Designing for Optimal Performance in SharePoint Online

@spmcdonough
on Twitter (for heckling purposes)

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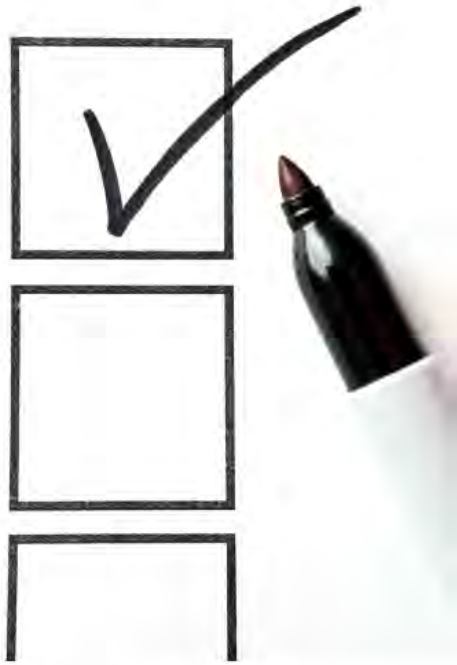
Our Agenda

- SharePoint Online (SPO) Implementation
- Acknowledging the Reality of Plumbing
- SharePoint Online Diagnostics and Tools
- Design and Development Guidance
- Samples and Examples
- Questions and Answers Throughout!
- References



But first ...


An important note

This is
Office 365

hanging and updating it"

Please do

Office 365 is an "evergreen service"

eaning "Microsoft is always changing and updating

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meaning "Microsoft is always changing and updating it"

What I show you today ...

- will probably be true tomorrow

always changing and updating

What I show you today ...

- will probably be true tomorrow
- has a good chance of being true next week
- might be true in month
- probably worth questioning and re-evaluating in a year

Please don't dig this up in five years and then send me hate mail because I presented something that is no longer accurate due to a SharePoint Online service change.

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Dear Sean,

I was reviewing a presentation you put together five years ago, and I found elements that were incorrect. You are a horrible person and you should never touch SharePoint Online again.

Love you lots!

- an attendee

First Stop:

Some basic SharePoint farm architecture

(and why that matters with SPO)


Welcome to the farm!

might think that SPO is simply an extension of this patt

On-premises SharePoint farms come in all shapes and sizes

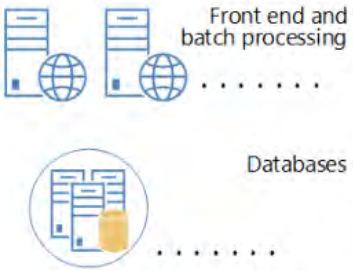
Small Farm

<1,000 users

Fault tolerance for simple workloads with small volumes of content

Two tiers:
- Combined front-end and batch processing servers
- Database servers

Scale the number of servers as needed.



Medium Farm

<10,000 users

Dedicated search servers for up to 10 million items.

Three tiers:
- Front-end servers
- Batch processing servers
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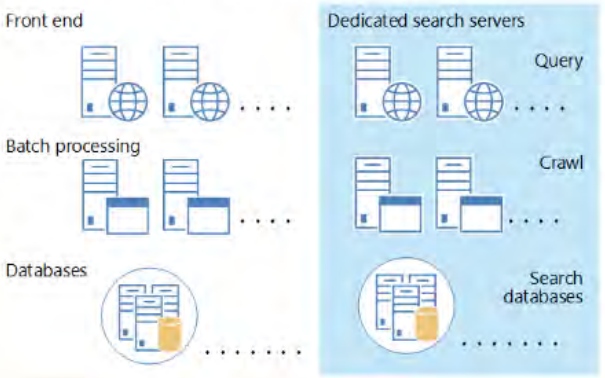
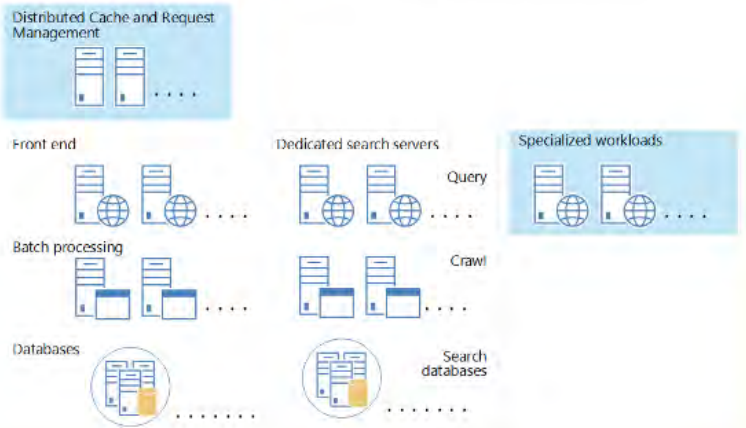


Large Farm

More than 10,000 users

Additional server types to support large farms.

This farm represents each of the server roles that are recommended. For each server role the servers are configured identically. Scale each server role independently. Large farms benefit by adding dedicated servers for Distributed Cache and by adding Request Management.



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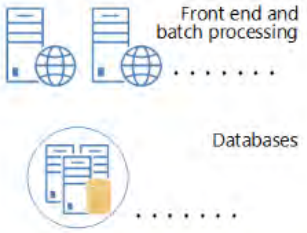

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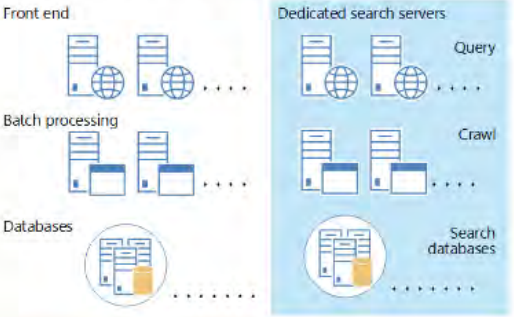

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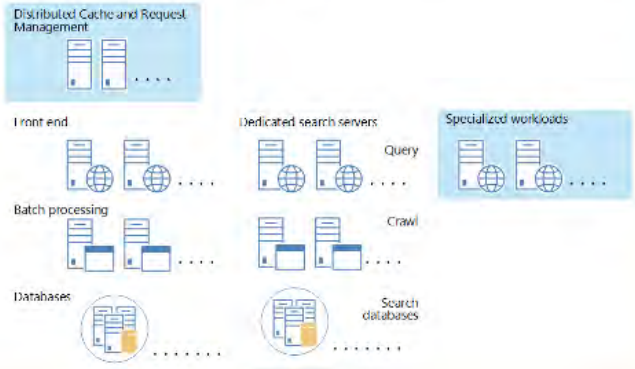

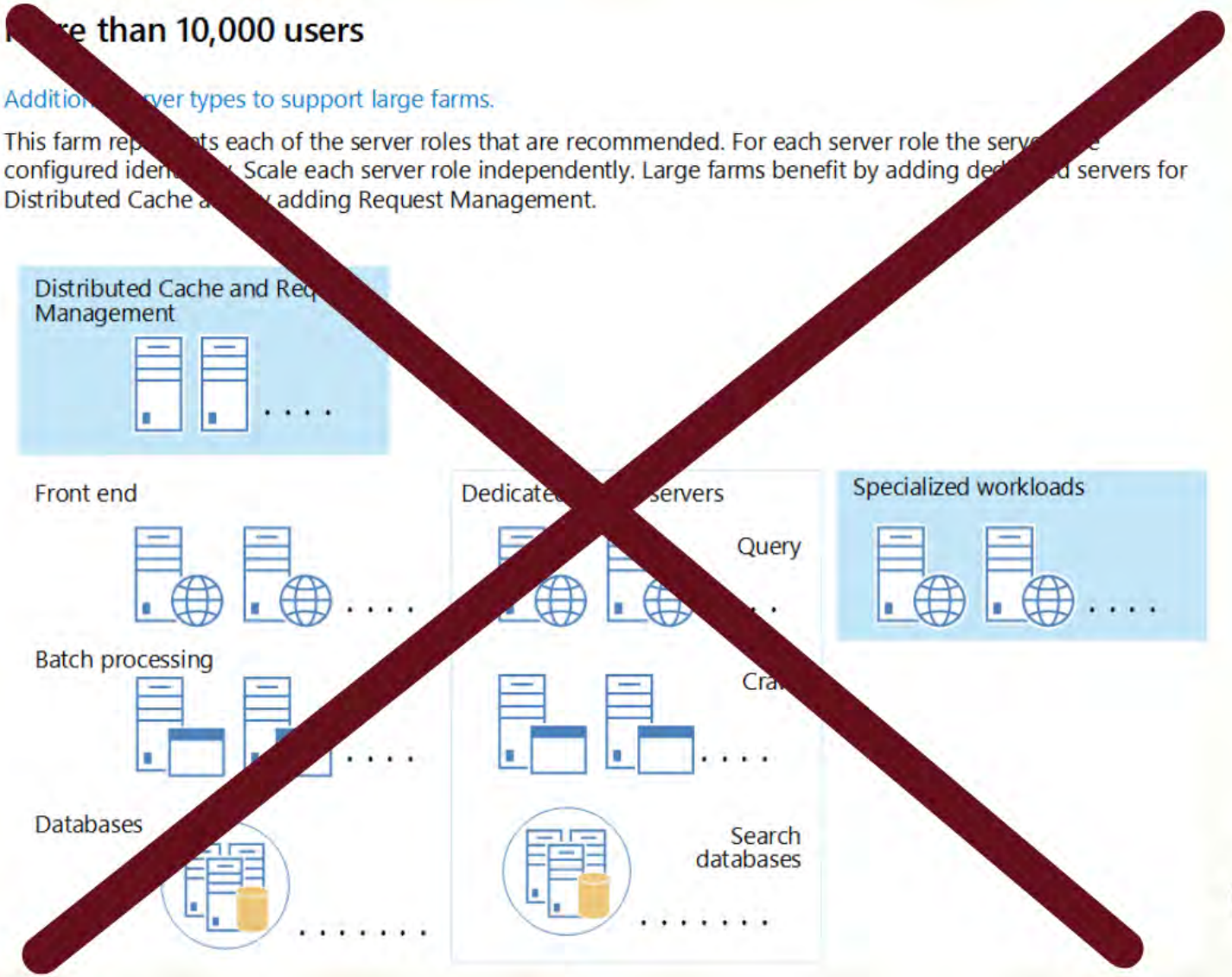

It is not.

well, not really ...

You might think that SPO is simply an extension of this pattern.

This is a stamp
too (well, several of them)

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Datacenter 1..N:

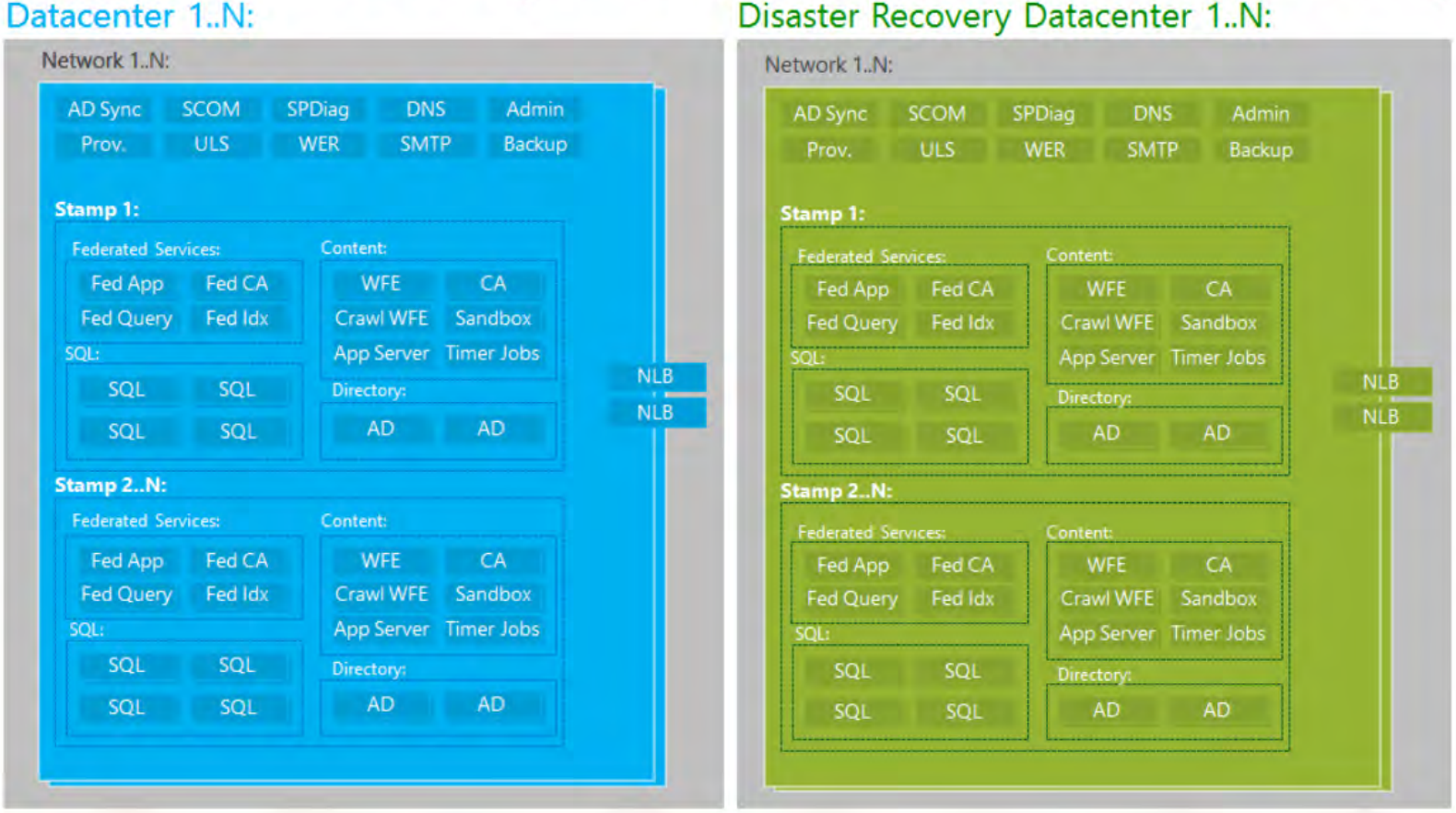
Network 1..N:

Disaster Recovery Datacenter 1..N:

Network 1..N:

Grid Manager

This is a stamp too (well, several of them)

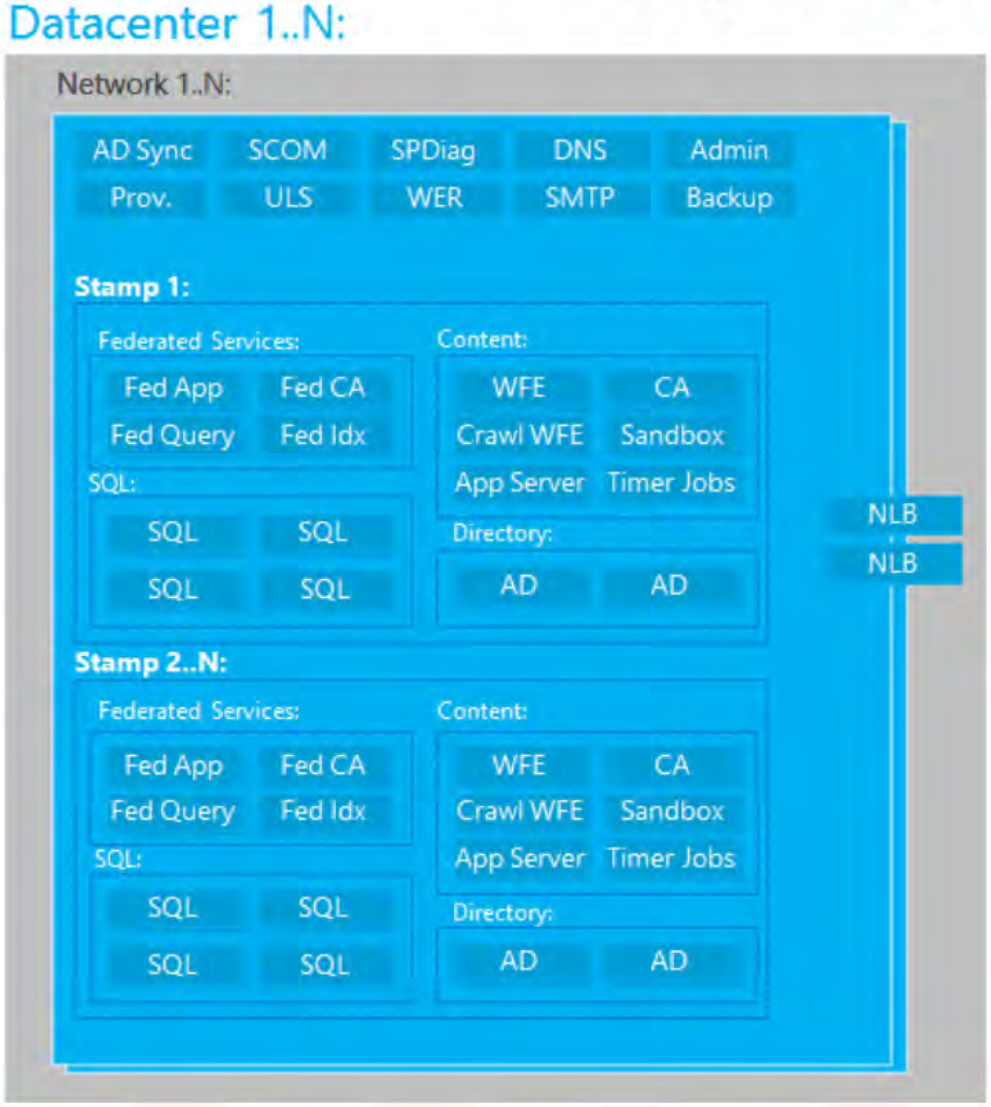


- Grid Manager
- Global Directory
- Tenant Admin (UI)
- Commerce backend
- DNS (multiple)
- OrgID Auth, Svc.
- Incident Management
- Azure (Windows/SQL)
- CDN Services

Looking at the representation of an individual stamp, you might think it's only 16 servers.

