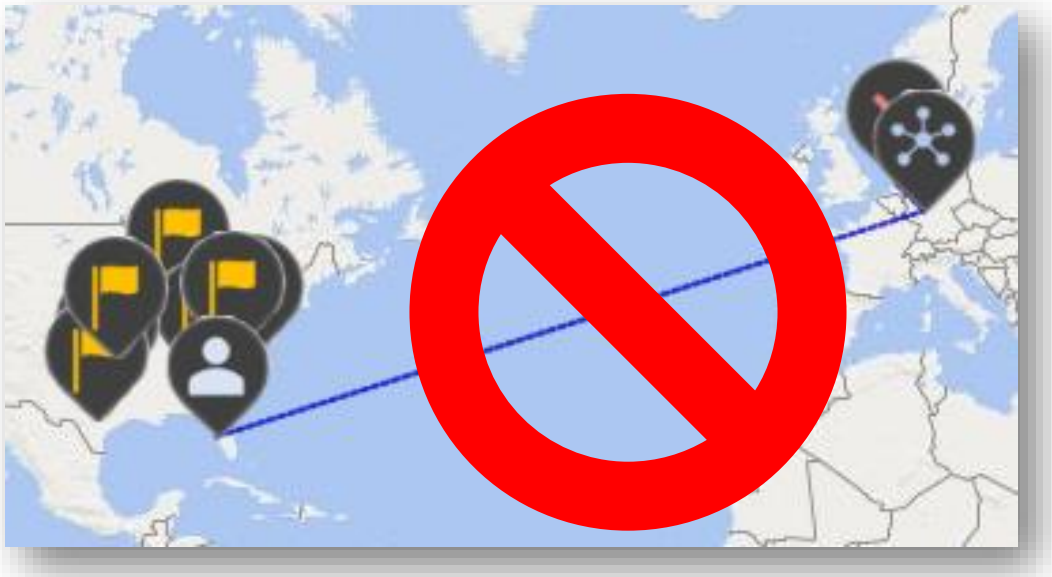


connectivity.office.com

This tool uses your location and shows where the optimal front door locations are.

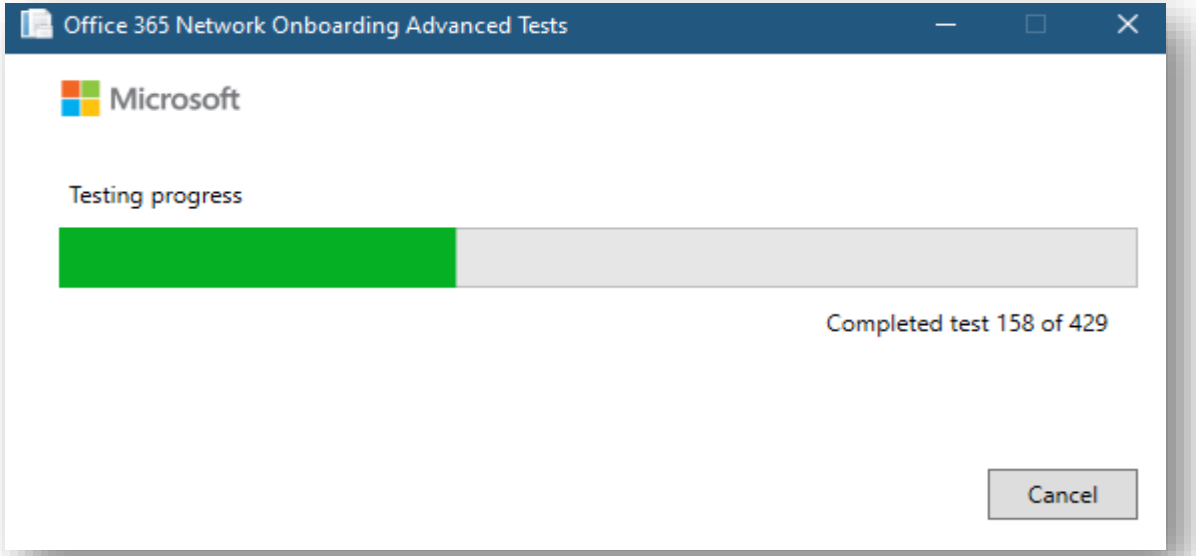






connectivity.office.com

Advanced network tests can also be run to get additional information



4 Teams media quality

What we test	Your results
Media connectivity (audio, video, and application sharing)	No errors
Packet loss	0% (target < 1% during 15s)
Latency	42 ms (target < 100ms)
Jitter	25 ms (target < 30ms)
Packet reordering	0 (target < 0.05%)

connectivity.office.com

Poor results example

1 Your information

What we test	Your results
Your location	St Petersburg, Florida, United States as entered by user
Network egress location (the location where your network connects to your ISP)	Frankfurt am Main, HE, DE
Your distance from the network egress location	[1] 4,832 miles (7,775 kilometers)
Time to make a DNS request on your network	10.63.0.1 (140 ms) 192.168.1.10 192.168.1.210 8.8.8.8 8.8.4.4 192.168.144.1 ::
Your distance from and/or time to connect to a DNS recursive resolver	[4] 45.86.203.193 (140 ms)
If you use a proxy server, distance from your location and time to connect	A proxy server was not identified in your connection
	Forced tunnel VPN detected:

