



SharePoint
CONFERENCE
NORTH AMERICA

Understanding and Avoiding Performance Pitfalls with SharePoint online

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Our Agenda

- SPO's current implementation
- Service Improvements
- What contributes to poor performance?
- Strategies for good performance
- Gathering diagnostic data and Tools
- Q & A

SPO's current implementation

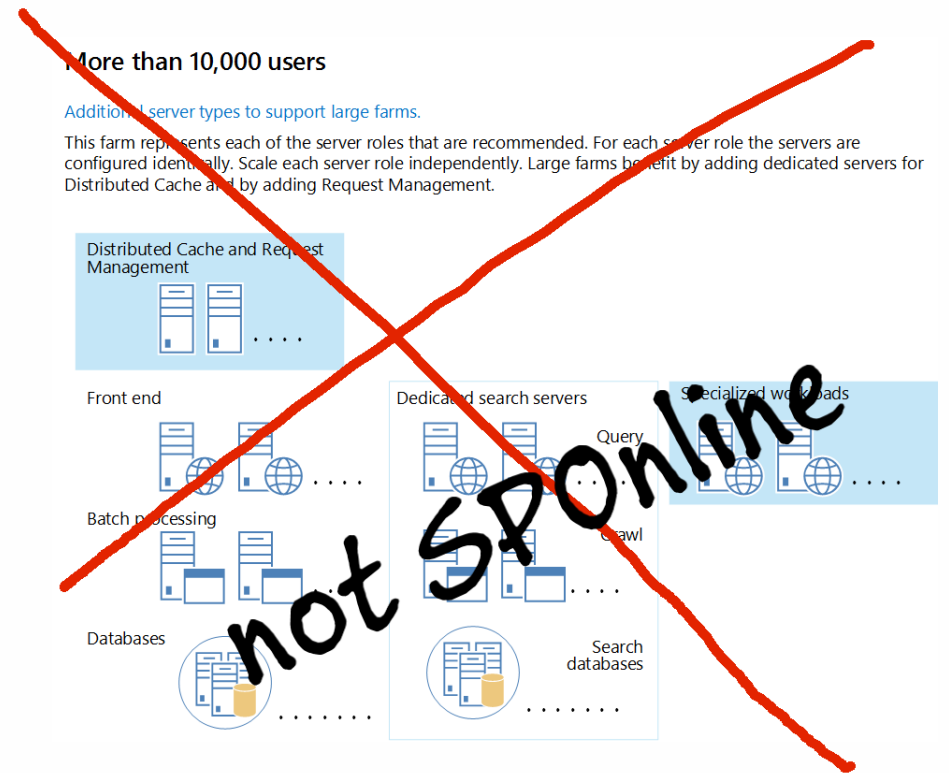
Welcome to the farm!

- A farm is the basic unit of SharePoint deployment
- SharePoint Online has Tenants within a Farm i.e. Multi-Tenant
- SPO contains most of the components you'd expect to find on-premises
- Don't make any assumptions beyond this point ...



Big Differences with SPO

- MinRole deployments
- WFEs – not two or three, but 100's on average
- High availability (multiple farms)
- Redundancy (across datacenters)
- Bottom line: extremely large scale versus on-premises



Load Testing

- Load testing is futile.
- Any load testing numbers you might get are temporary.
- If you attempt to load test, Microsoft will detect it and throttle your load generators.