This
too (well,

Each datacenter has two or more stamps per SPO environment for high-availability.



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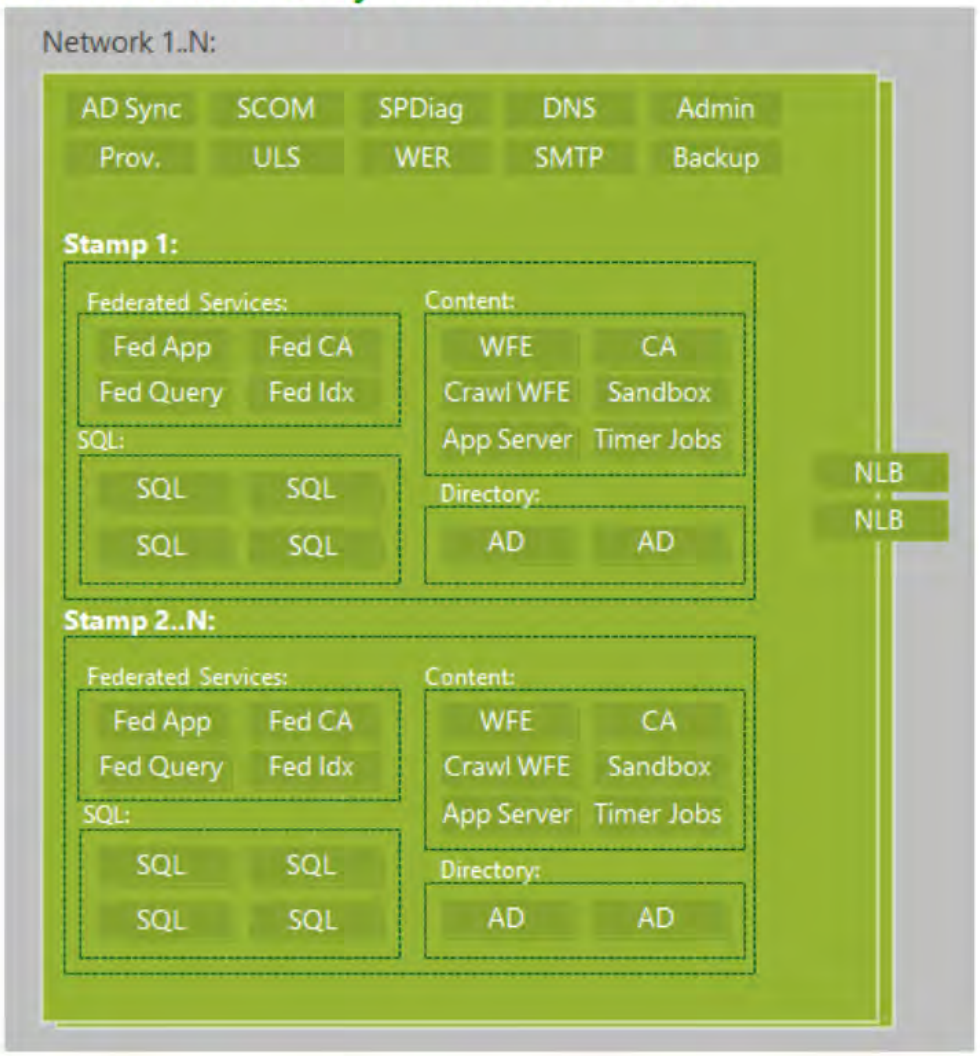
Disaster Recovery Datacenter 1..N:



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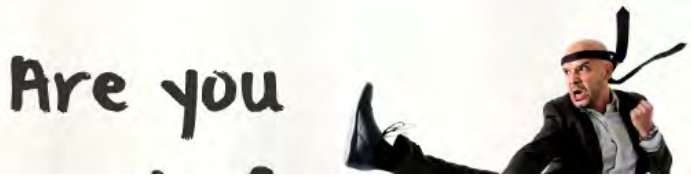
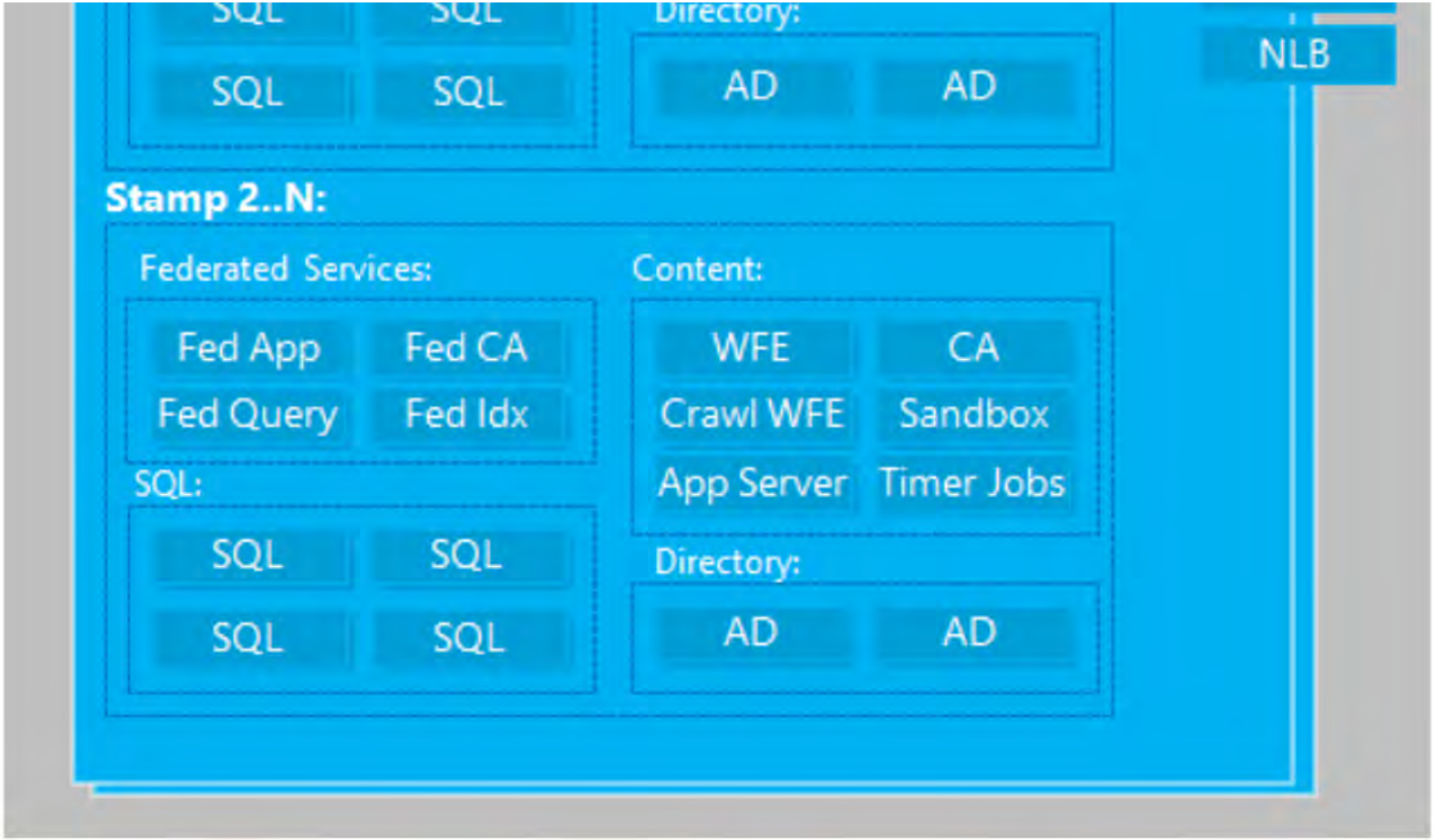
Additional stamps exist in a different region for redundancy and failover.





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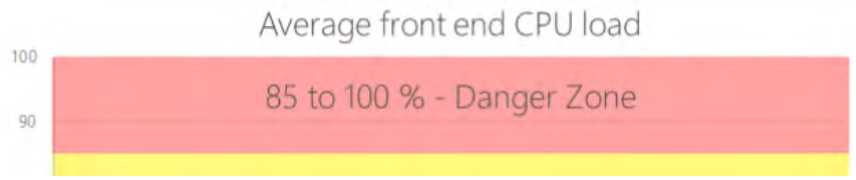
Are you ready for the kicker?

The exact number of servers in a SharePoint Online stamp is variable.

The number of servers per



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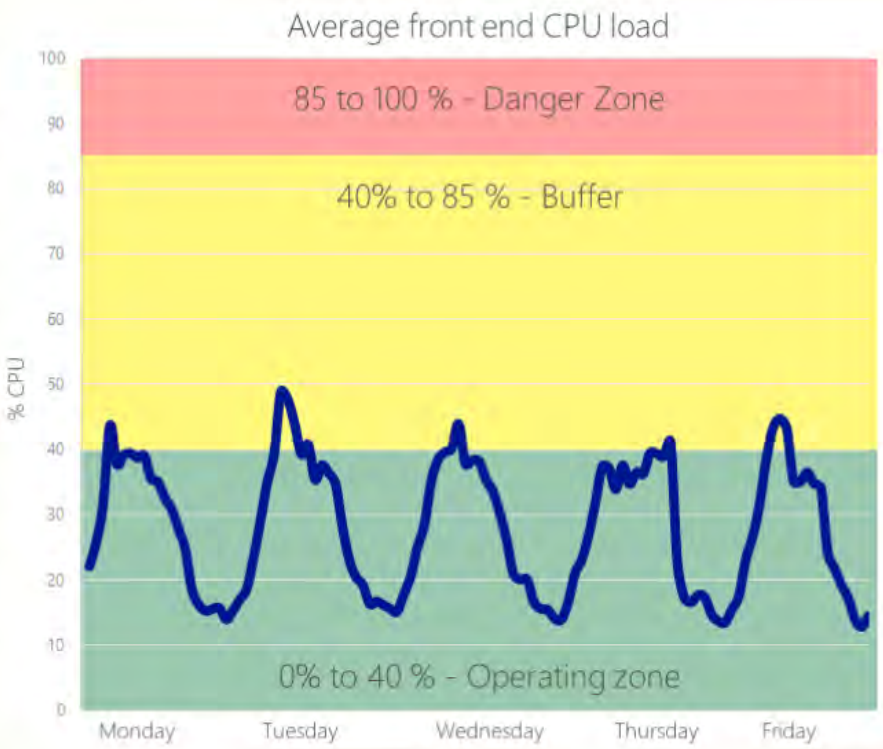
The number of servers per stamp varies because the server count is adjusted based on average front-end CPU load.



- If load rises above 40%*, additional servers are automatically provisioned and added to the stamp

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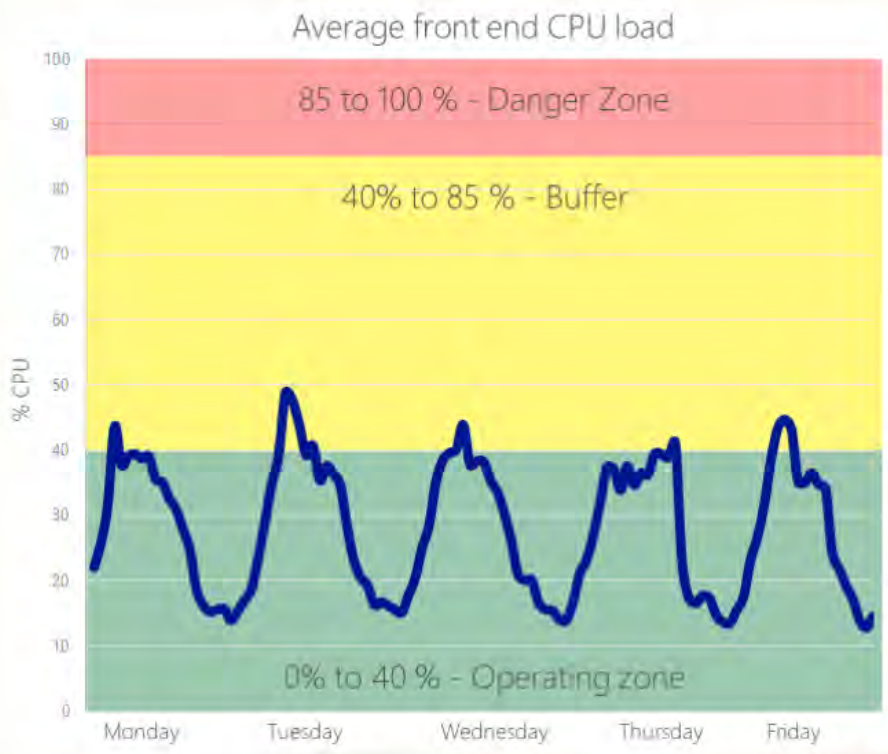
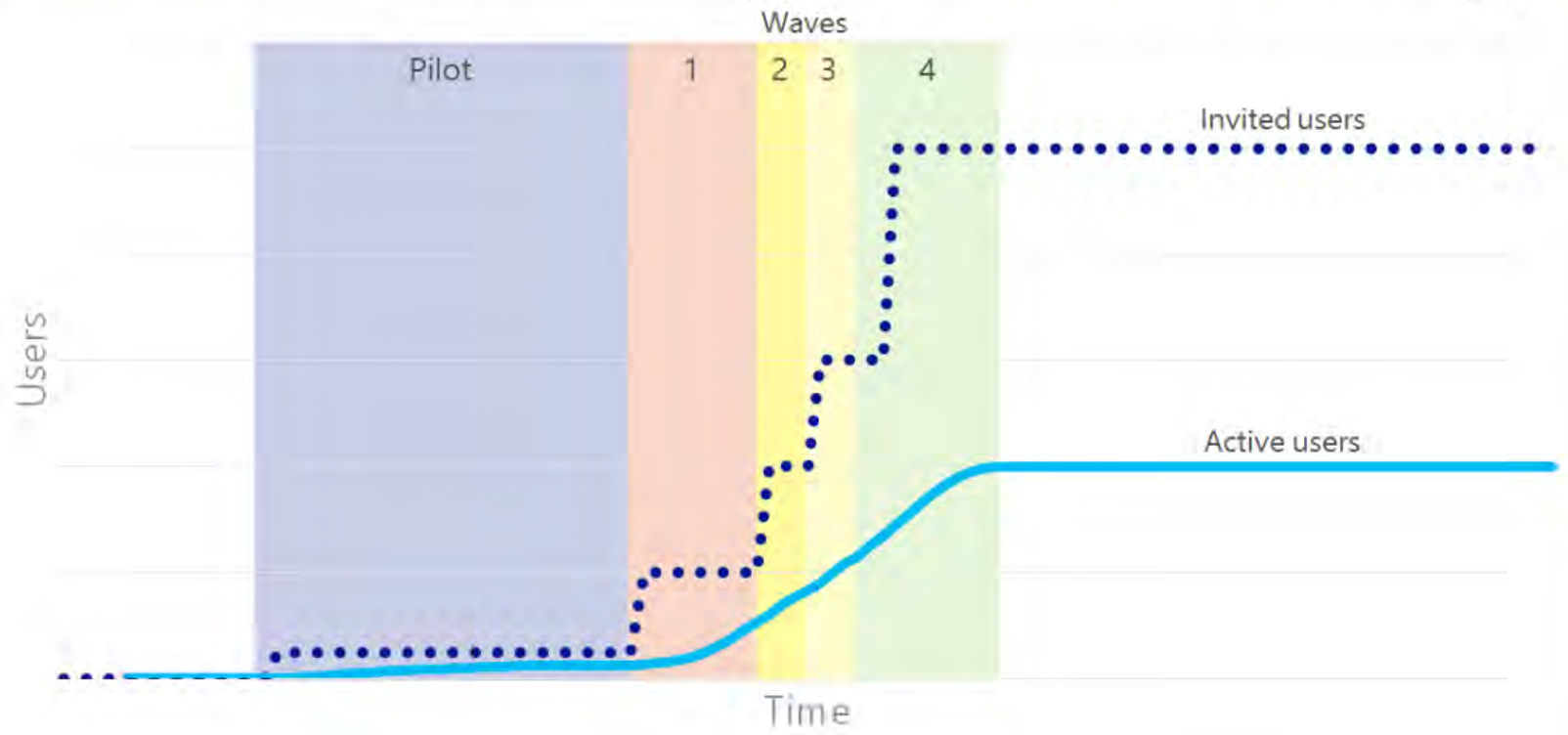


- If load rises above 40%*, additional servers are automatically provisioned and added to the stamp.
- If load drops, servers are decommissioned.