4 Teams media quality

What we test	Your results
Media connectivity (audio, video, and application sharing)	No errors
Packet loss	[7] Skype call was not successful
Latency	[7] Skype call was not successful
Jitter	[7] Skype call was not successful
Packet reordering	[7] Skype call was not successful

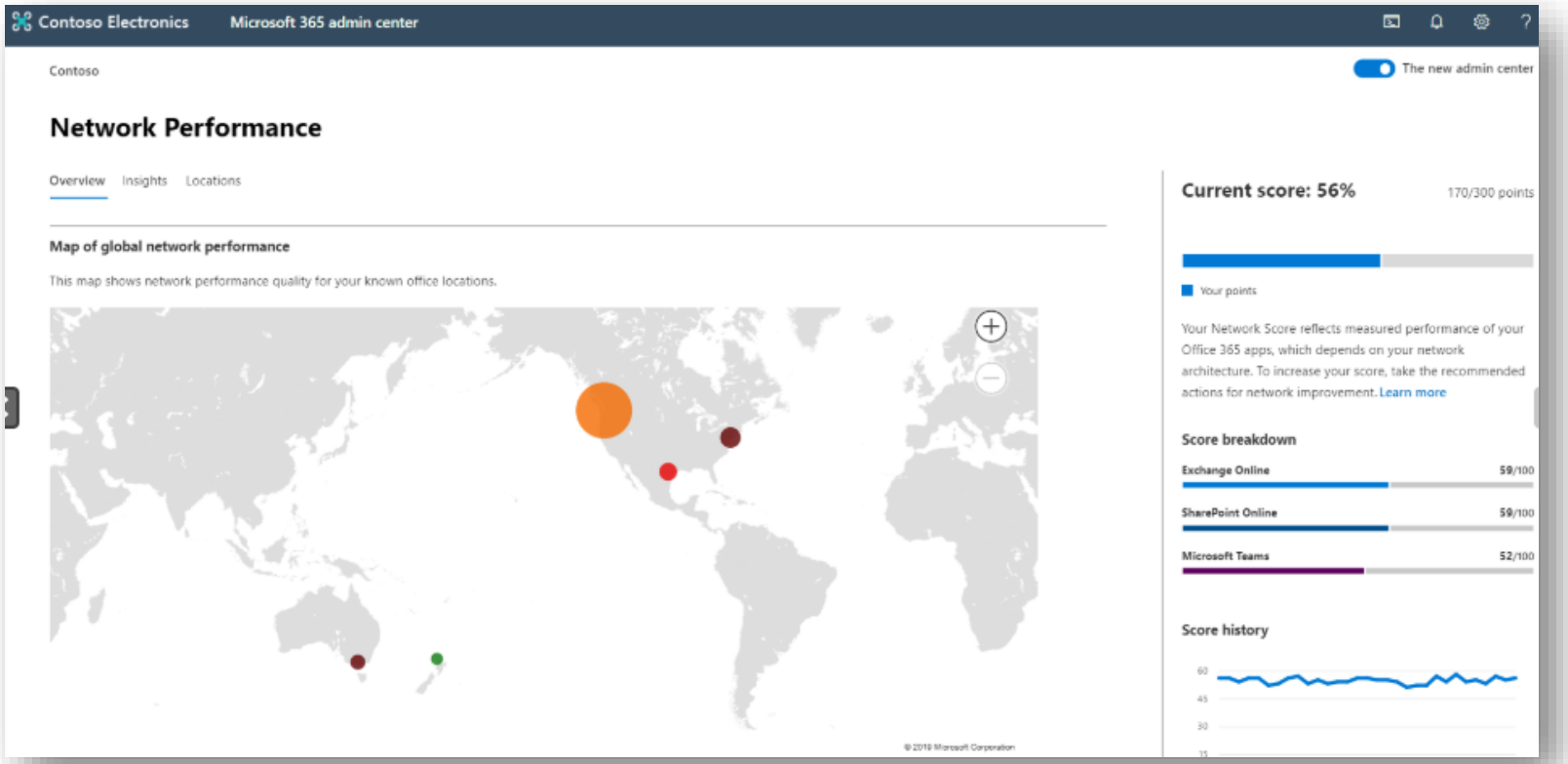
Network performance in the Microsoft 365 Admin Center

Currently in Preview

Metrics collected by OneDrive, Teams, and Exchange

Compare results against other organizations in a region

Quickly see performance results

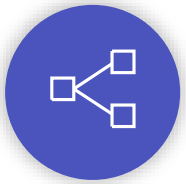


http://aka.ms/netignite

Summary

You should have a better understanding of the investments Microsoft has made with Microsoft Teams

We went into detail how Microsoft designed cloud-based connectivity, especially for Microsoft Teams



Explain why bypassing proxy and firewalls can provide an optimal experience for Microsoft Teams.

Questions?