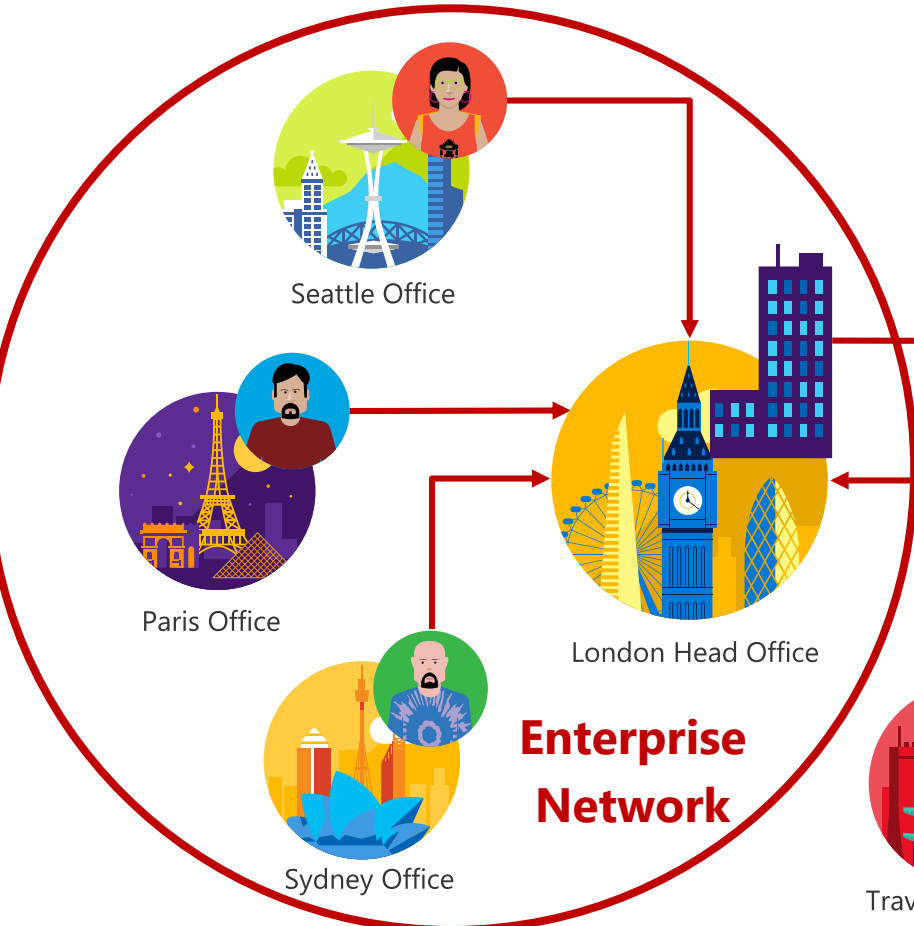


Service improvements

Traditional Connectivity

Enterprise Last Mile

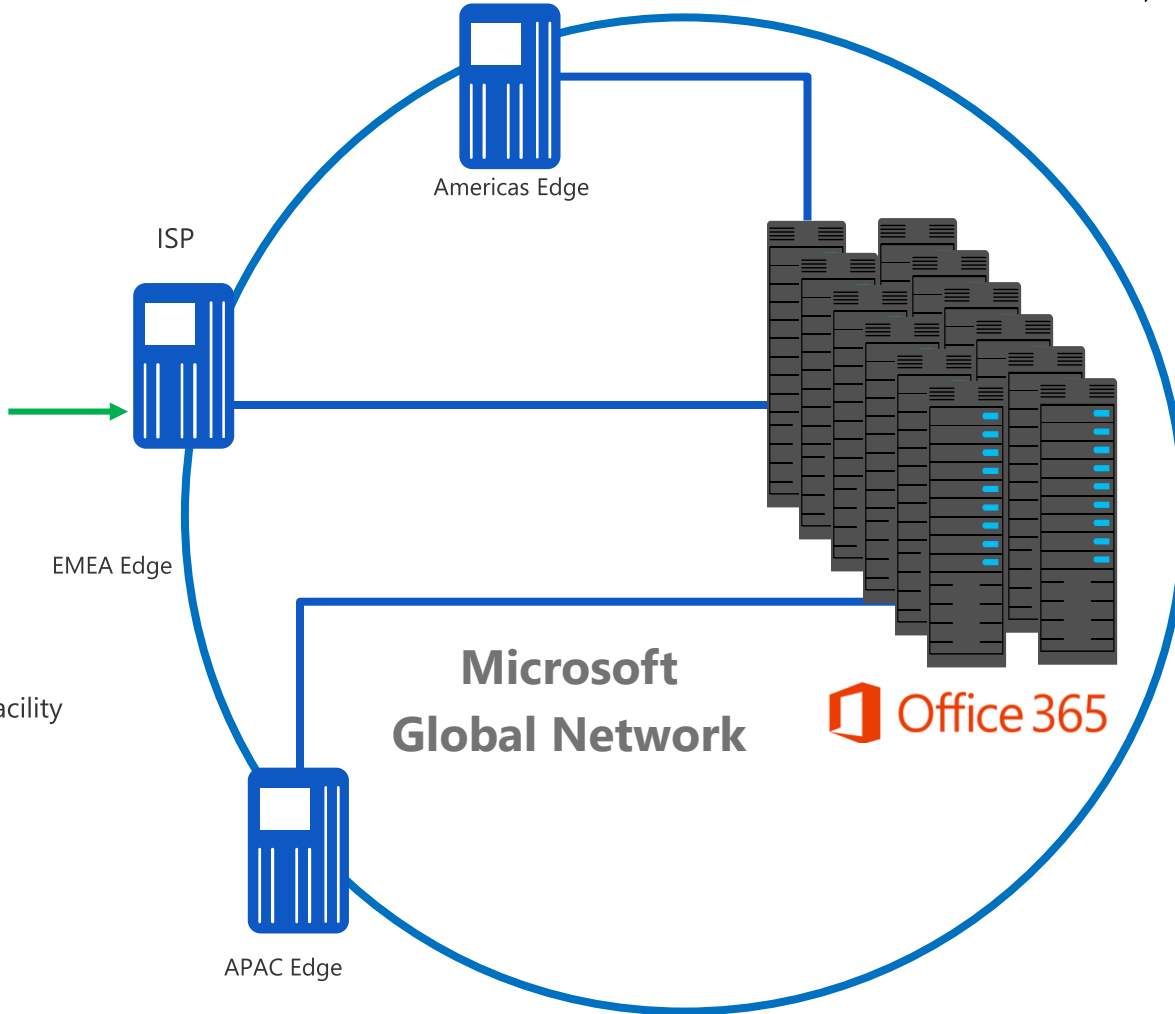
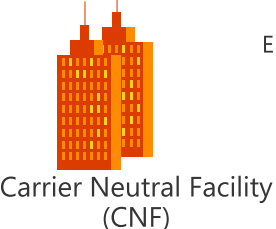
Microsoft First Mile