Adding and removing is not an instantaneous process, though.



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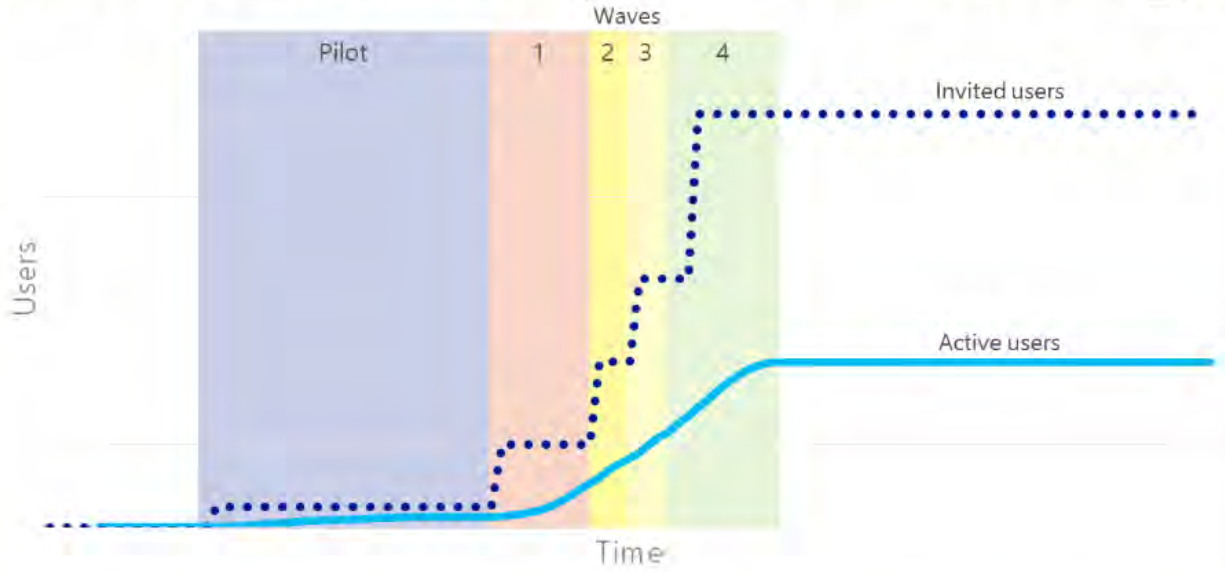

If you can control load (for example, gradually increasing the number of invited users over time when you roll out a site), you should. It will give the provisioning system time to adjust/compensate for growing load.

If you remember only one thing in this discussion of stamps and elastic capacity, please let it be this one point ...

Load testing is futile.

astic nature of a stamp, there's really no way to effectively load t

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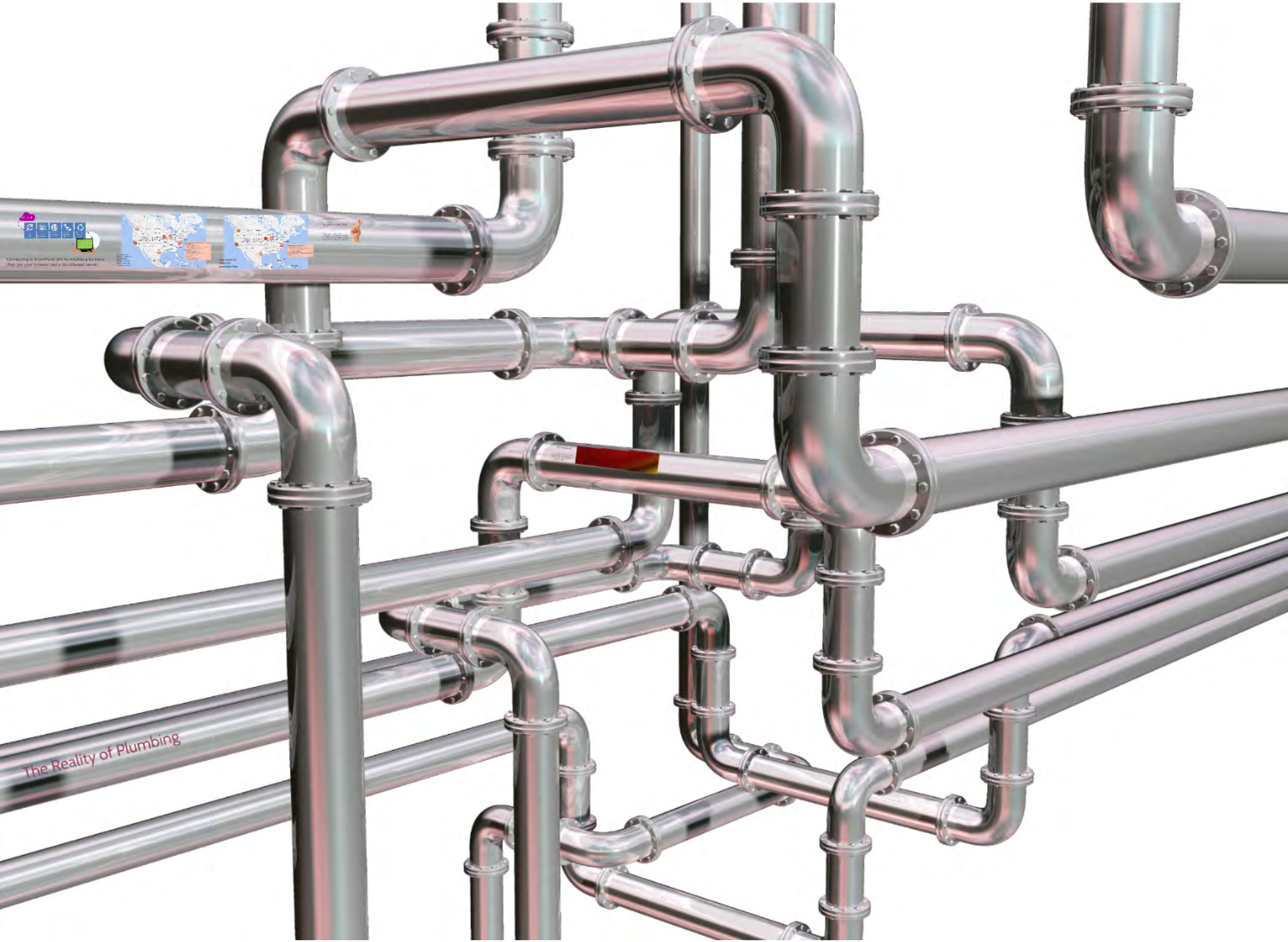
growing load.

Load testing is futile.

- Given the elastic nature of a stamp, there's really no way to effectively load test SPO. Any numbers you get or produce are essentially meaningless in the grand scheme of things.
- Rather than load testing, focus instead on the items we're going to cover in the rest of this presentation. They'll help you avoid poorly performing pages and sites.


Welcome to the farm!