Connecting to worldwide Microsoft consumer services



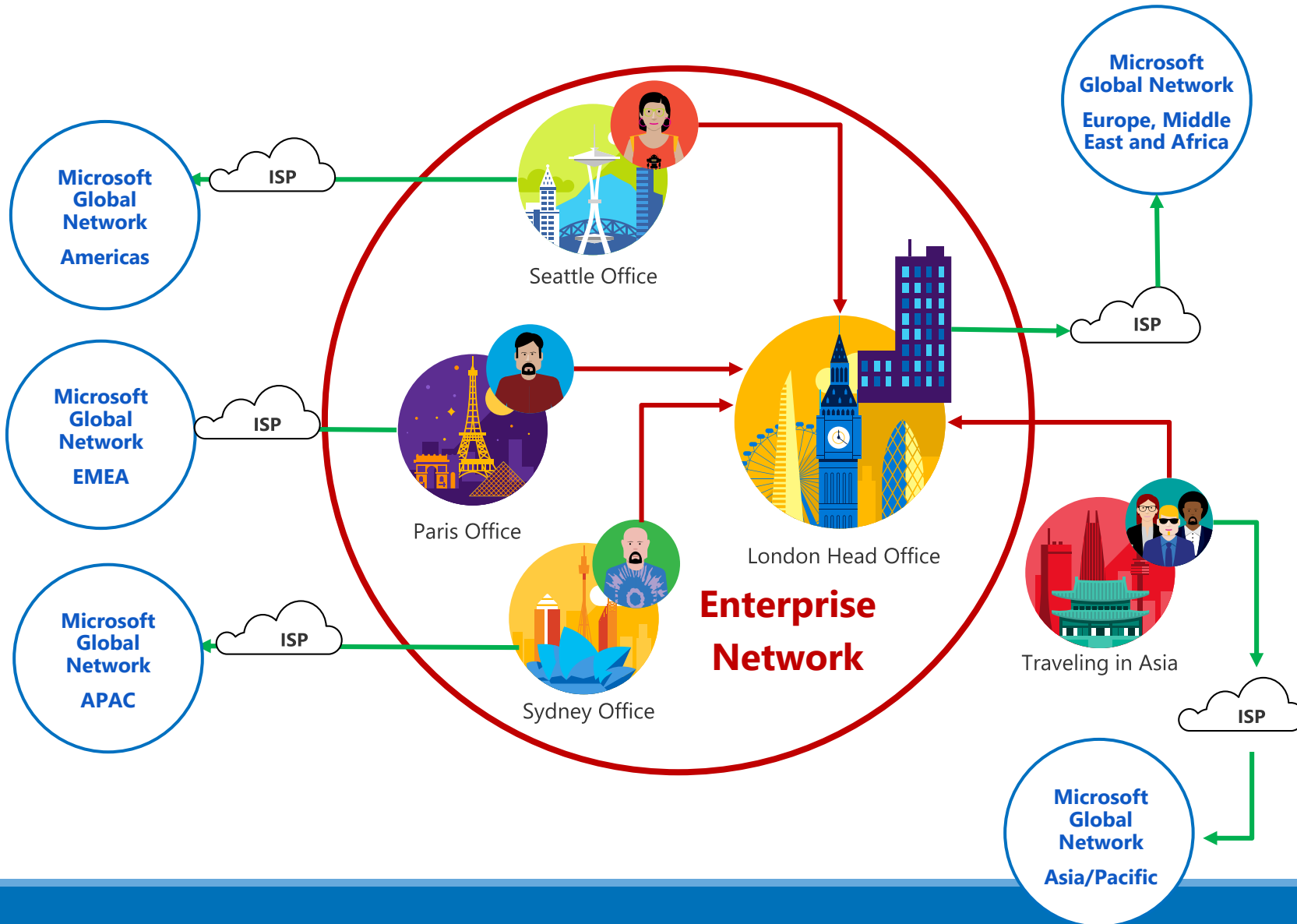
The internet



Microsoft Global Network



Direct Egress to Microsoft

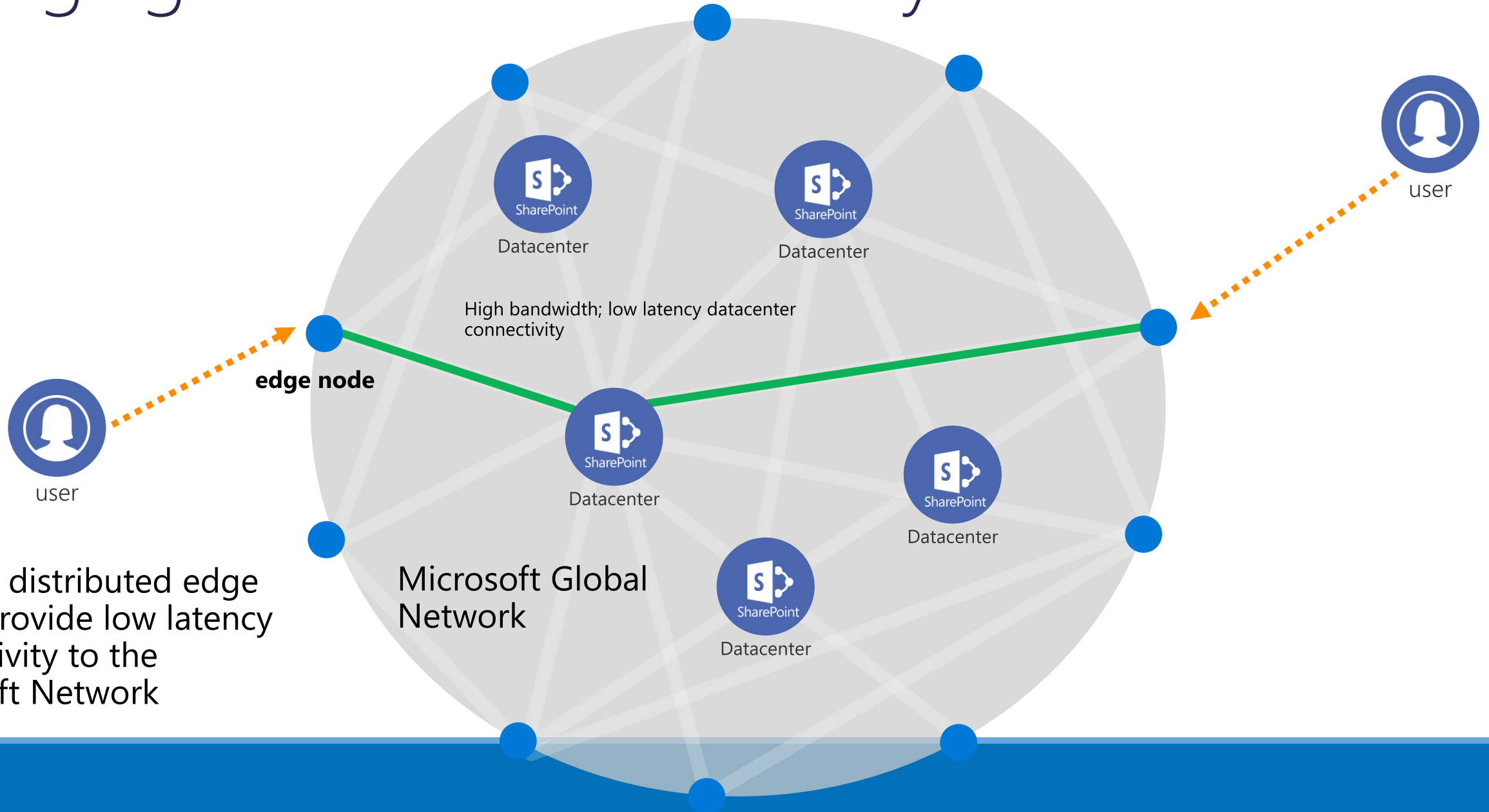


Network devices identify Office 365 traffic

Local egress to Microsoft Network at every location

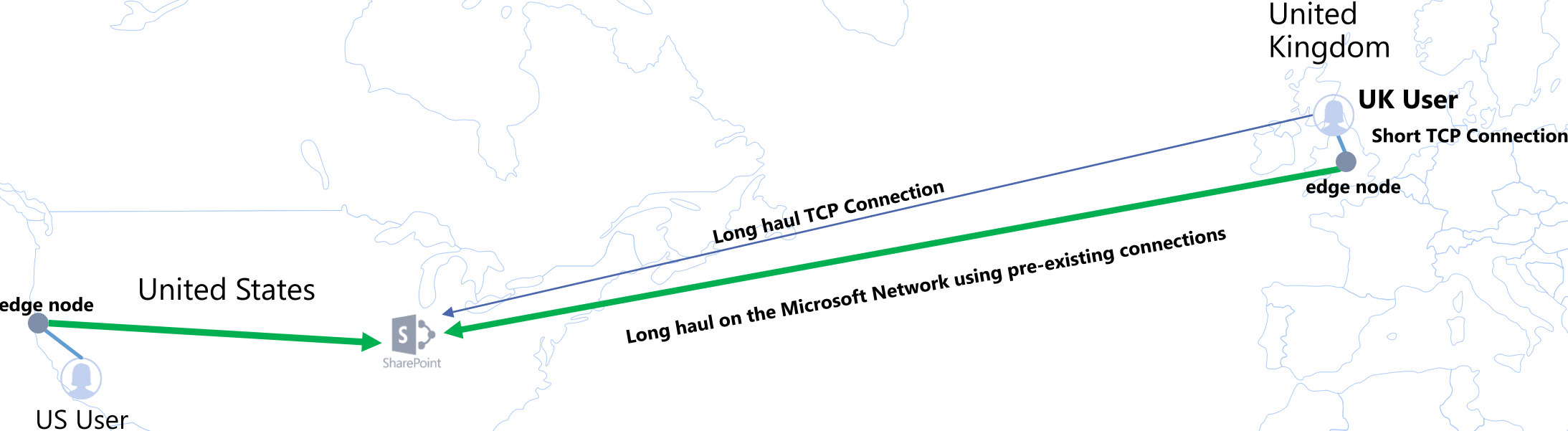
Bypass network security stack with trusted SaaS traffic

Bringing SharePoint Online to you



Globally distributed edge nodes provide low latency connectivity to the Microsoft Network

Connectivity



Edge – Latency and Hops

```
Tracing route to prodnet10364-10388ipv4a0000.sharepointonline.com.akadns.net [40.108.182.25]
over a maximum of 30 hops:
```

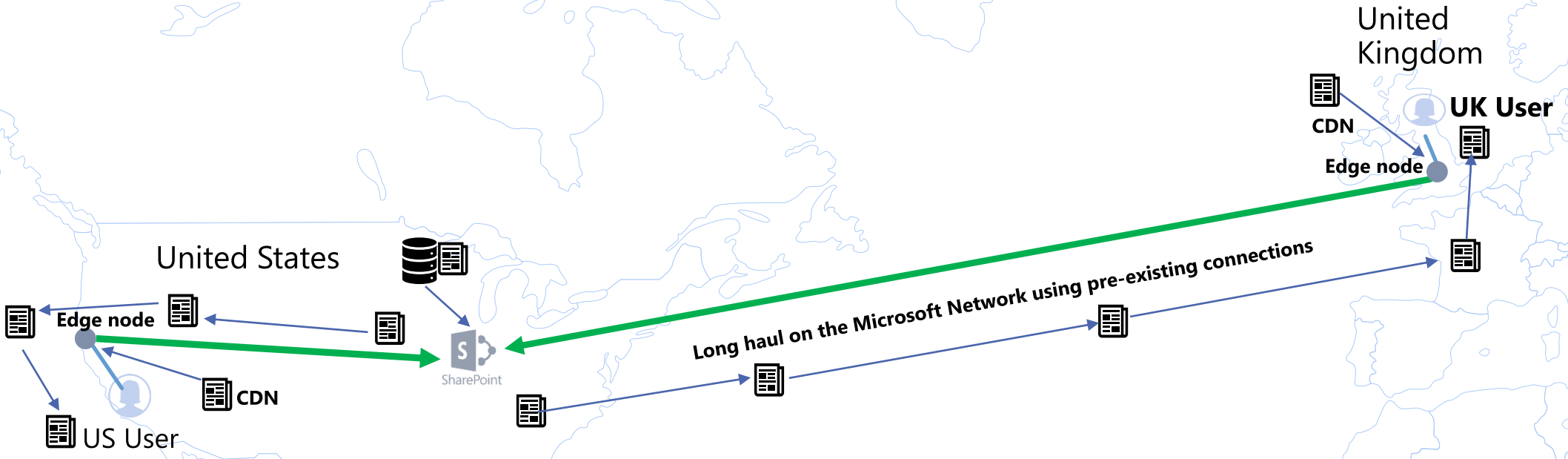
```
C:\WINDOWS\system32>tracert .sharepoint.com
```

```
Tracing route to b-0001.b-msedge.net [13.107.6.151]
over a maximum of 30 hops:
```

1	1 ms	1 ms	2 ms						
2	<1 ms	1 ms	<1 ms						
3	1 ms	1 ms	1 ms						
4	<1 ms	<1 ms	<1 ms	1	1 ms	<1 ms	1 ms	cusred010ca902-tengige0-005-12.network.microsoft.com [10.121.236.3]	
5	3 ms	<1 ms	1 ms	2	<1 ms	<1 ms	<1 ms	cusred116cn940-ethernet2-10.network.microsoft.com [10.200.172.21]	
6	1 ms	1 ms	1 ms	3	1 ms	1 ms	1 ms	10.240.128.66	
7	2 ms	1 ms	1 ms	4	<1 ms	<1 ms	<1 ms	cusred116f3701-eeen-in-2.network.microsoft.com [10.240.128.43]	
8	56 ms	56 ms	55 ms	5	1 ms	1 ms	1 ms	10.240.128.45	
9	56 ms	55 ms	54 ms	6	2 ms	2 ms	2 ms	167.220.32.118	
10	56 ms	55 ms	55 ms	7	4 ms	4 ms	4 ms	10.22.24.91	
11	56 ms	57 ms	56 ms	8	10 ms	8 ms	9 ms	be-61-0.ibr01.stb.ntwk.msn.net [104.44.8.64]	
12	56 ms	55 ms	56 ms	9	9 ms	11 ms	10 ms	be-6-0.ibr01.cnr02.mwh01.ntwk.msn.net [104.44.4.100]	
13	54 ms	57 ms	56 ms	10	9 ms	10 ms	9 ms	ae63-0.cys04-96cbe-1c.ntwk.msn.net [104.44.9.203]	
14	57 ms	56 ms	54 ms	11	8 ms	8 ms	8 ms	207.46.47.47	
15	56 ms	56 ms	56 ms	12	7 ms	8 ms	8 ms	10.254.200.16	
16	55 ms	56 ms	56 ms	13	*	*	*	Request timed out.	
17	54 ms	54 ms	54 ms	14	*	*	*	Request timed out.	
18	54 ms	54 ms	54 ms	15	*	*	*	Request timed out.	
19	55 ms	55 ms	54 ms	16	7 ms	7 ms	8 ms	13.107.6.151	
20	54 ms	55 ms	54 ms						
21	55 ms	54 ms	54 ms						Trace complete.
22	54 ms	54 ms	54 ms						40.108.182.25

```
Trace complete.
```

Connectivity



Using SharePoint CDN's

- Tenant level control with folder level (origins) opt-in
- Auto origins for Publishing
- HTTP2
- Automatic URL rewrite
- 15min update worldwide
- SharePoint referrer

Public (Site Assets)	Private (Content)	Public Common
<ul style="list-style-type: none">• Anonymous access• SharePoint	<ul style="list-style-type: none">• User cookie on first access• 60 min lifespan• Slower than Public ~100ms	<pre><script src=http://ajax.aspnetcdn.com/ajax / jquery-2.1.1.js> </script></pre>

Demo

Configure CDN's

Scott

CDN Command set

Get-Command *TenantCdn*

Set-SPOTenantCdnEnabled -Enable \$true -CdnType <Both, Private, Public>
(without any params will configure all default settings including both public and private and default origins)

If you don't want the default origins you can add the -NoDefaultOrigins switch

Get-SPOTenantCdnEnabled

Add-SPOTenantCdnOrigin

Example: Add-SPOTenantCdnOrigin -CdnType Public -OriginUrl "*/masterpage"

Get-SPOTenantCdnOrigins

Remove-SPOTenantCdnOrigin

Get-SPOTenantCdnPolicies

Set-SPOTenantCdnPolicy

CDN's and SPFx

```
Windows PowerShell
D:\>
D:\>
D:\> Set-SPOTenantCdnEnabled -CdnType Public

WARNING: This is a feature built on a 3rd party application with privacy and compliance standards that differ from the
commitments outlined by the Microsoft Office365 Trust Center. Any data cached through this service does not conform to the
Microsoft Data Processing Terms (DPT) and is outside of the Microsoft Office365 Trust Center compliance boundaries.

Confirm
Are you sure you want to perform this action?
Performing the operation "Enable Tenant CDN" on target "Public CDN".
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "Y"): Y

WARNING: Files of type CSS,EOT,GIF,ICO,JPEG,JPG,JS,MAP,PNG,SVG,TTF,WOFF stored in the locations configured to serve as Public
CDN origins will now also be served and cached in Content Delivery Network (CDN). Such content will then be accessible by
everyone anonymously not monitored nor governed by Microsoft content policies.

Public CDN enabled locations:
*/MASTERPAGE
*/STYLE LIBRARY
*/CLIENTSIDEASSETS (configuration pending)

D:\> _
```

Sources Content scripts Snippets

- top
 - sppnp.sharepoint.com
 - _layouts/15
 - sites/Group
 - outlook.office365.com
 - portal.office.com
 - publiccdn.sharepointonline.com
 - sppnp.sharepoint.com/sites/apps/ClientSideAssets/3509e0ac-1986-4464-b294-2814180be2ca
 - hello-world-web-part_f489063644c9c5844b42a29d1818f2e5.js
 - r1.res.office365.com
 - spoprod-a.akamaihd.net
 - static2.sharepointonline.com
 - https://outlook.office365.com/owa/SuiteServiceProxy.aspx?suiteServiceUserName=vesaj%40sppnp.sharepoint.com
 - https://webshell.suite.office.com/iframe/TokenFactory/iframe?origin=https%3A%2F%2Fsppnp.sharepoint.com
 - onePageResourceLoader (about:blank)

Public non-Microsoft CDNs

Customer accessing the asset from their own library

URL	Received	Taken	Initiator
/_catalogs/masterpage/javascript/jquery-2.1.1.min.js	82.98 KB	1.51 s	<script>
https://cdn.sharepointonline.com/12413/_layouts/15/16	18.98 KB	156 ms	<script>
/ScriptResource.axd?d=M1vNi_a6A2vtkOenP45i9-peGfx	100.80 KB	2.04 s	<script>

Using the publicly published version

URL	Received	Taken
https://ajax.aspnetcdn.com/ajax/jquery/jquery-2.1.1.min.js	82.74 KB	469 ms
/WebResource.axd?d=nMv/y4IjrcBwmUsI-gLXCgiVJy4RM4FI/qCk2olh3D5KbMXzSdwm5KllpDx9vM8MKkztZon...	22.33 KB	0.84 s
/_layouts/15/images/spcommon.png?rev=38	20.56 KB	1.15 s

What contributes to poor performance?

The Good, the Bad and the Ugly

Structural Navigation

Security Trimming

- Further impacted by broken Role Inheritance

CDN's not configured

Large Images

CBQ vs CSWP

MUI

Large Taxonomy
Hierarchy

SharePoint Online is a shared service

How to avoid being Throttled?

- Do not load test
- Don't build code that utilizes a single service account
- Optimize custom code
- Follow recommended guidelines

User throttling is rare

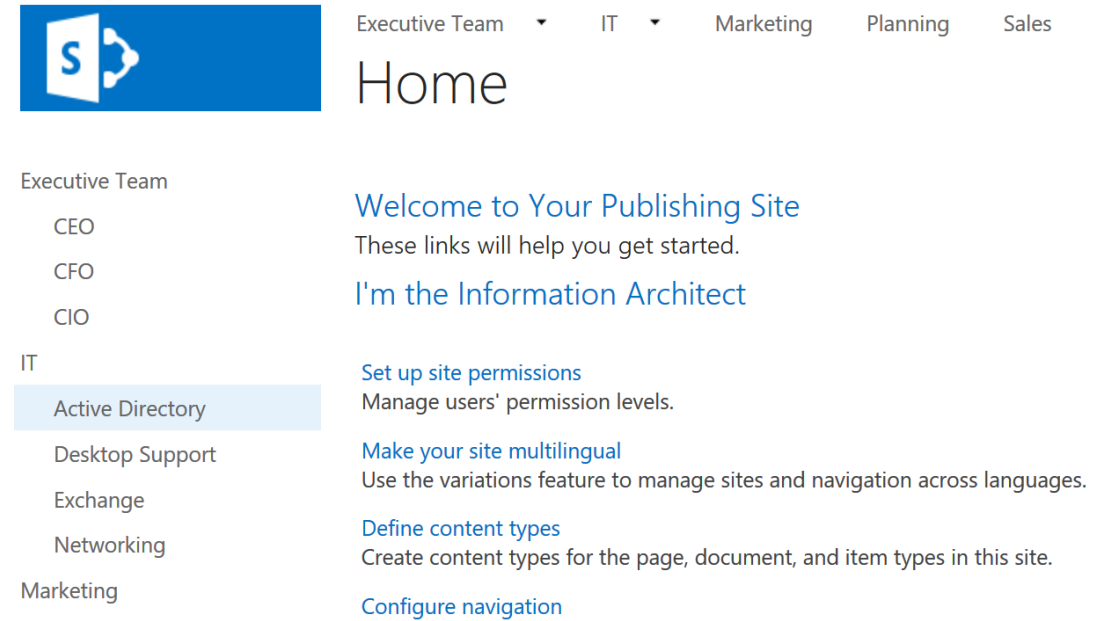
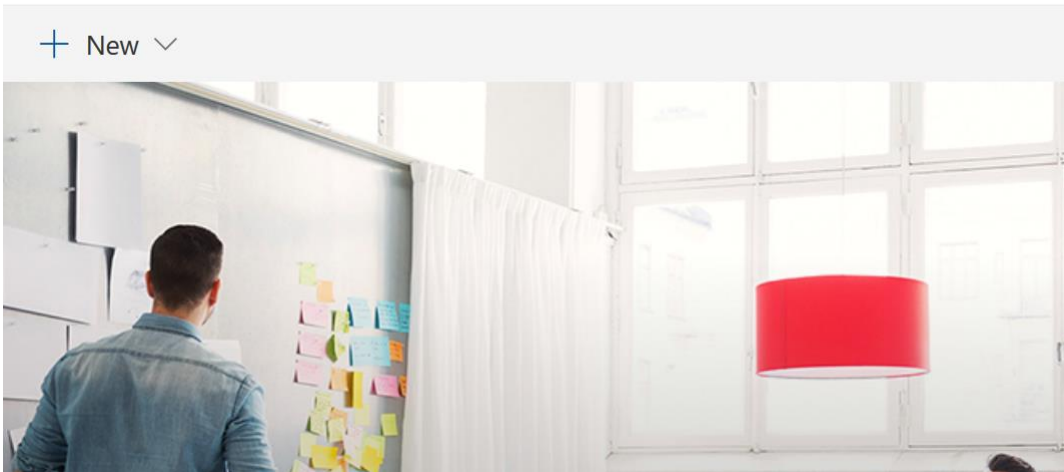
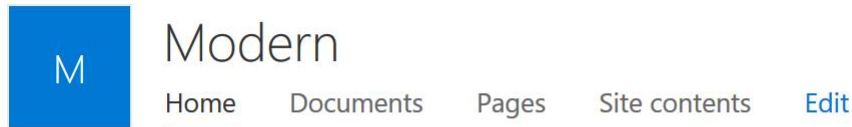
Background tasks