The Reality of Plumbing

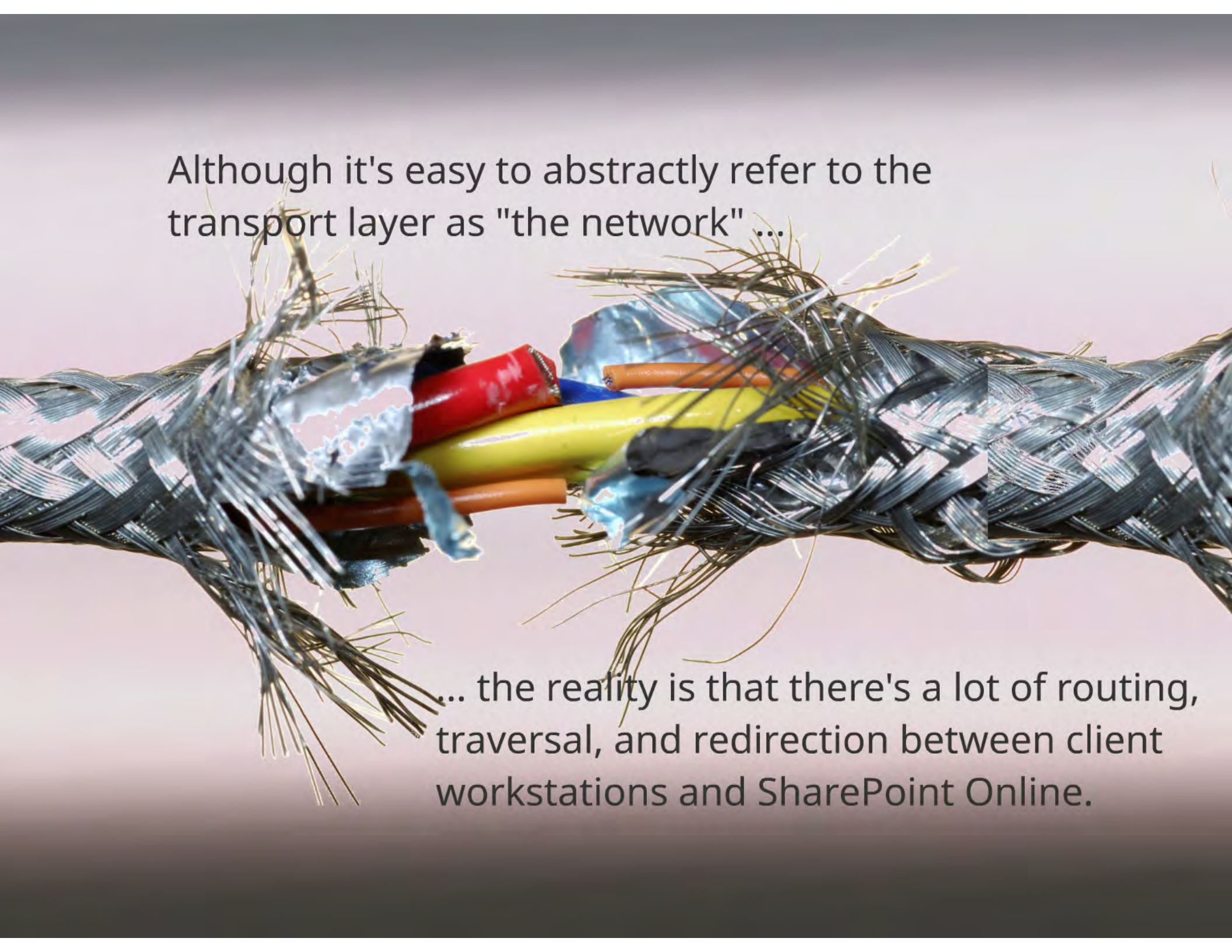

The Reality of Plumbing


The Network

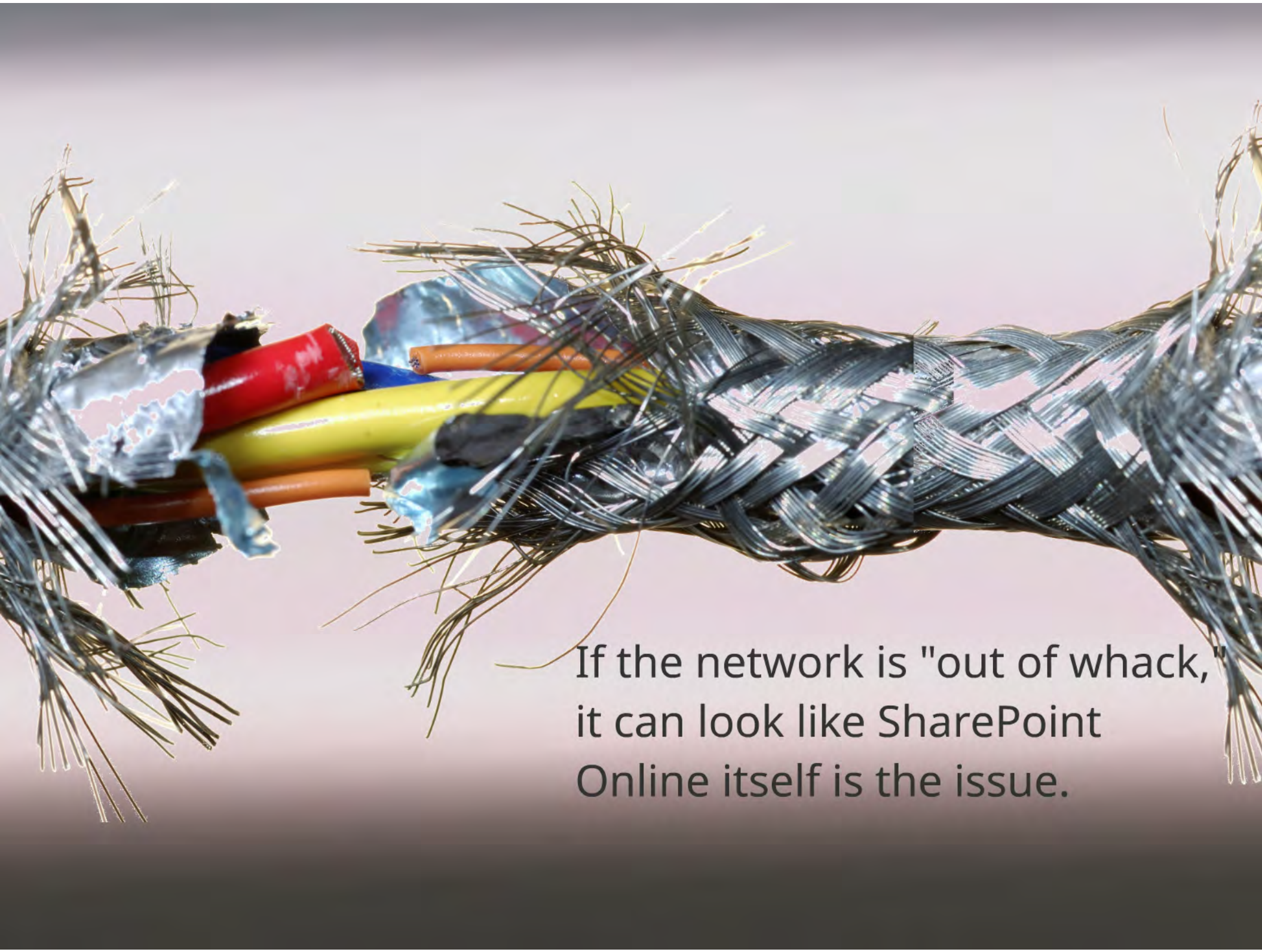
The Network

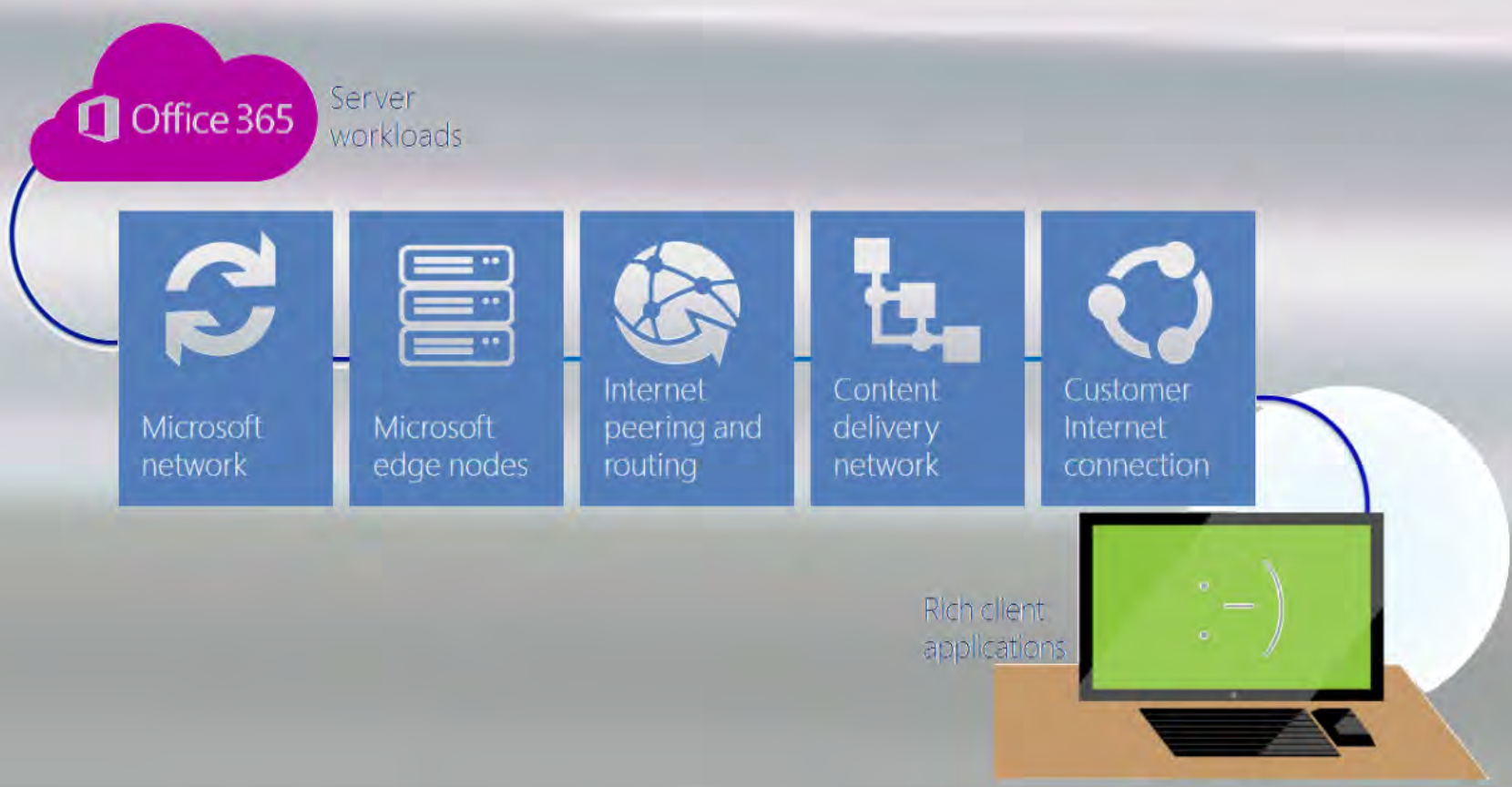
If we're talking about end-to-end performance, we really need to start with the plumbing that carries everything.

Although it's easy to abstractly refer to the transport layer as "the network" ...



... the reality is that there's a lot of routing, traversal, and redirection between client workstations and SharePoint Online.


If the network is "out of whack,"
it can look like SharePoint
Online itself is the issue.



Connecting to SharePoint Online involves a lot more than just your browser and a cloud-based server.

We don't have time to cover all the plumbing in this session ...

So, remember this

If you've spent a lot of time

We don't have time to cover all the plumbing in this session ...

So, remember this:

If you've spent a lot of time troubleshooting in SharePoint Online (to little or no effect), maybe you should zoom out and consider the network.

Okay, so it really feels like there is a tangible performance problem.

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How do you prove it objectively?

The good news: the destruction of computer equipment is not necessary (although you might feel compelled to do so)!

objectively?

Meet your primary diagnostic tool.

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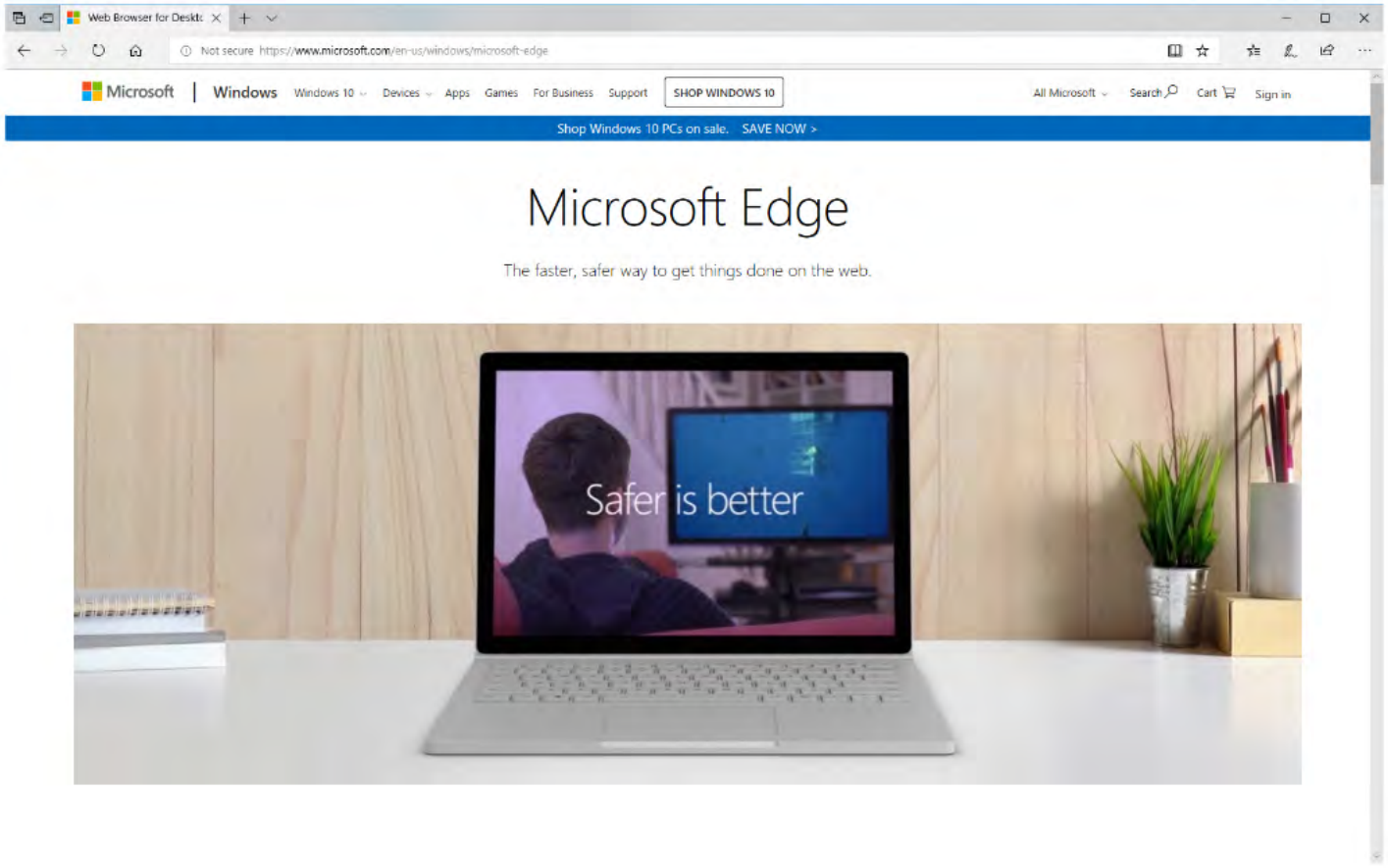
In all likelihood, you already have it on your system.


Web Browser for Deskto
Not secure https://www.microsoft.com/en-us/windows/microsoft-edge
Microsoft | Windows
Windows 10
Devices
Apps
Games
For Business
Support
SHOP WINDOWS 10
All Microsoft
Search
Cart
Sign in
Shop Windows 10 PCs on sale. SAVE NOW >
Microsoft Edge
The faster, safer way to get things done on the web.
Safer is better

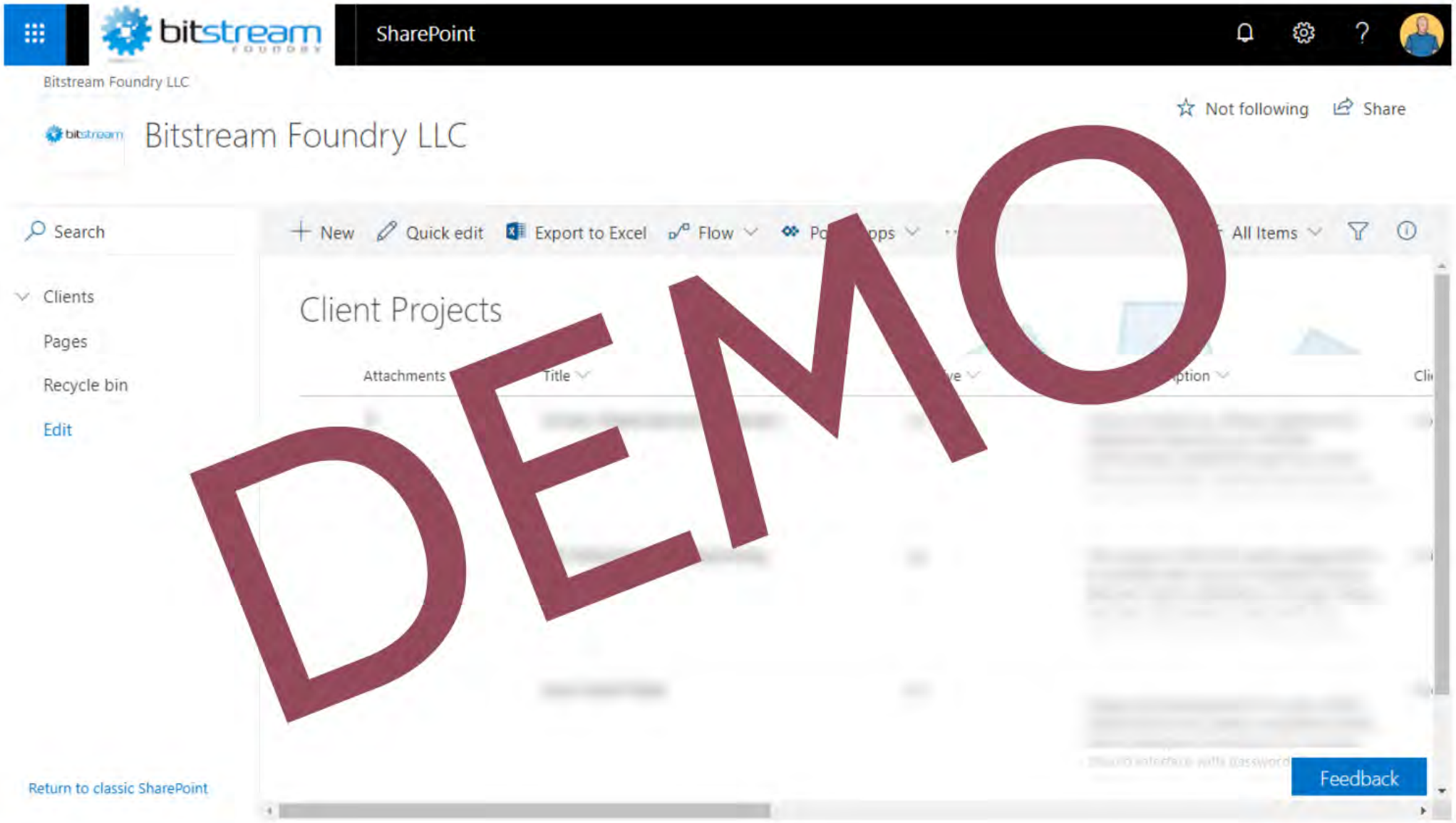
Hello, Edge!

Um ... you're kidding, right?

None!

Um ... you're kidding, right?

Nope!


bitstream
SharePoint
Bitstream Foundry LLC
Not following
Share
Bitstream Foundry LLC
Search
New
Quick edit
Export to Excel
Flow
All Items
Clients
Pages
Recycle bin
Edit
Client Projects
Attachments
Title
Return to classic SharePoint
Feedback
DEMO

* may be due to routing issues (as in "number of hops")
* plenty of other possibilities

Demo Takeaways

HTTP Response Headers

- SPIisLatency — waiting on server - generally zero or near zero
- SPRequestDuration — time spent processing on server (in ms) - ideally low
- X-SharePointHealthScore — 0 to 10 (you want 0)

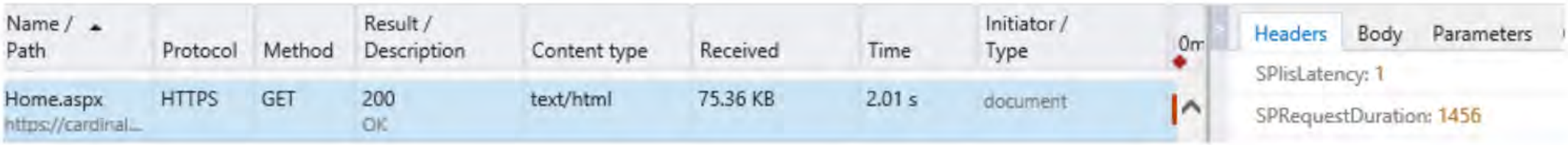
Don't see the headers?

I'll be demonstrating a better way to get the performance numbers (and site assessments) a little bit later!

HTTP Response Headers

- SPIisLa

Generally speaking ...



Time - (SPRequestDuration + SPIisLatency) = "time lost elsewhere"

* potential network latency
* may be due to routing issues (as in "number of hops")
* plenty of other possibilities

Demo Takeaways

HTTP Response

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time spent processing on

So, you've concluded that your pages are slow and you have the data to prove it!

SPIisLatency is low, and
X-SharePointHealthScore is low,

but ...

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SPIisLatency is low, and
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but ...

SPRequestDuration is crazy high (e.g., 9000 ms)!

Repeat after me ...

"The problem probably isn't

Repeat after me ...

"The problem probably isn't SharePoint Online. It's my site."

Okay, one more time:

Repe

"The prob

SharePoir

Repeat after me ...

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So, who's to blame?

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*Note: not all devs are lousy devs. Just the ones who create performance problems and knee-jerk into blaming Microsoft and SharePoint Online.

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- In the majority of poor performance scenarios, a combination of UI/UX , client-side code additions, and questionable customization/deployment mechanisms are to blame.
- Microsoft has indicated that the slowest 1% of pages in SPO take more than 5,000ms to load - again, usually due to customizations.

- Compare processing and response times to your problematic SharePoint site or page.

(may not be valid approach much longer ...)

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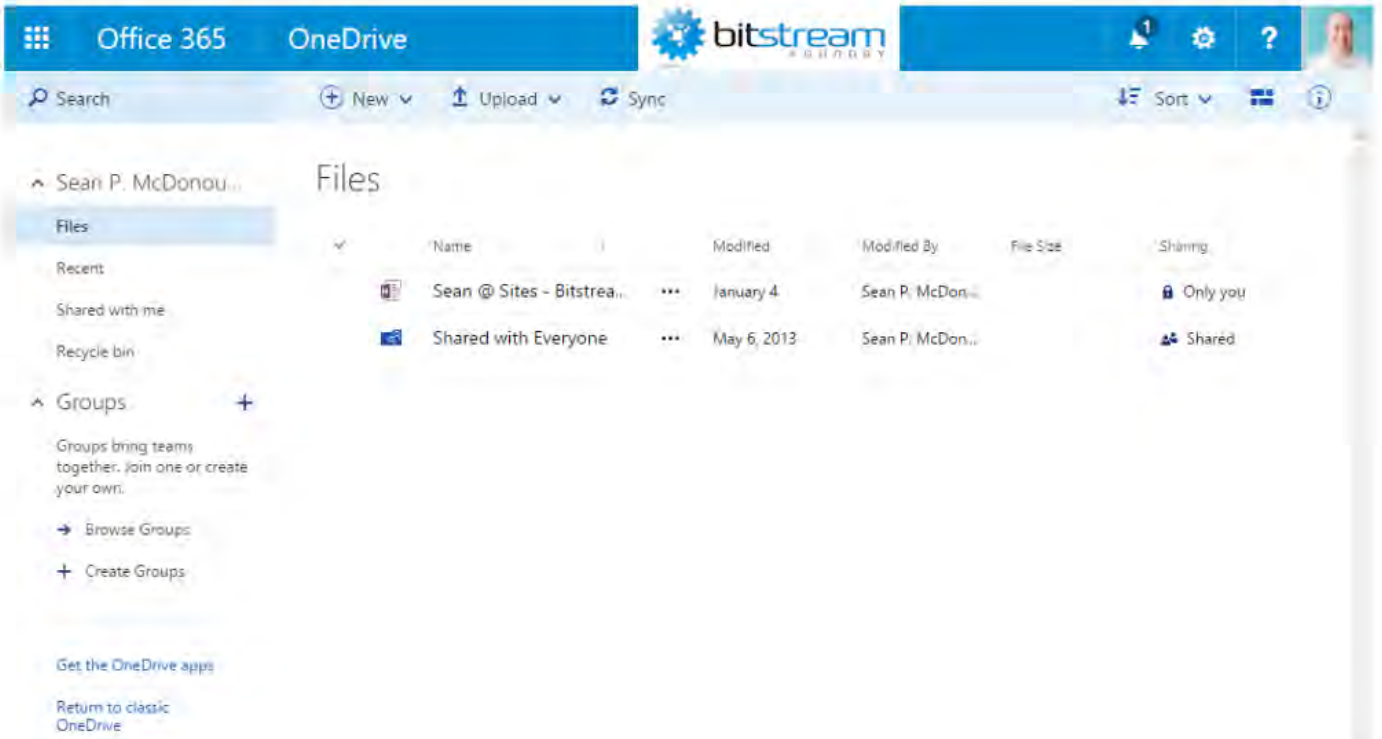
Don't believe me?