- Migration
- Backup
- Search
- Sync

Classic or Modern

Why Classic Publishing?

Team sites – why publishing?



Why not Modern?

Strategies for good performance

Avoid “too many, too big”

On-prem

- Low-latencies
- High bandwidth

SPO

- Minimize file sizes
- Reduce file counts.
- Number of calls back to SPO



Avoid “too many, too big”

- Minify files
- Resize images
- Compress images
- Use sprite sheets



Avoid “too many, too big”

- Use SharePoint’s Image Rendition service.
- Leverage a toolkit like Font Awesome in place of individual icons and similar files.



Caching

- Shared Multi-Tenant
- Bottom line: You cannot use Object Cache
- Use Browser Cache
- Blob Cache
Cachability headers (24 hours)



Leverage Search

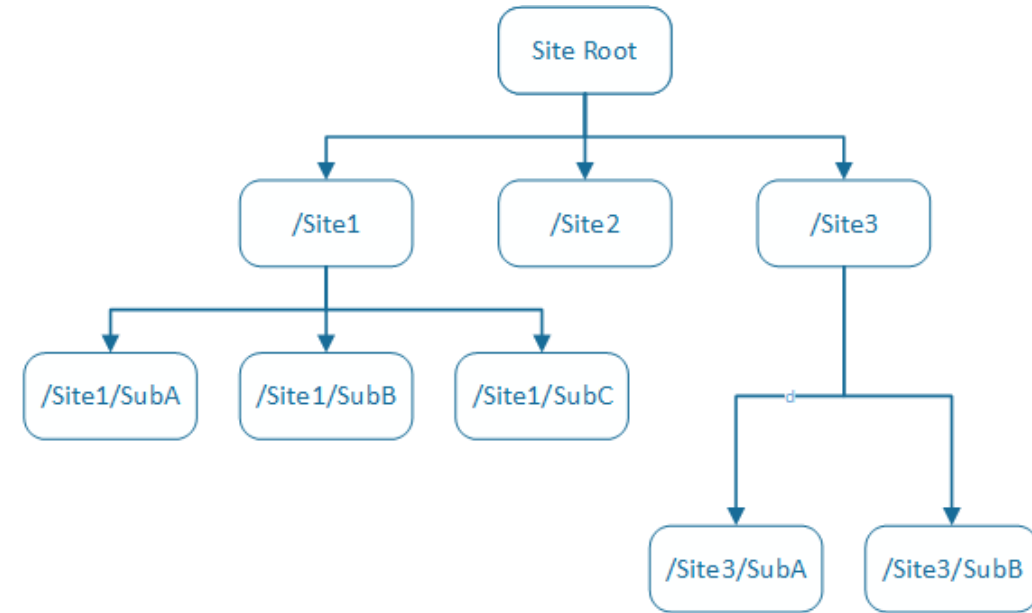
- Replace Content Query Web Part (CBQ)
- Use Content Search Web Part (CSWP)

*if you have SPO Plan 2 or an E3/G3/etc. plan.



Navigation

- Structural navigation
(Not Recommended)
It is extremely inefficient
- Use Managed navigation without security trimming
- Use Search-driven navigation
- Use a Custom provider



Site Structure and scalability

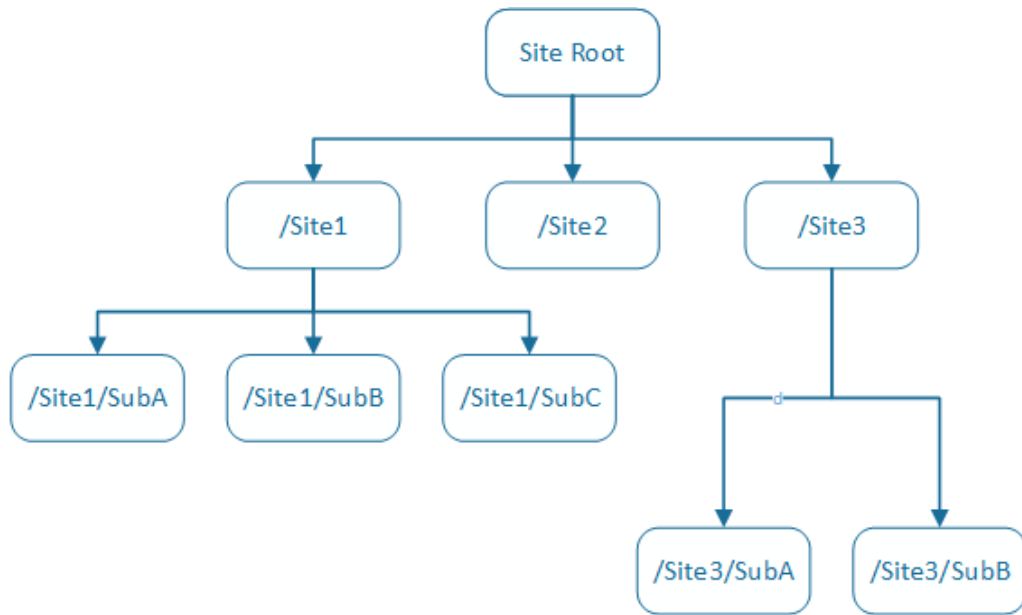
Traditional design

Top Parent Site Collection

----->Root Site (Rootweb)

----->Subsites (Subwebs)

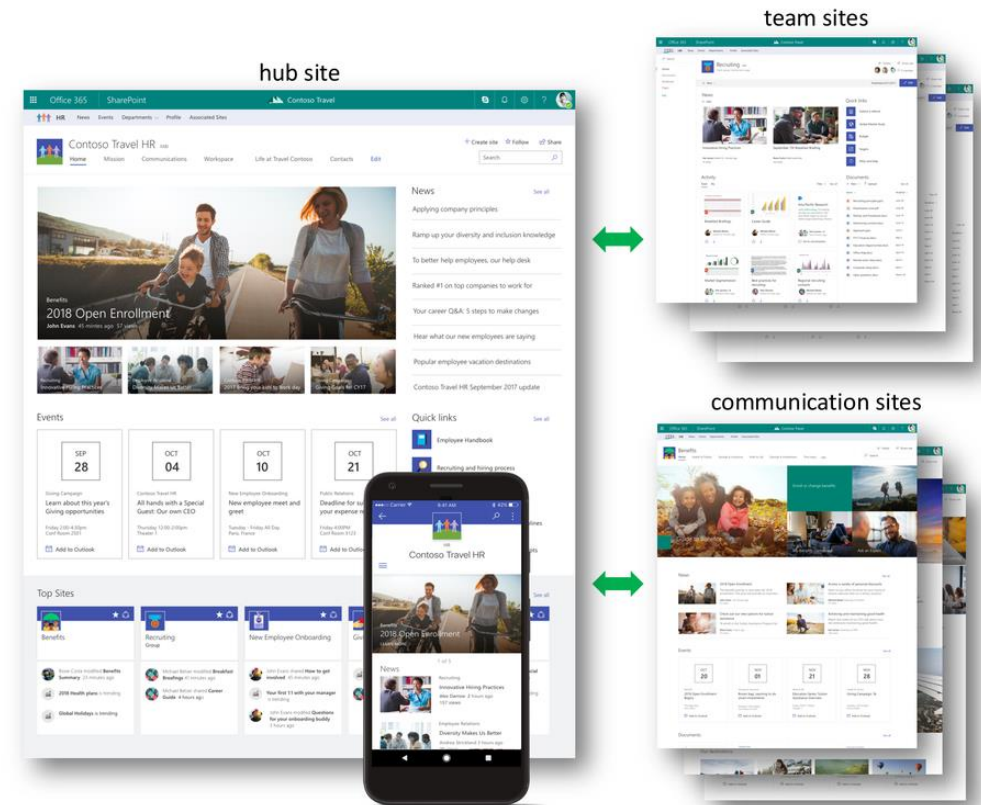
----->.....



Modern design

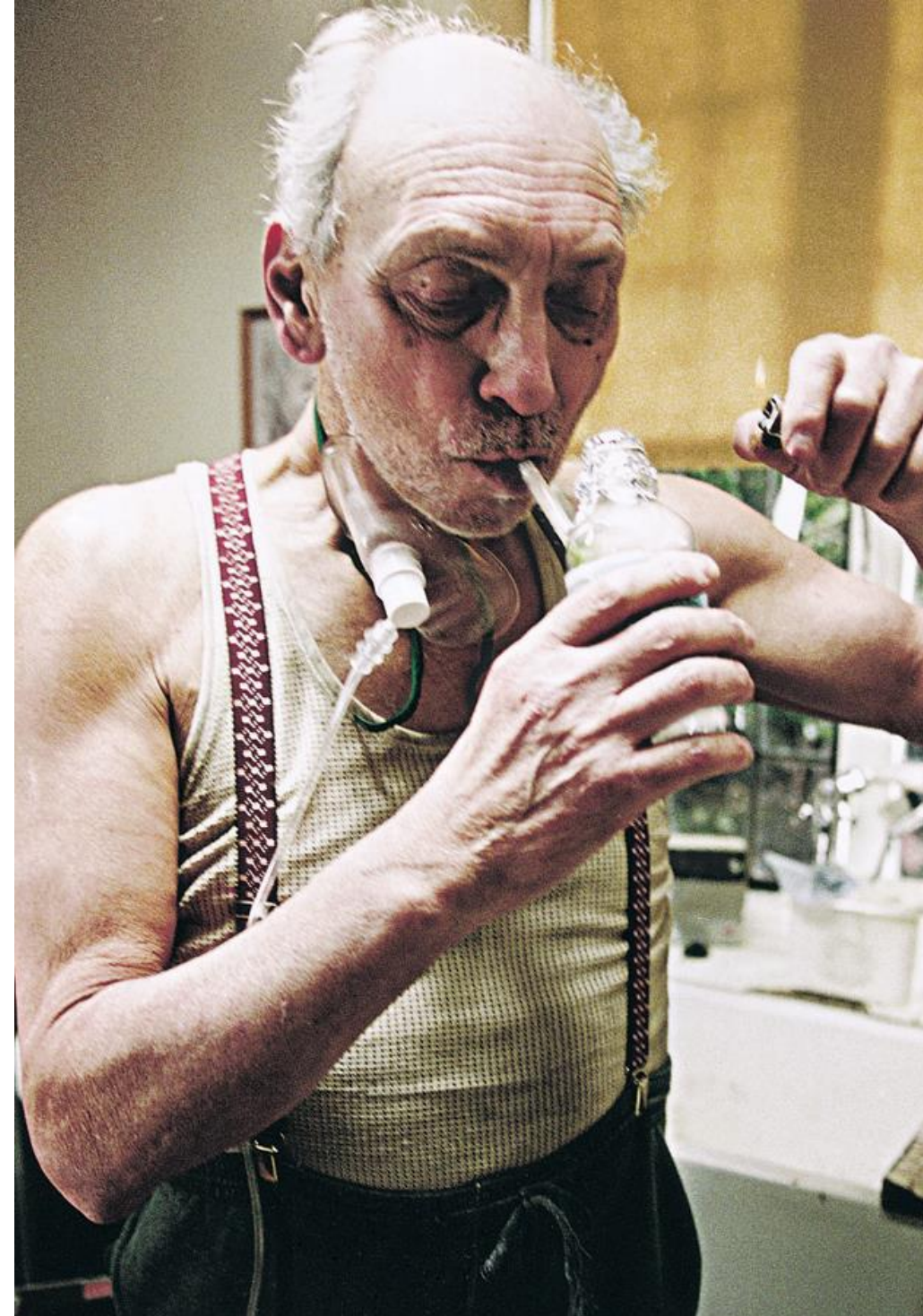
Site Collection

----->Root Site (Rootweb)



Web Parts

- Are you a web part junkie? If so, it's time to talk rehab.
- Make sure you don't have closed web parts on pages (?contents=1)
- Switch to client-side code (e.g. SPFx) instead of using server-side processing.



Async code

- Use good asynchronous development techniques.
- For long-running operations, ensure users have a visual indicator (e.g. a spinner) to let them know something is going on.
- For users, appearing slow and being slow are no different.



Know your JS libraries

- Lots of legacy JS code out there.
- Much of it works with SPO, but should you use it?
- Profile libraries to understand how they work to ensure you aren't introducing slowdowns.
- SPServices example ...



Know your JS libraries

- `$().SPServices.SPGetCurrentUser()`
- Necessary in 2007, but no longer necessary (i.e. we have UPA to supply the information).
- `SPGetCurrentUser()` does “screen scraping” of a rendered profile page and is dead-slow!



Gathering diagnostic tools and data

Tools Overview

- Page Diagnostics for SharePoint **New*
- Browser (F12)
- Fiddler
- Wireshark
- Message Analyzer



Demo

Page Diagnostics for SharePoint

Scott

Browser (F12)