Collect the data and validate for yourself!



- Profile your OneDrive for Business page (it's in your MySite).
- Compare processing and response times to your problematic SharePoint site or page.

(may not be valid approach much longer ...)

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Don't believe me?

"Okay, yeah - my OneDrive for Business page is really fast ... but my SharePoint pages are completely choking."

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"Okay, yeah - my OneDrive for Business page is really fast ... but my SharePoint pages are completely choking."

You're probably thinking **"What can I do?"**


You are now in the cloud!
Let's compare:
COMING ATTRACTIONS
Path to Better Performance

Let's start with a very important acknowledgement:

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You are now in the cloud!

As obvious as that sounds, I continually see

acknowledgement:

You are now in the cloud!

As obvious as that sounds, I continually see SharePoint developers and those customizing sites act as if SharePoint Online were no different than their on-premises SharePoint environments.

very important
acknowledgement:

You are now in the cloud!

As obvious as that sounds, I continually see SharePoint developers and those customizing sites act as if SharePoint Online were no different than their on-premises SharePoint environments.

Let's compare:

On-Premises	SPO
High Bandwidth	Low(er) Bandwidth
Low Latency	High(er) Latency

Failing to acknowledge the "we're in the cloud now" reality leads to a problem I simply call ...

Too Many

Failing to acknowledge the "we're in the cloud now" reality leads to a problem I simply call ...

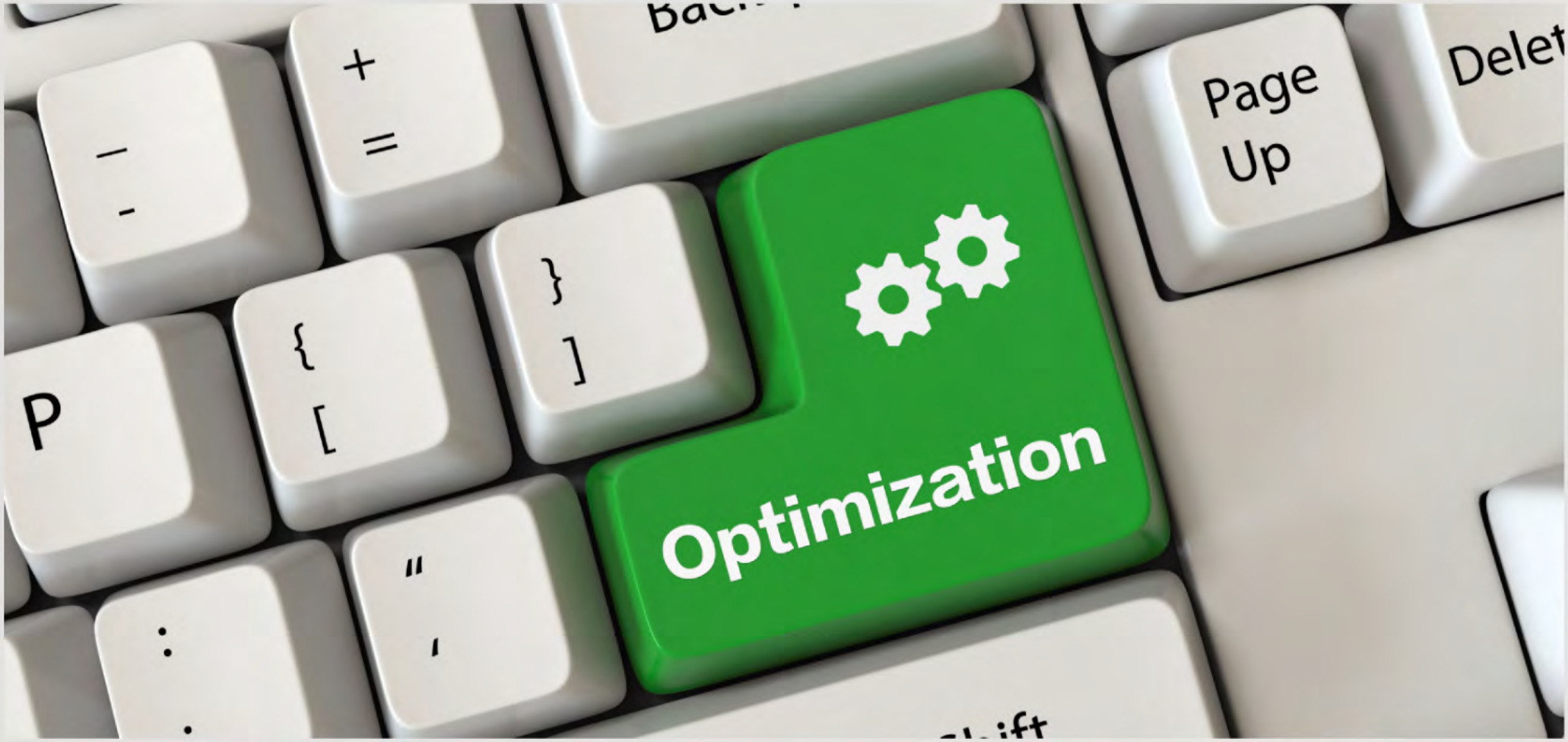
Too Many, Too Big

- Too many calls are made to the server.

now" reality leads to a problem I simply call ...

Too Many, Too Big

- Too many calls are made to the server.
- Too many files are referenced on pages.
- The files in-use are too large.



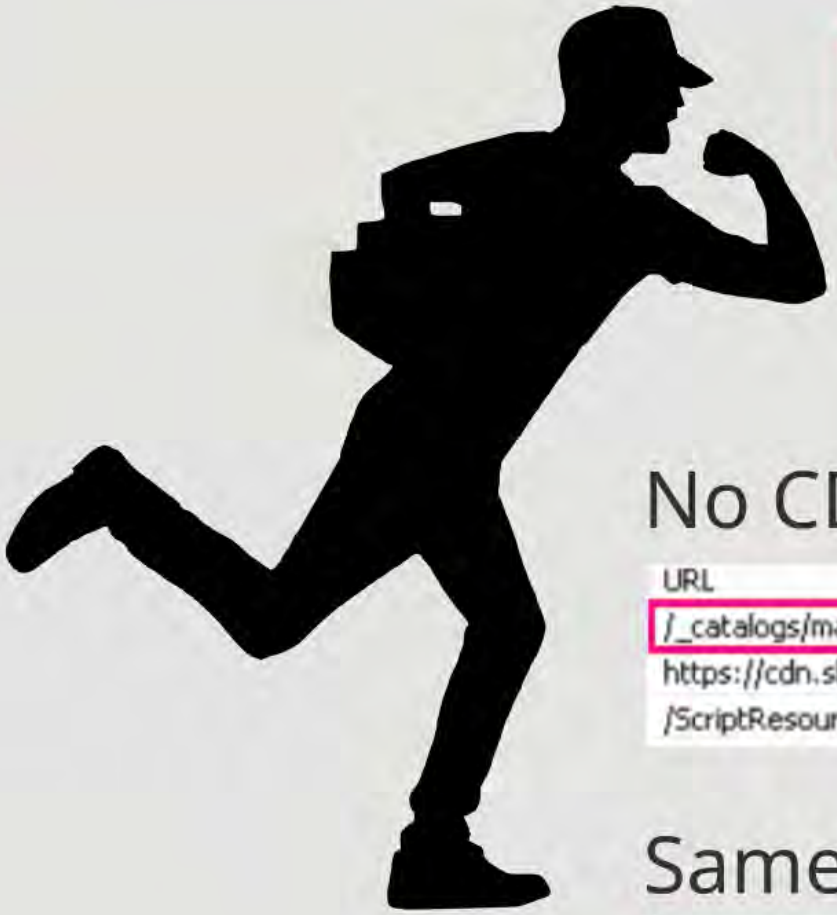
Consider one or more of the following:

- Minify files, especially JavaScript files.
- Resize images to usage sizes

Consider one or more of the following:

- Minify files, especially JavaScript files.
- Resize images to usage sizes.
- Compress images (more) aggressively.
- Use sprite sheets to reduce the actual number of HTTP requests needed to retrieve images.
- Use SharePoint's Image Rendition service.
- Leverage a toolkit like Font Awesome in place of individual icons and associated files.

And the big kahuna …



Use a CDN!!!

(Content Delivery Network)

No CDN in use (i.e., SPO library direct)

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>

Same resource from a CDN

URL	Received	Taken
https://ajax.aspnetcdn.com/ajax/jQuery/jquery-2.1.1.min.js	82.74 KB	469 ms
/WebResource.axd?d=nMv7y4tJrCBwmUs1-GLXCgiVJy4RM4FI7qCK2olh3D5KbMXzSdwm5kIlpDx9vM8MKlztZon...	22.33 KB	0.84 s
/_layouts/15/images/spcommon.png?rev=38	20.56 KB	1.15 s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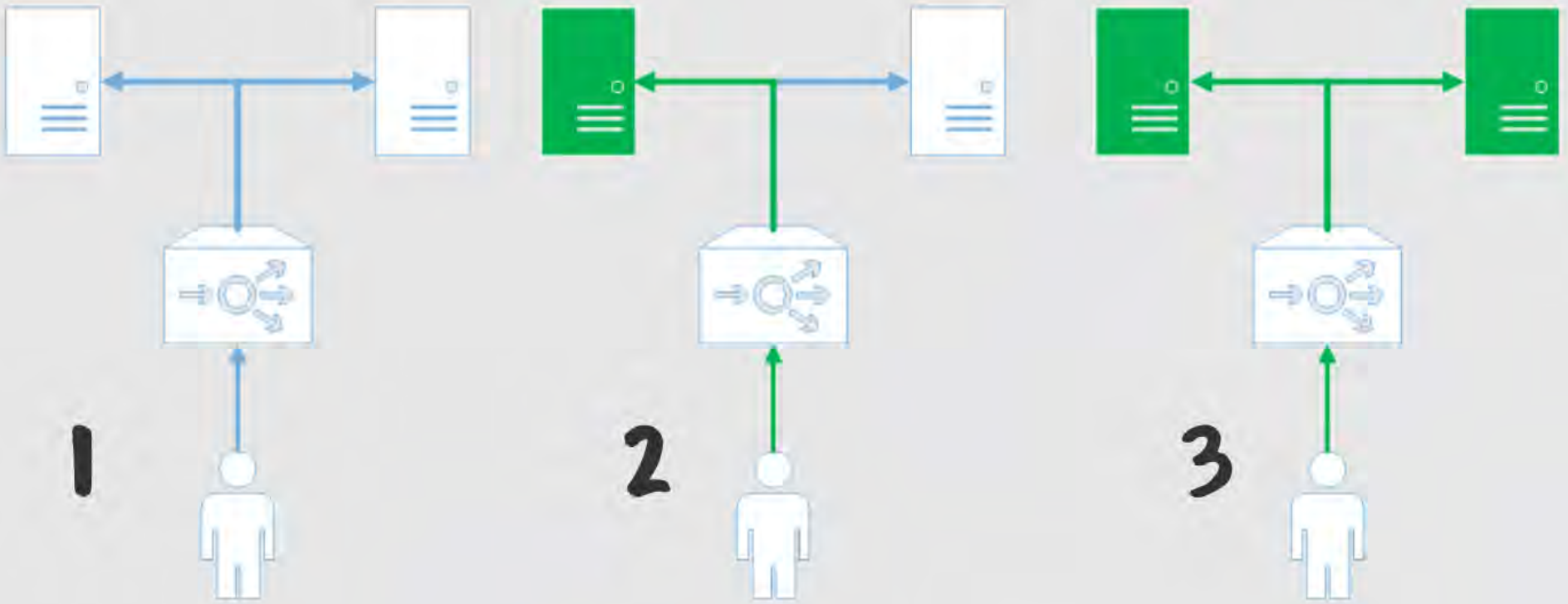
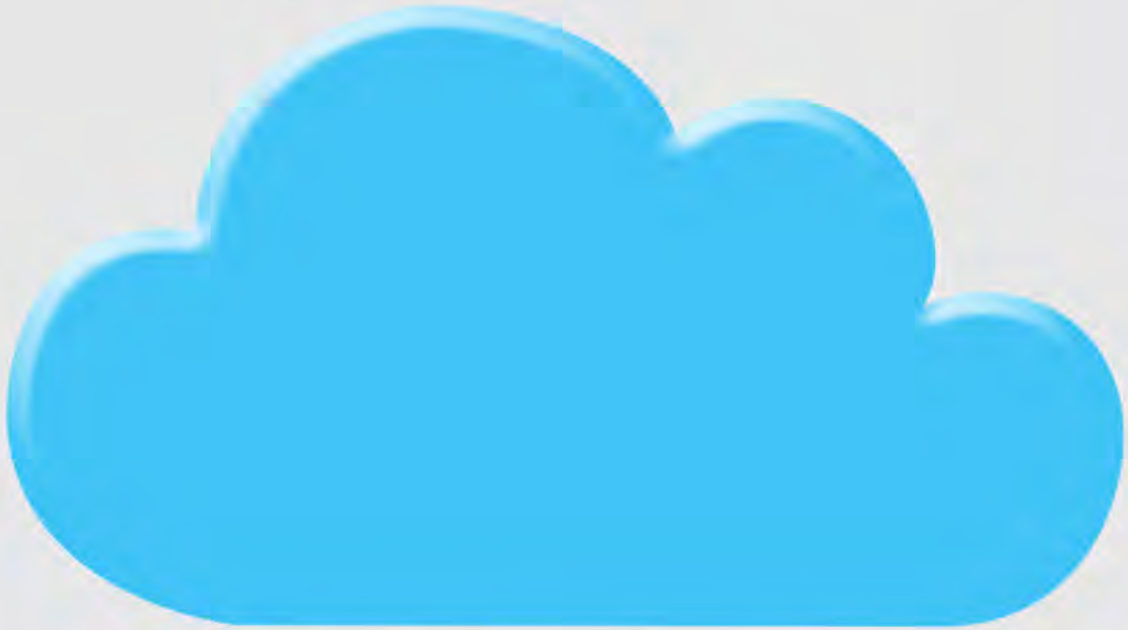
COMING ATTRACTIONS
Path to Better Performance

Conventional wisdom says caching is good.

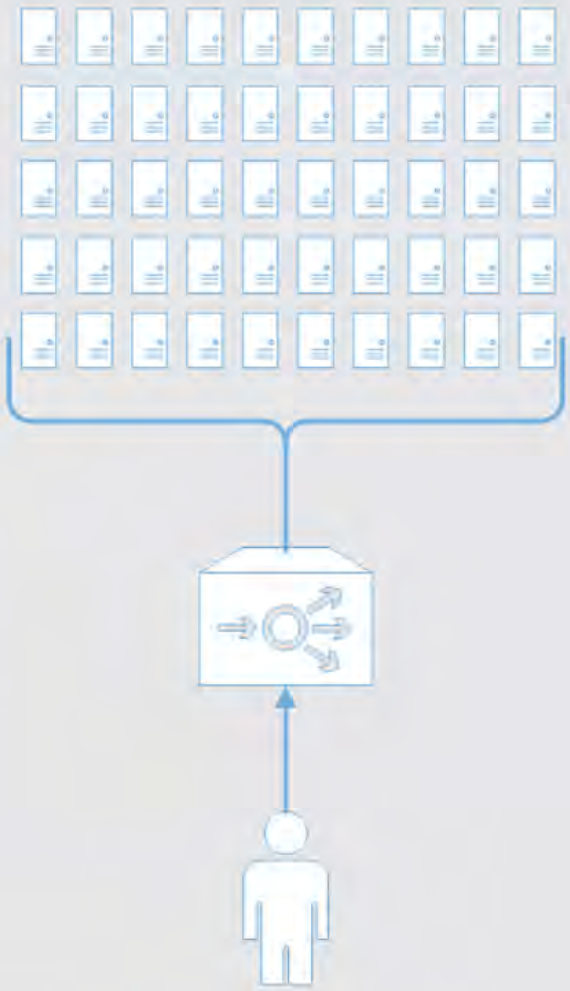
says caching is good.