- Strengths

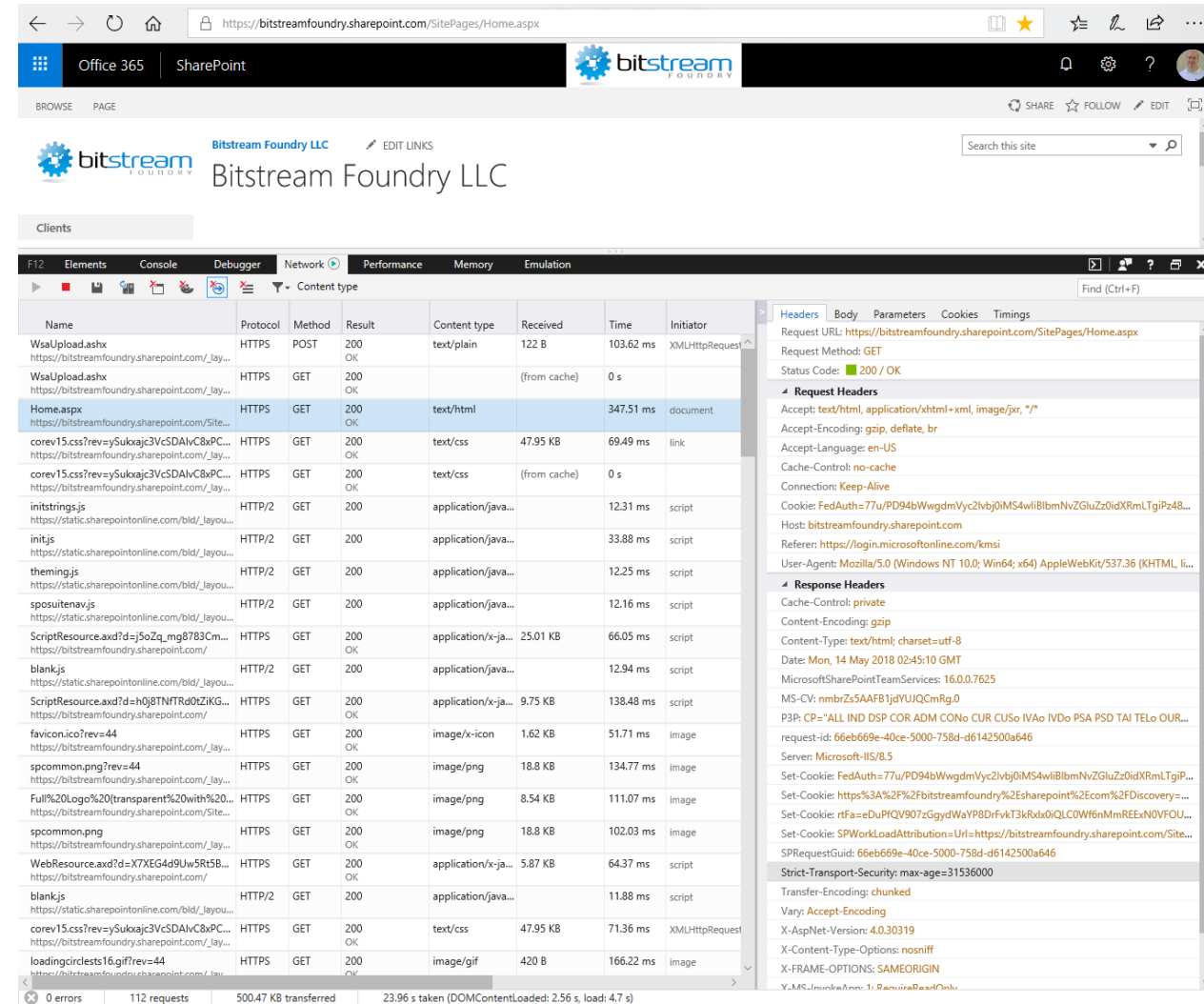
- Easy to use
- All major browsers have debug tools ...
- ... so present on all systems
- Wide variety of inspectors and analyses
- Can export results for further analysis

- Weaknesses

- Limited ability to shape data and requests
- Goes fairly deep in some areas, but not many

- Sum-Up

- Excellent first-line tool for determining where problems may exist.



Demo

F12 Dev Tools

Sean

Fiddler

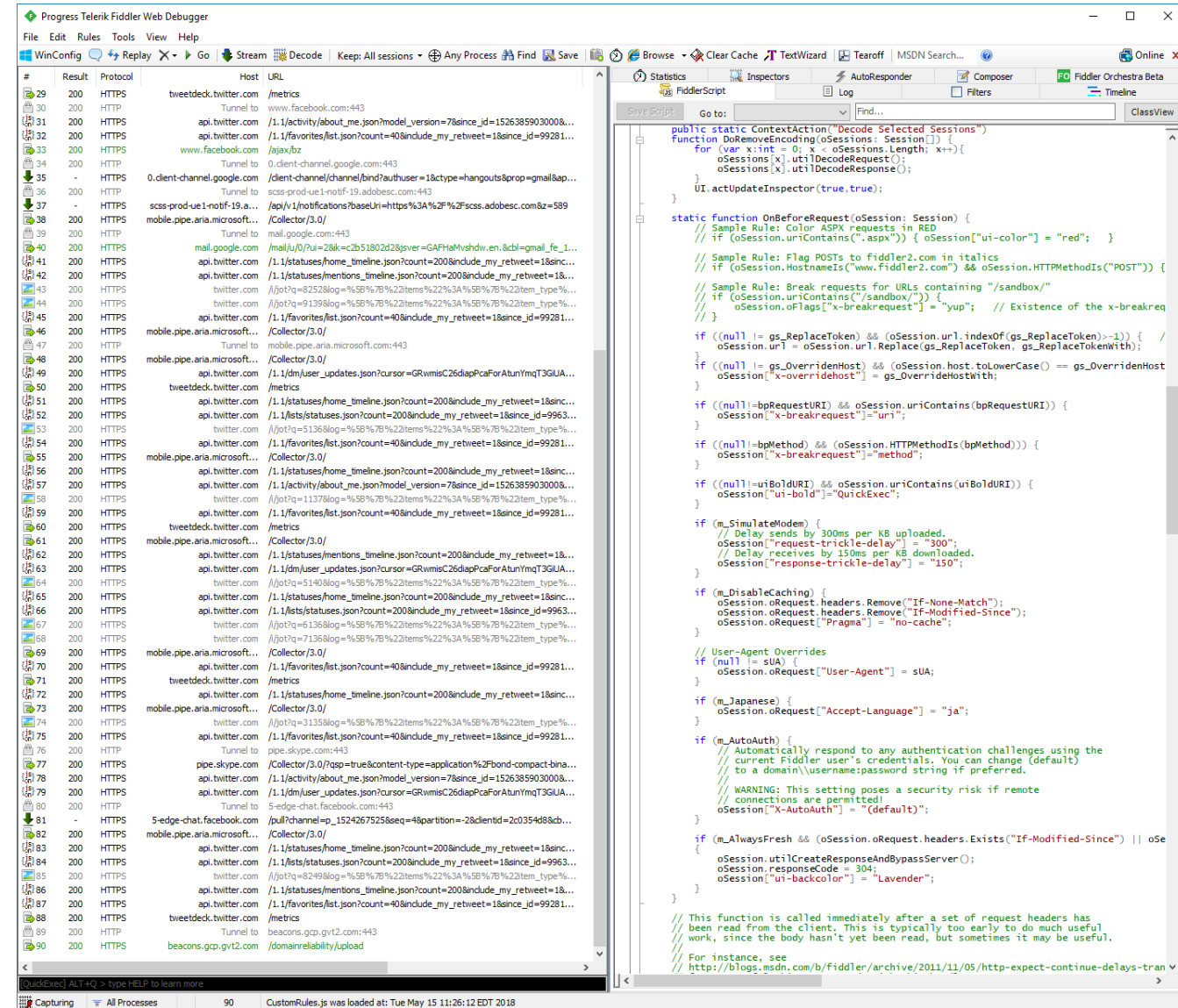
- Strengths
 - Relatively easy to use
 - Includes front-end web dev tools
 - Extensible; includes FiddlerScript engine
 - Can import traces from other tools

- Weaknesses

- SSL analysis requires additional setup
- More difficult to learn and use

- Sum-Up

- Great "next step" tool beyond browser F12 capabilities



Wireshark

- Strengths
 - Low-level protocol analysis
 - Watch network packets coming/going
 - Built-in expert system capability
 - Goes very, very deep in providing visibility
- Weaknesses
 - Need to develop some experience to use effectively
 - Knowledge of network protocols a must (although the tool can lend a hand)
 - As much an art as a science
- Sum-Up
 - Great “next step” tool beyond browser F12 capabilities

The screenshot displays the Wireshark interface with a list of captured network packets. The main pane shows a table with columns for No., Time, Source, Destination, Protocol, Length, and Info. The selected packet (No. 1244) is highlighted in red. Below the list, the packet details pane shows the structure of the selected packet: Frame 1: 55 bytes on wire (440 bits), 55 bytes captured (440 bits) on interface 0; Ethernet II, Src: AsustekC_ec:92:ac (14:dd:a9:ec:92:ac), Dst: Ubiquiti_9b:96:9d (44:d9:e7:9b:96:9d); Internet Protocol Version 4, Src: 10.163.201.2, Dst: 23.63.193.176; Transmission Control Protocol, Src Port: 53008, Dst Port: 443, Seq: 1, Ack: 1, Len: 1.