After just a few requests, the on-premises Object Cache can be "ready for action."



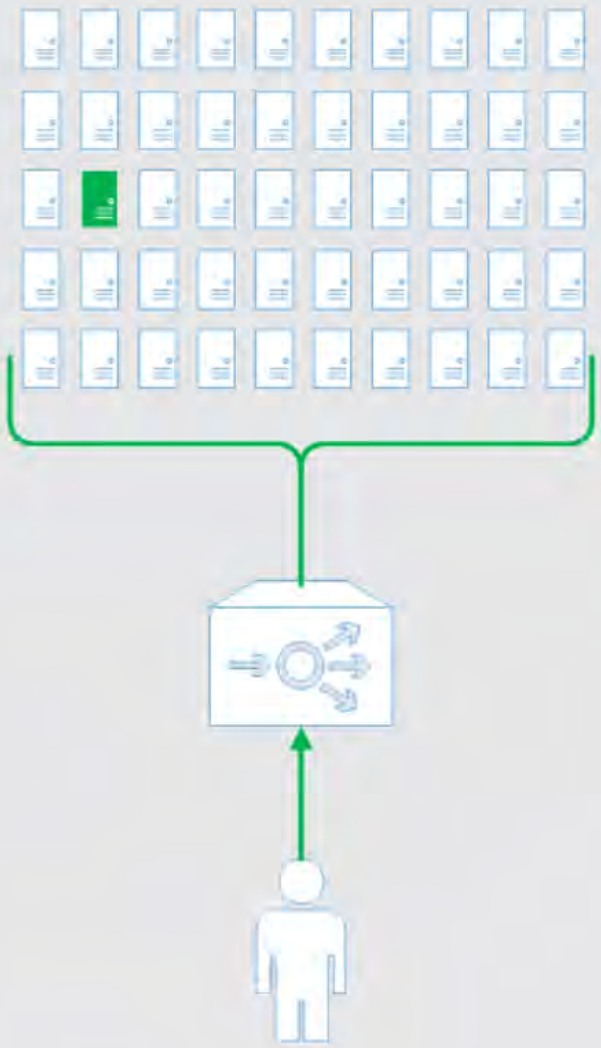
In the cloud, the caching equation (for per-server memory-based caches like the Object Cache) works out a bit differently.



User's Initial Request

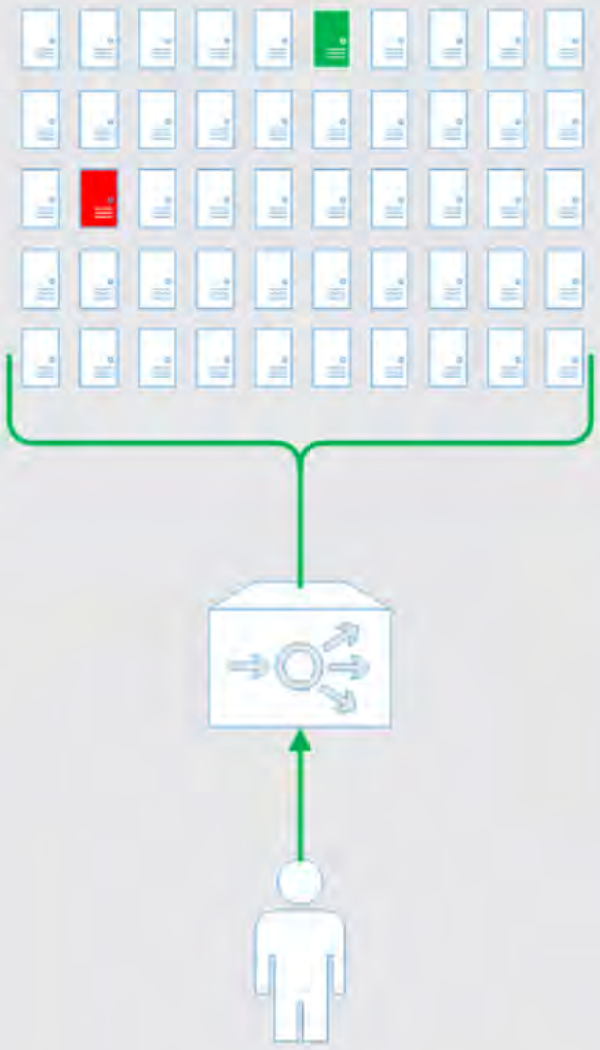
- First thing to note: the number of WFEs tends to be *much* higher in the cloud versus on-premises.

User's Second Request



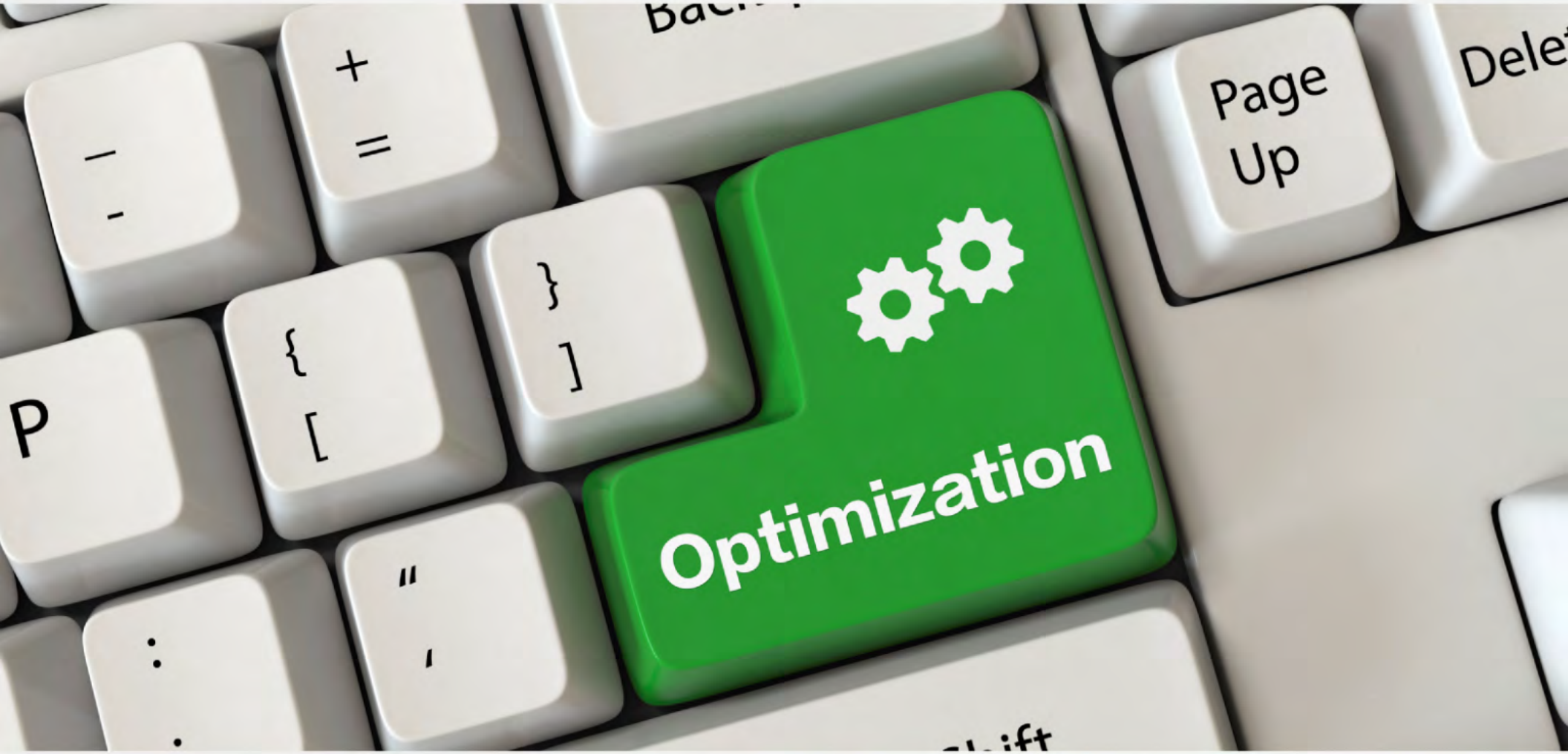
User's Second Request

- No affinity is in use, so the chance of a user hitting the same server again is dramatically less than the on-premises scenario.



Subsequent Requests

- Same reduced chance of hitting the WFE last visited
- Memory pressure causes much more frequent cache ejections versus on-premises.



Two significant adjustments can be made.

* These sitemaps are then stored in the Object

Navigation style has a huge impact on performance.

Using structural navigation is the default (but poor) choice for complex site hierarchies in the cloud.

* building each site node generates roughly 8 SQL Server round trips
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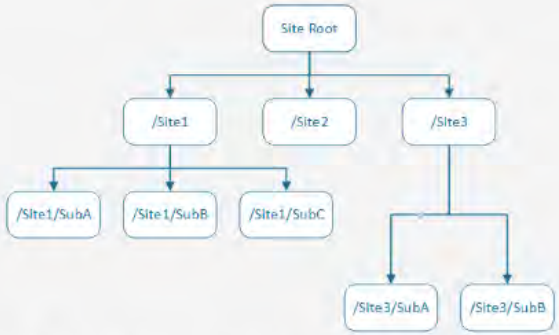
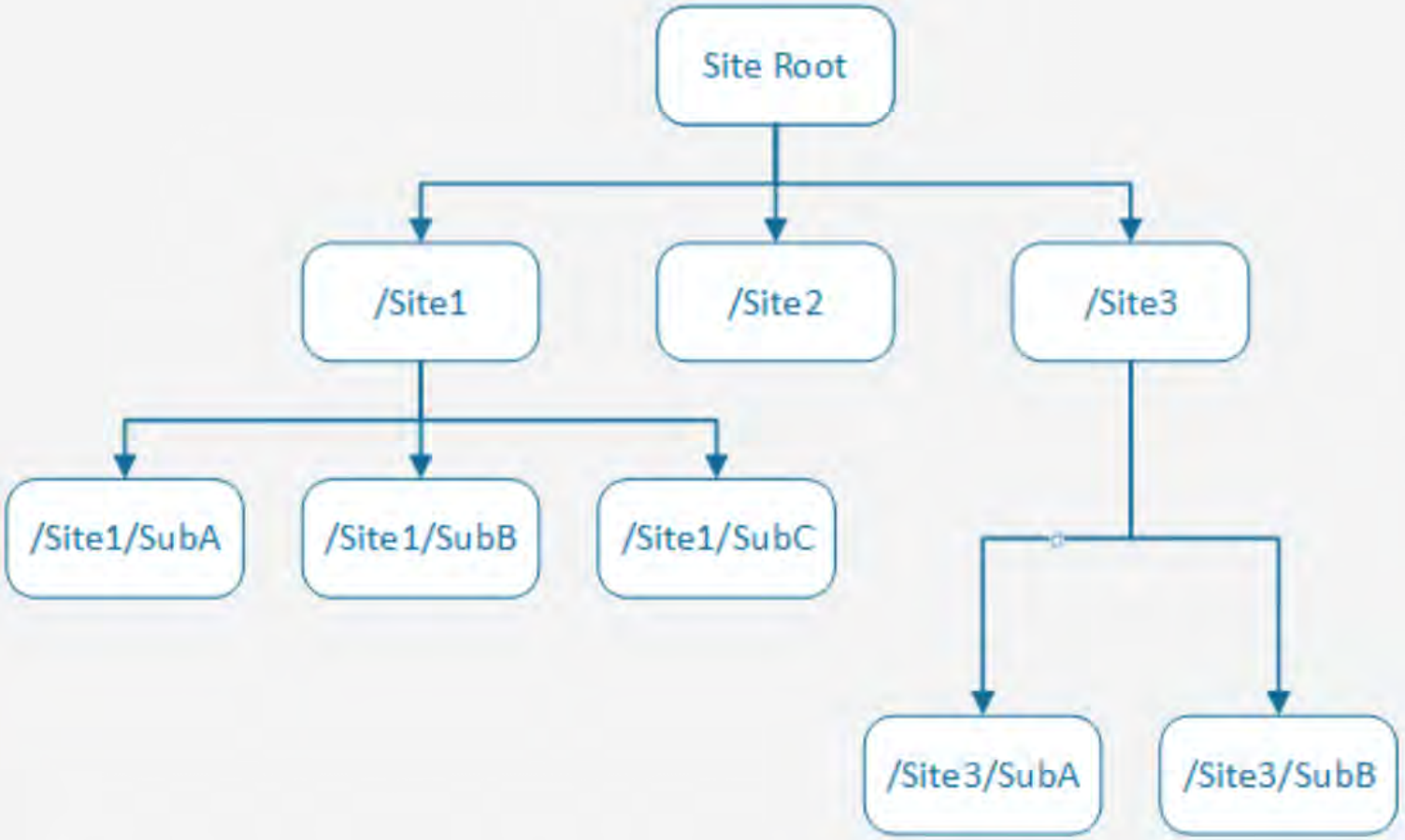


8 site nodes/~64 SQL calls



8 site nodes/~64 SQL calls

Better Options for Navigation

- Managed Navigation (i.e., using a term set to drive navigational structures) can significantly improve page performance.
  note: the SharePoint Server Publishing Infrastructure site collection Feature must be enabled to use Managed Navigation
- Search-driven navigation leverages SharePoint's Search index and the process of client-side navigational rendering to dramatically speed things up.
  note: implementation is non-trivial and less customizable

Using structural navigation is the default (but poor) choice for complex site hierarchies in the cloud.

* building each site node generates roughly 8 SQL Server round trips
* These sitemaps are then stored in the Object Cache on WFEs

Navigation style

As was pointed-out in the navigational scenario,
Search can be used to boost performance significantly.

In the cloud, the CQWP can cause some signif

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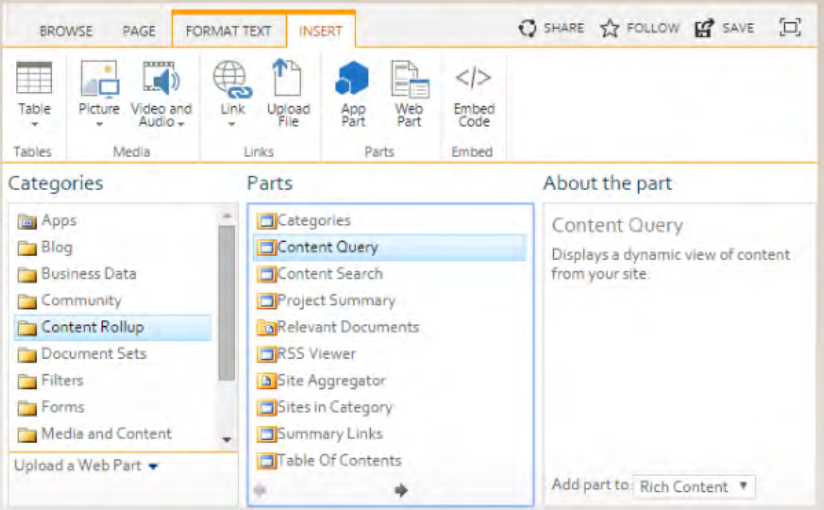
Do you like the Content Query Web Part (CQWP)?