No.	Time	Source	Destination	Protocol	Length	Info
1241	16.692282	157.240.18.35	10.163.201.2	TLSv1.2	308	Application Data
1242	16.692282	157.240.18.35	10.163.201.2	TLSv1.2	86	Application Data
1243	16.692370	10.163.201.2	157.240.18.35	TCP	54	53852 → 443 [ACK] Seq=1273 Ack=339 Win=256 Len=0
1244	16.713536	104.244.42.2	10.163.201.2	TCP	64	443 → 20276 [ACK] Seq=14066 Ack=2522 Win=1701 Len=0 [ETHERNET II]
1245	16.715687	10.163.201.2	52.14.32.166	TCP	54	39906 → 443 [ACK] Seq=127 Ack=127 Win=254 Len=0
1246	16.717687	104.244.42.2	10.163.201.2	TLSv1.2	1510	Application Data
1247	16.717688	104.244.42.2	10.163.201.2	TLSv1.2	347	Application Data
1248	16.717721	10.163.201.2	104.244.42.2	TCP	54	20276 → 443 [ACK] Seq=2522 Ack=15815 Win=2805 Len=0
1249	16.722054	104.244.42.2	10.163.201.2	TLSv1.2	1510	Application Data
1250	16.722055	104.244.42.2	10.163.201.2	TLSv1.2	565	Application Data
1251	16.722099	10.163.201.2	104.244.42.2	TCP	54	20276 → 443 [ACK] Seq=2522 Ack=17782 Win=2805 Len=0
1252	16.758517	104.244.42.2	10.163.201.2	TLSv1.2	1510	Application Data
1253	16.758519	104.244.42.2	10.163.201.2	TLSv1.2	145	Application Data
1254	16.758579	10.163.201.2	104.244.42.2	TCP	54	20276 → 443 [ACK] Seq=2522 Ack=19329 Win=2805 Len=0
1255	16.763383	10.163.201.2	104.244.42.193	TLSv1.2	1356	Application Data
1256	16.802883	104.244.42.193	10.163.201.2	TCP	64	443 → 20267 [ACK] Seq=1460 Ack=7695 Win=1696 Len=0 [ETHERNET II]
1257	16.819574	104.244.42.193	10.163.201.2	TLSv1.2	353	Application Data, Application Data
1258	16.821329	10.163.201.87	239.255.255.250	SSDP	179	M-SEARCH * HTTP/1.1
1259	16.837098	Cisco_4b:d5:27	Spanning-tree-(for-...	STP	60	RST. Root = 32768/0/b0:00:b4:4b:d5:1e Cost = 0 Port = 0x80...
1260	16.859405	10.163.201.2	104.244.42.193	TCP	54	20267 → 443 [ACK] Seq=7695 Ack=1759 Win=2319 Len=0
1261	16.898900	10.163.201.2	104.146.230.68	TLSv1.2	2363	Application Data
1262	16.939812	104.146.230.68	10.163.201.2	TCP	60	443 → 50988 [ACK] Seq=1 Ack=2310 Win=513 Len=0
1263	17.022618	104.146.230.68	10.163.201.2	TLSv1.2	1147	Application Data
1264	17.039292	10.163.201.2	104.146.230.68	TLSv1.2	2219	Application Data
1265	17.039440	10.163.201.2	104.146.230.68	TLSv1.2	5387	Application Data
1266	17.039573	10.163.201.87	10.163.255.255	UDP	305	54915 → 54915 Len=263
1267	17.062979	10.163.201.2	104.146.230.68	TCP	54	50988 → 443 [ACK] Seq=2310 Ack=1094 Win=252 Len=0

```
0000 44 d9 e7 9b 96 9d 14 dd a9 ec 92 ac 08 00 45 00  D.....E.
0010 00 29 38 52 40 00 80 06 00 00 0a a3 c9 02 17 3f  .)BR@.....?
0020 c1 b0 cf 10 01 bb 1e c9 4c 89 81 64 e8 ea 50 10  .....L..d..P.
0030 01 00 ac b0 00 00 00 00  .....
```

Microsoft Message Analyzer

- Strengths

- Evolution of NetMon
- Tremendous capabilities ...
- OMS and other support
- Very little it can't do

- Weaknesses

- Tough tool to learn
- Overkill for most purposes

- Sum-Up

- The network tool to rule them all ...

The screenshot displays the Microsoft Message Analyzer interface. The main window shows a list of network messages with columns for MessageNumber, Timestamp, TimeElapsed, Source, Destination, Module, and Summary. A filter is applied: `tcp.port==80` and `*address==192.168.1.1`. The Message Stack 1 pane shows a stack of protocols for message 814: SSDP, UDP, IPv6, Ethernet, NdisEtwProvider, and NdisEtwProvider. The Details 1 pane shows the message details for the selected SSDP message, including Name, Method (NOTIFY), Uri, Version (1.1), and Headers.

MessageNumber	Timestamp	TimeElapsed	Source	Destination	Module	Summary
797	2018-05-16T02:25:04.7528043	0.0000619	104.146.230.68	10.163.201.81	TLS	Records: [Appli
799	2018-05-16T02:25:04.7626123		10.163.201.2	239.255.255.250	SSDP	Request, Methoc
803	2018-05-16T02:25:05.1352041				Windows_Kerne...	Process_V4_Type
804	2018-05-16T02:25:05.1550479				Windows_Kerne...	Process_V4_Type
800	2018-05-16T02:25:05.1692967		10.163.203.20	10.163.255.255	UDP	SrcPort: 50496,
801	2018-05-16T02:25:05.1692974		10.163.203.20	10.163.255.255	UDP	SrcPort: 50495,
802	2018-05-16T02:25:05.2092448		10.163.201.87	10.163.255.255	UDP	SrcPort: 54915,
805	2018-05-16T02:25:05.4000647				Windows_Kerne...	Process_V4_Type
806	2018-05-16T02:25:05.4304075				Windows_Kerne...	Process_Termin...
807	2018-05-16T02:25:05.4306631				Windows_Kerne...	Process_V4_Type
808	2018-05-16T02:25:05.4505552				Windows_Kerne...	Process_Termin...
809	2018-05-16T02:25:05.4514063				Windows_Kerne...	Process_V4_Type
810	2018-05-16T02:25:05.4523287				Windows_Kerne...	Process_Termin...
811	2018-05-16T02:25:05.4547422				Windows_Kerne...	Process_V4_Type
812	2018-05-16T02:25:05.5000595		10.163.201.81	239.255.255.250	SSDP	Request, Methoc
813	2018-05-16T02:25:05.5009778		10.163.201.2	239.255.255.250	SSDP	Request, Methoc
814	2018-05-16T02:25:05.5011727		FE80:0:0:0:1056...	FF02:0:0:0:0:...	SSDP	Request, Methoc
815	2018-05-16T02:25:05.5749849		10.163.201.81	13.91.52.255	TLS	Records: [Appli
816	2018-05-16T02:25:05.5750268	0.0619253	10.163.201.81	13.91.52.255	TLS	Records: [Appli
817	2018-05-16T02:25:05.5763091		10.163.201.2	239.255.255.250	SSDP	Request, Methoc

Q & A

Helpful Links

O365 Performance Tuning

<https://aka.ms/tune>

Tune SharePoint Online Performance

<https://go.microsoft.com/fwlink/?linkid=873107>

Navigation options for SharePoint Online

<https://go.microsoft.com/fwlink/?linkid=873247>

Using Content by Search Web Part

<https://go.microsoft.com/fwlink/?linkid=873245>

SharePoint Developer Community

<https://docs.microsoft.com/en-us/sharepoint/dev/community/community>

SharePoint PnP Solution Guidance

<https://docs.microsoft.com/en-us/sharepoint/dev/solution-guidance/office-365-development-patterns-and-practices-solution-guidance>

How to avoid being throttled in SharePoint Online?

<https://docs.microsoft.com/en-us/sharepoint/dev/general-development/how-to-avoid-getting-throttled-or-blocked-in-sharepoint-online>