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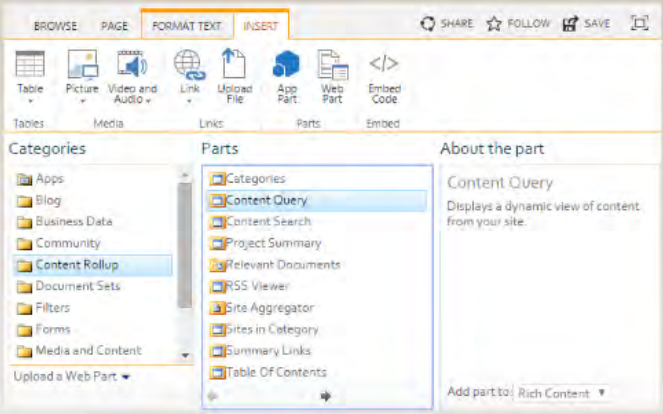


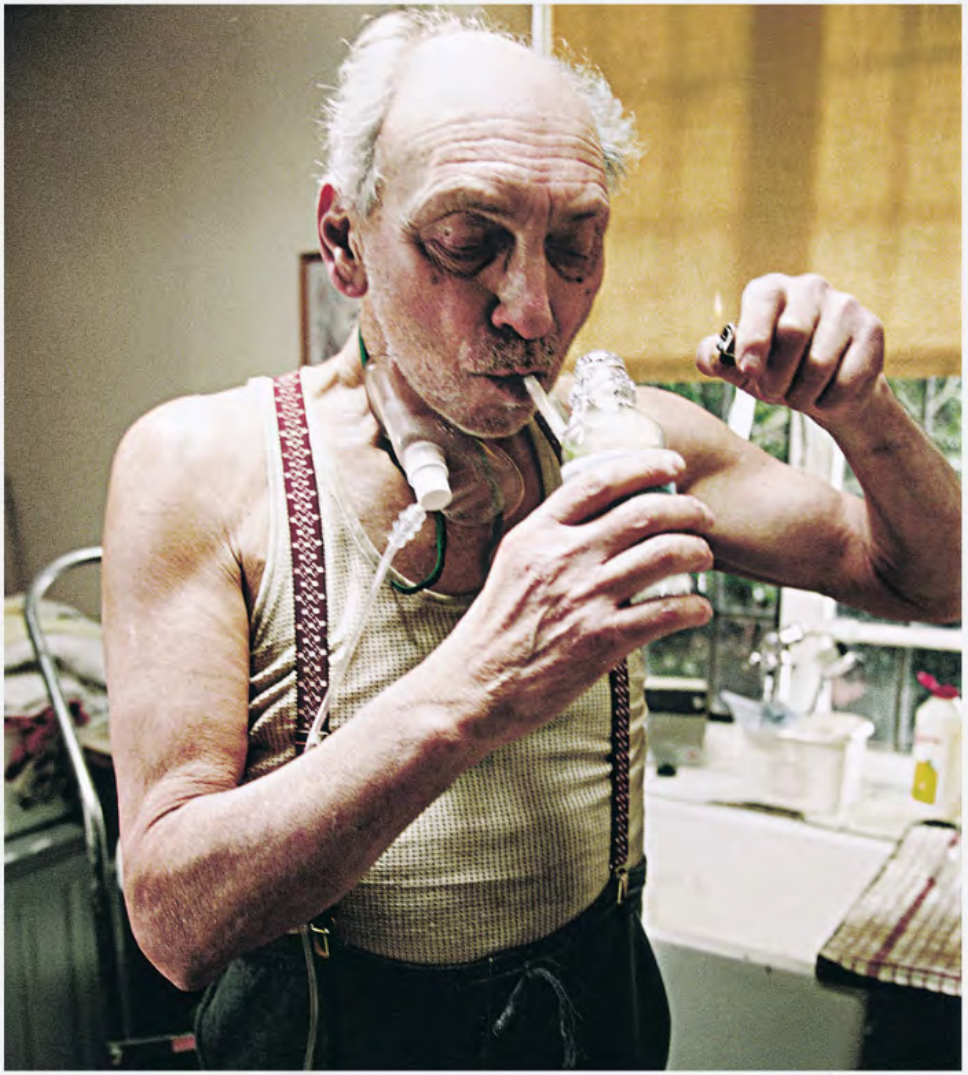
In the cloud, the CQWP can cause some significant performance hits.

- The CQWP performs expensive cross-list and cross-site queries at run-time.
- The CQWP relies on the Object Cache to store results for acceptable performance.
- The Content Search Web Part (CSWP) provides options that are similar to the CQWP (and in a number of ways, more powerful) and uses Search so it's FAST!

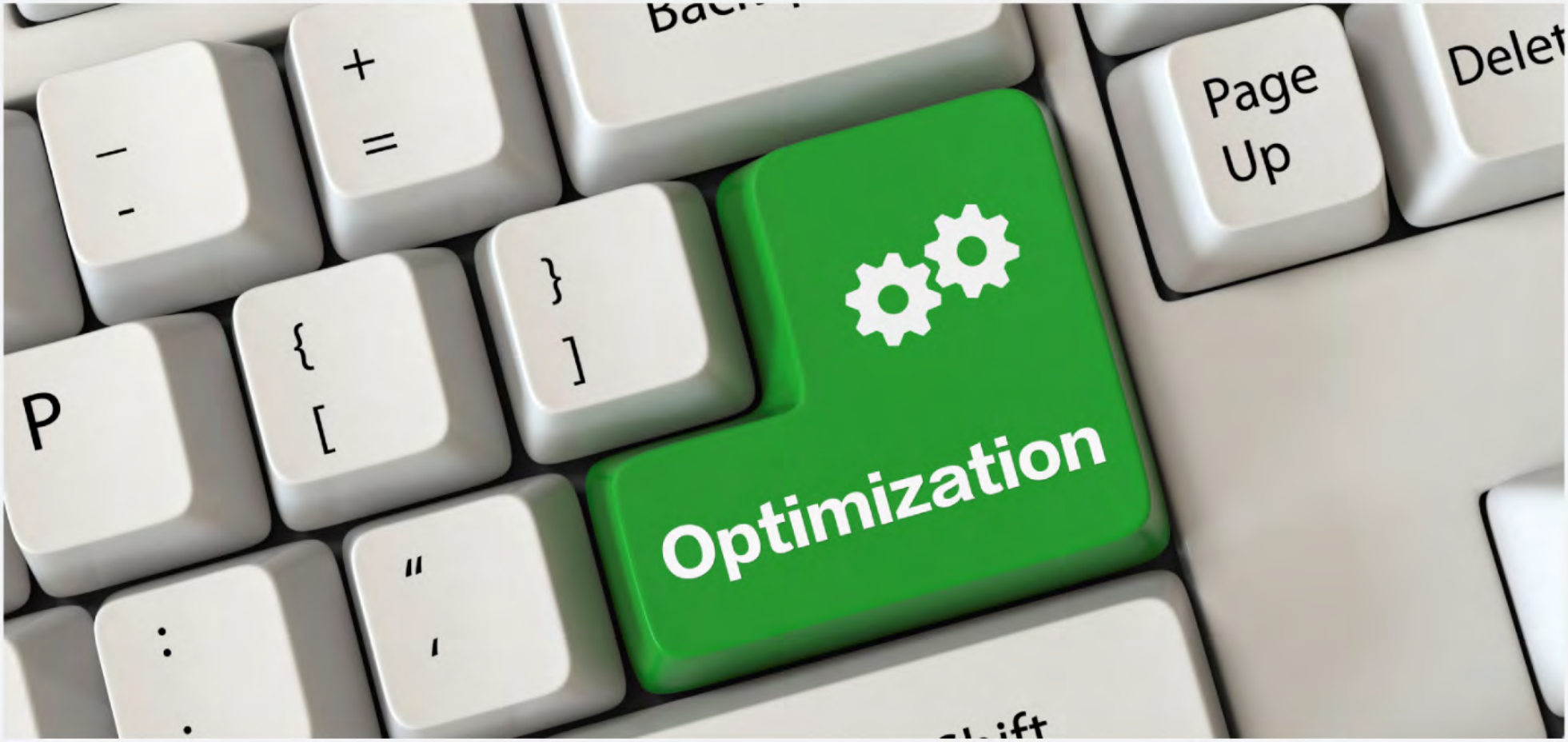

You are now in the cloud!
Let's compare:
COMING ATTRACTIONS
Path to Better Performance

Okay, time for a serious question ...

Are you a web part junkie?

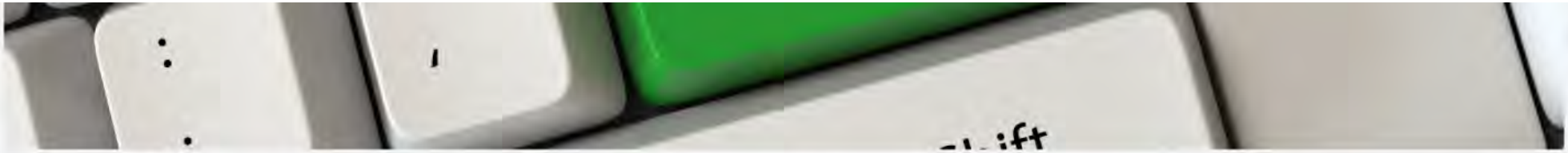


If so, it's time to talk rehab.



What's the alternative to freebasing web parts?

There's no single



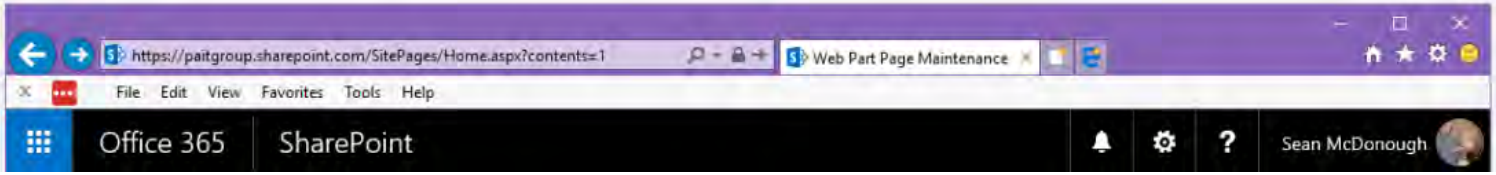
What's the alternative to freebasing web parts?

There's no single (or simple) answer.

Generally speaking, consider leveraging client-side code (JavaScript) and asynchronous techniques - both of which we'll discuss soon.

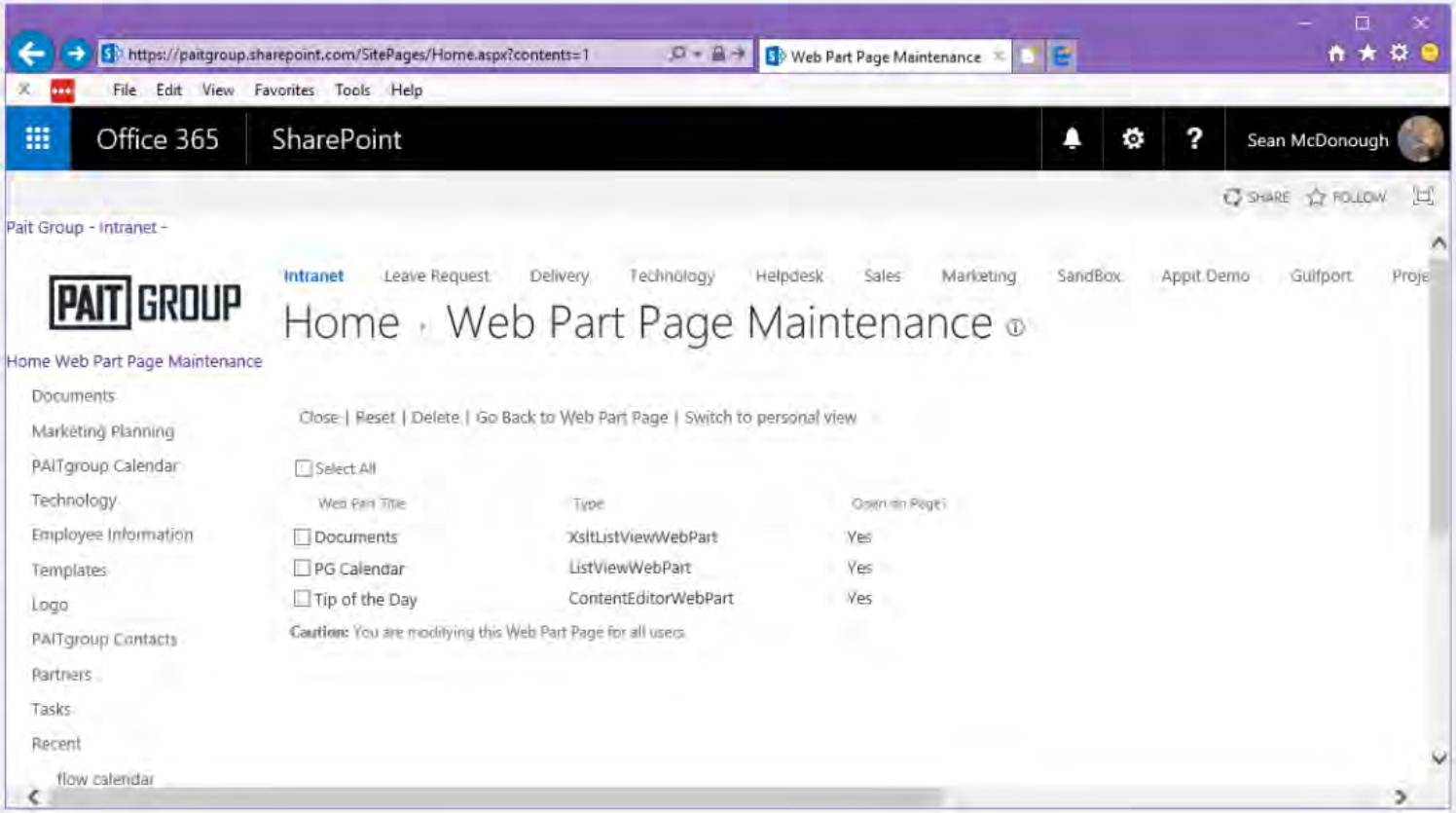
but ...

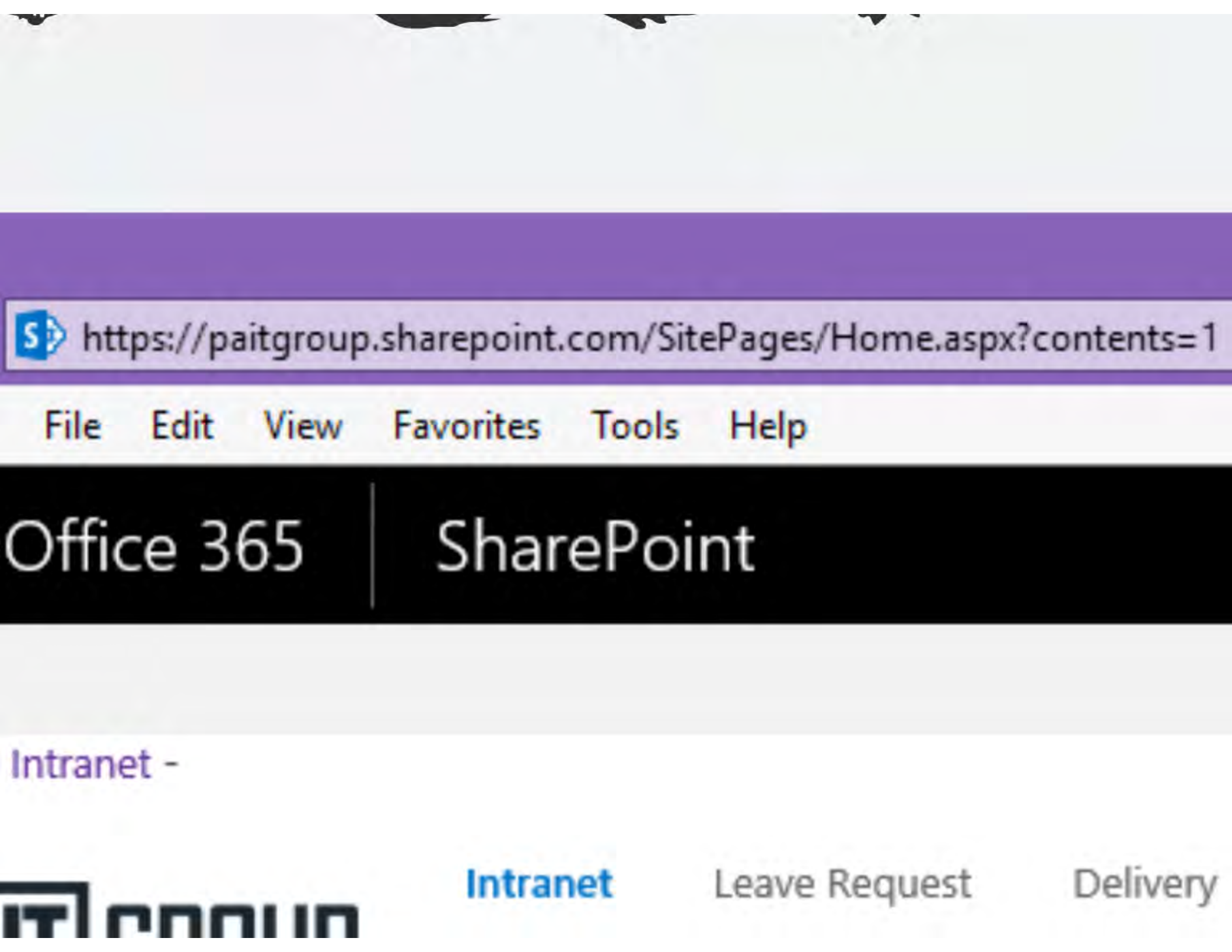
Be sure to put problem pages



but ...

Be sure to put problem pages in web part maintenance view with **?contents=1** to find web parts which are closed but not deleted!

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File Edit View Favorites Tools Help
Office 365 | SharePoint
Intranet -
Intranet
Leave Request
Delivery

Home ▸ Web Part Page Maintenance

Close | Reset | Delete | Go Back to Web Part Page | Switch to personal view

Select All

Web Part Title	Type	Open on Page?
Documents	XsltListViewWebPart	Yes
PG Calendar	ListViewWebPart	Yes
Tip of the Day	ContentEditorWebPart	Yes

Caution: You are modifying this Web Part Page for all users.

which are closed but not deleted!

also note ...

When I say "web part," I'm talking about traditional (server-side) web parts. Everything is different, and all bets are off with SPFx/client-side web parts.

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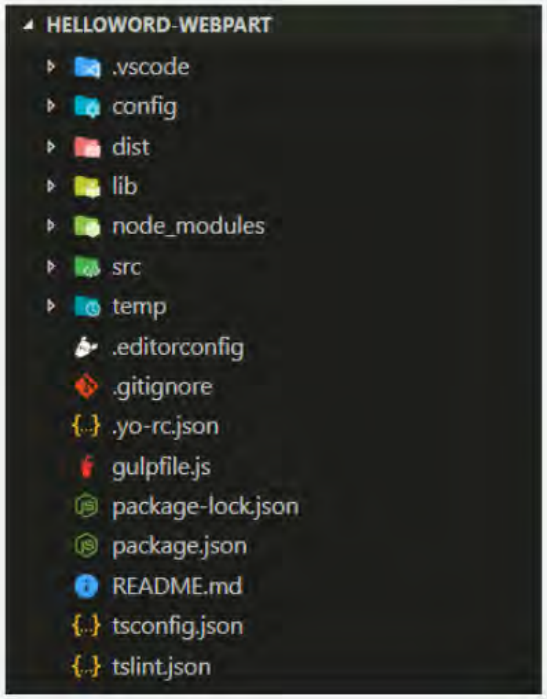

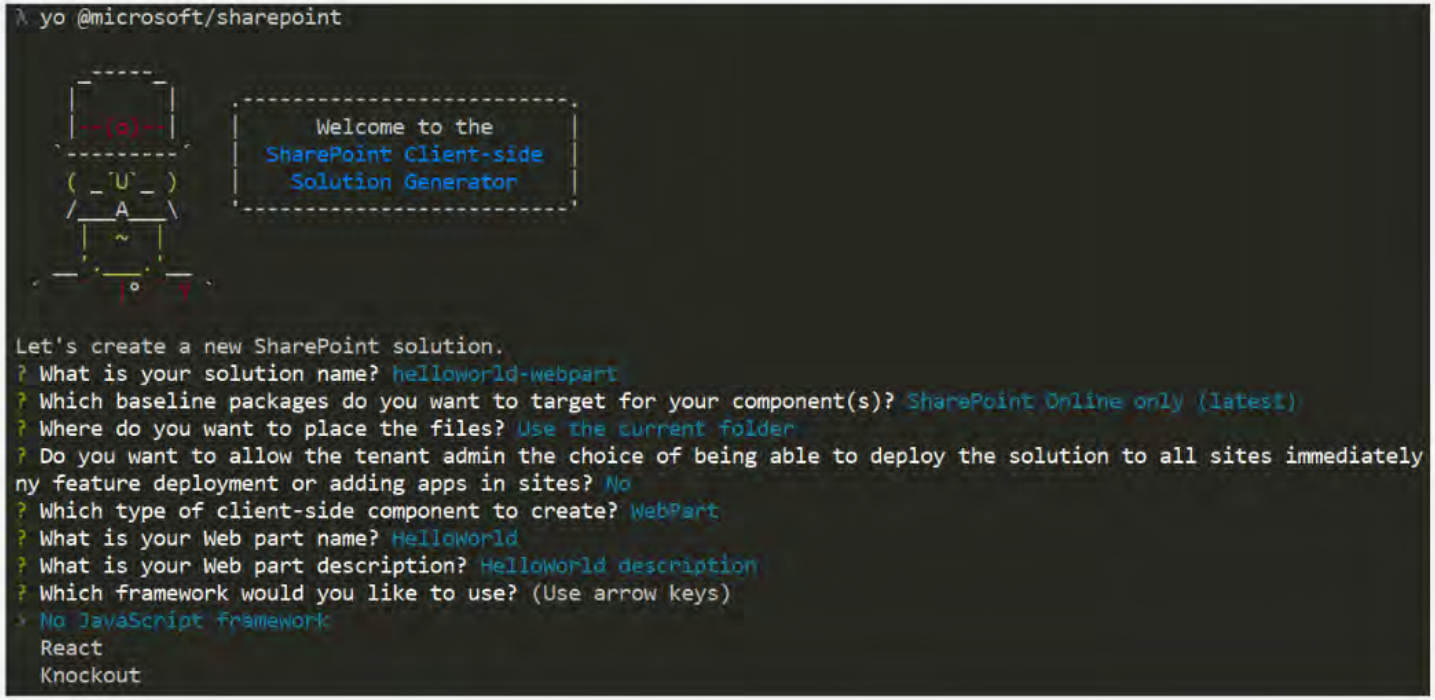

And a friendly reminder: use a CDN with those SPFx web parts!

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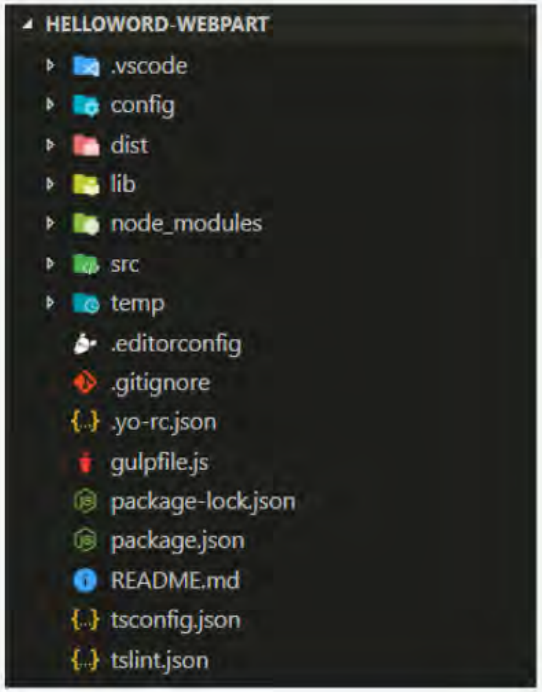

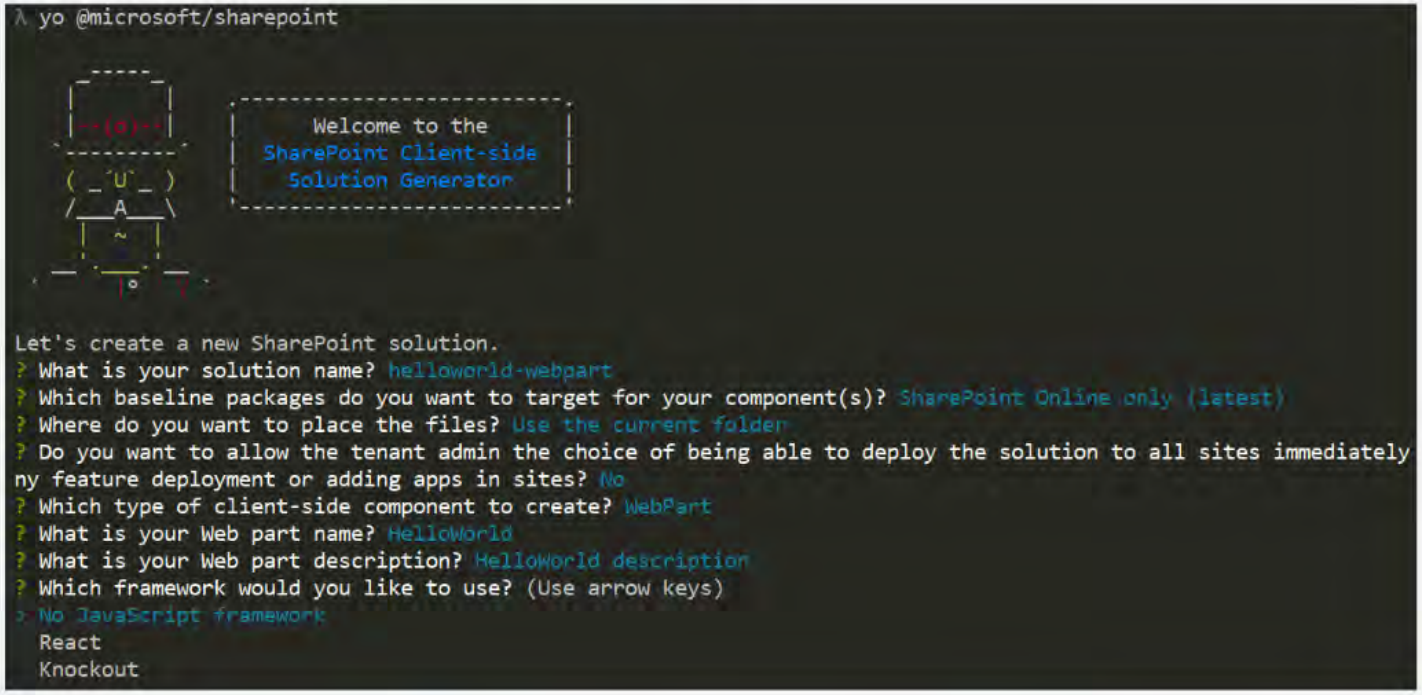

And a friendly reminder: use a CDN with those SPFx web parts!


You are now in the cloud!
Let's compare:
COMING ATTRACTIONS
Path to Better Performance


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Sometimes, perception is everything.

A page may load quickly, but if it FEELS slow to users, it is the SAME AS BEING SLOW.

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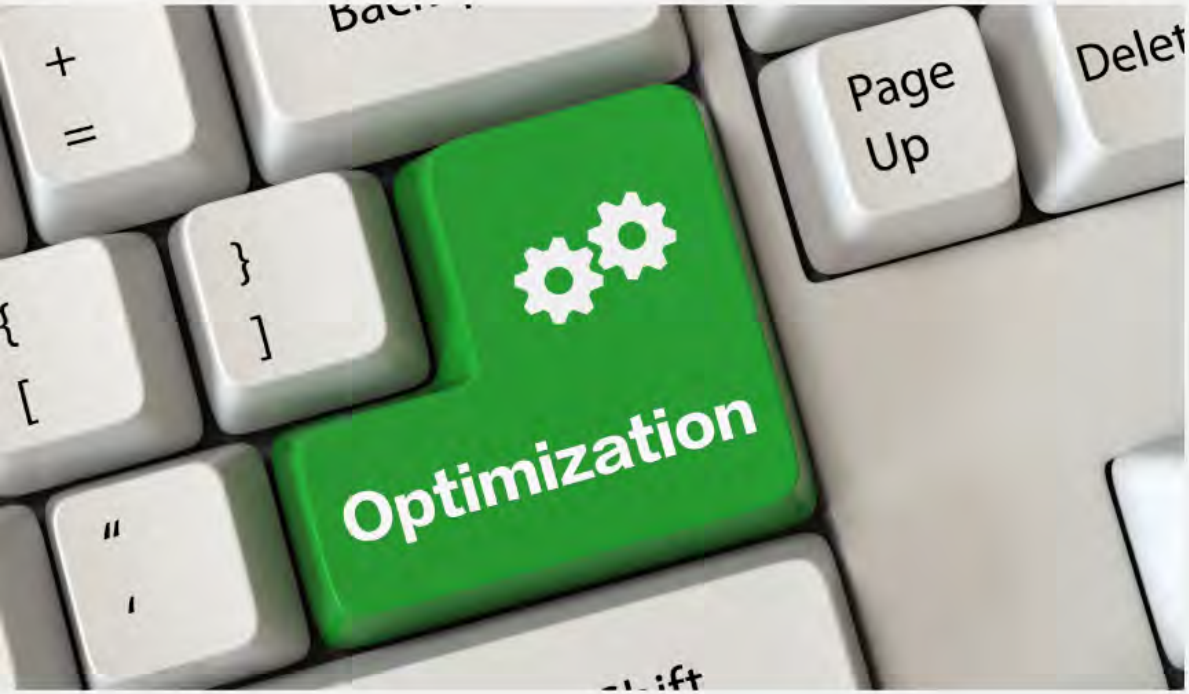
Develop your asynchronous programming techniques



- You can't block a browser's main thread of execution, so leveraging async development patterns is essential.
- Async programming is made much easier in jQuery using promises. Promises approximate a synchronous programming model under asynchronous conditions.
- Certain web parts (e.g., the CSWP) also allow you to set their (a)sync behavior.
- Good use of async techniques make pages ***appear*** to load faster ... and as we discussed, perception is everything.

Speaking of asynchronous techniques:

Only load what you need.

- Instead of fetching everything at once within the context of the initial page load, retrieve the page with only the payload that's needed immediately.
- (Lazy) load images and other items "below the fold" only if users start scrolling down and will see them (e.g., Facebook and LinkedIn's "forever-scrolling" pages).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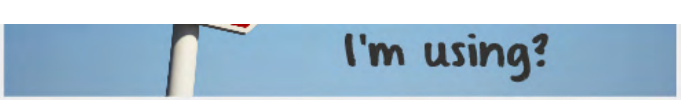
Let's compare:
COMING ATTRACTIONS
Path to Better Performance

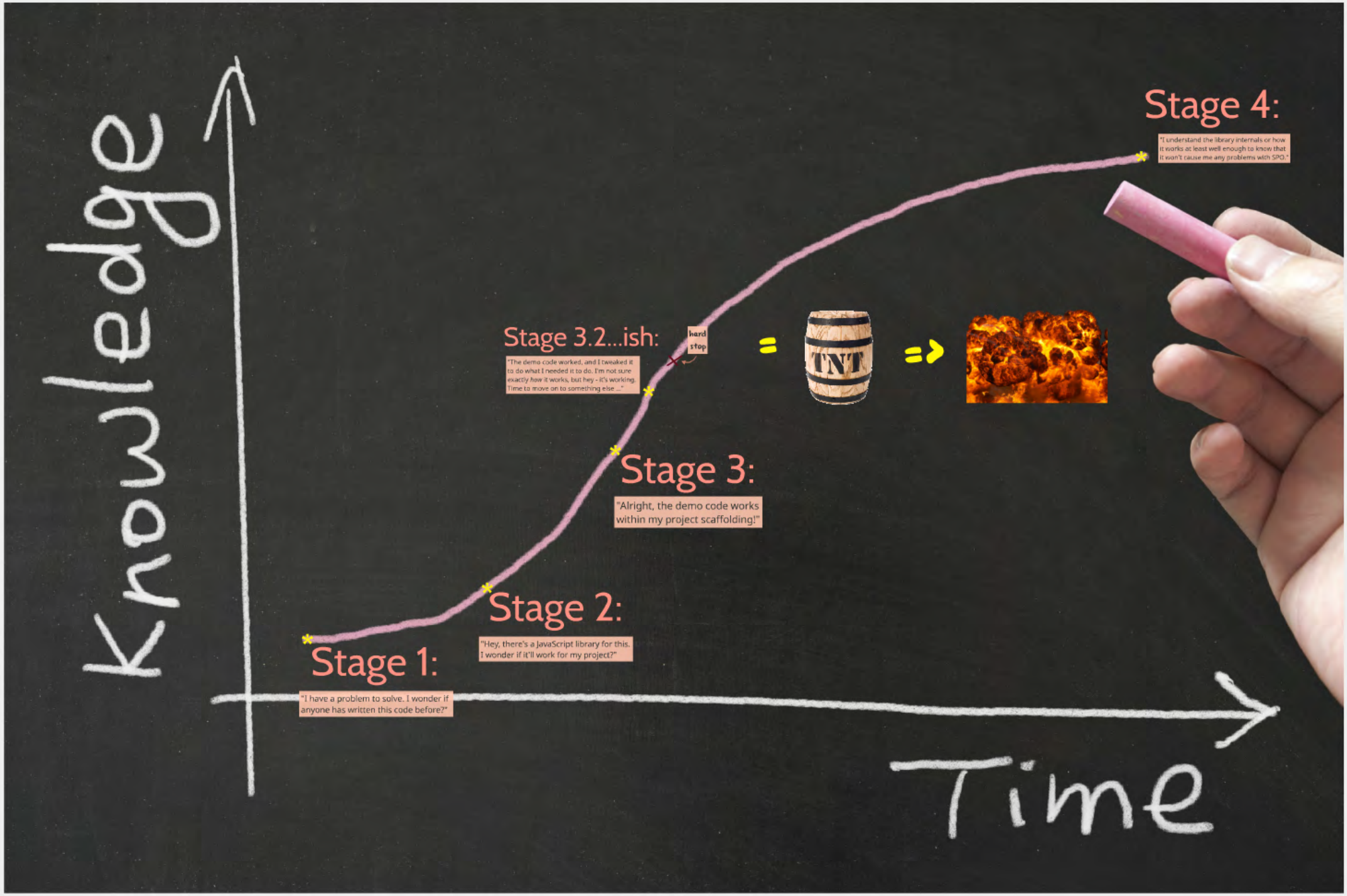
Ask yourself this question:

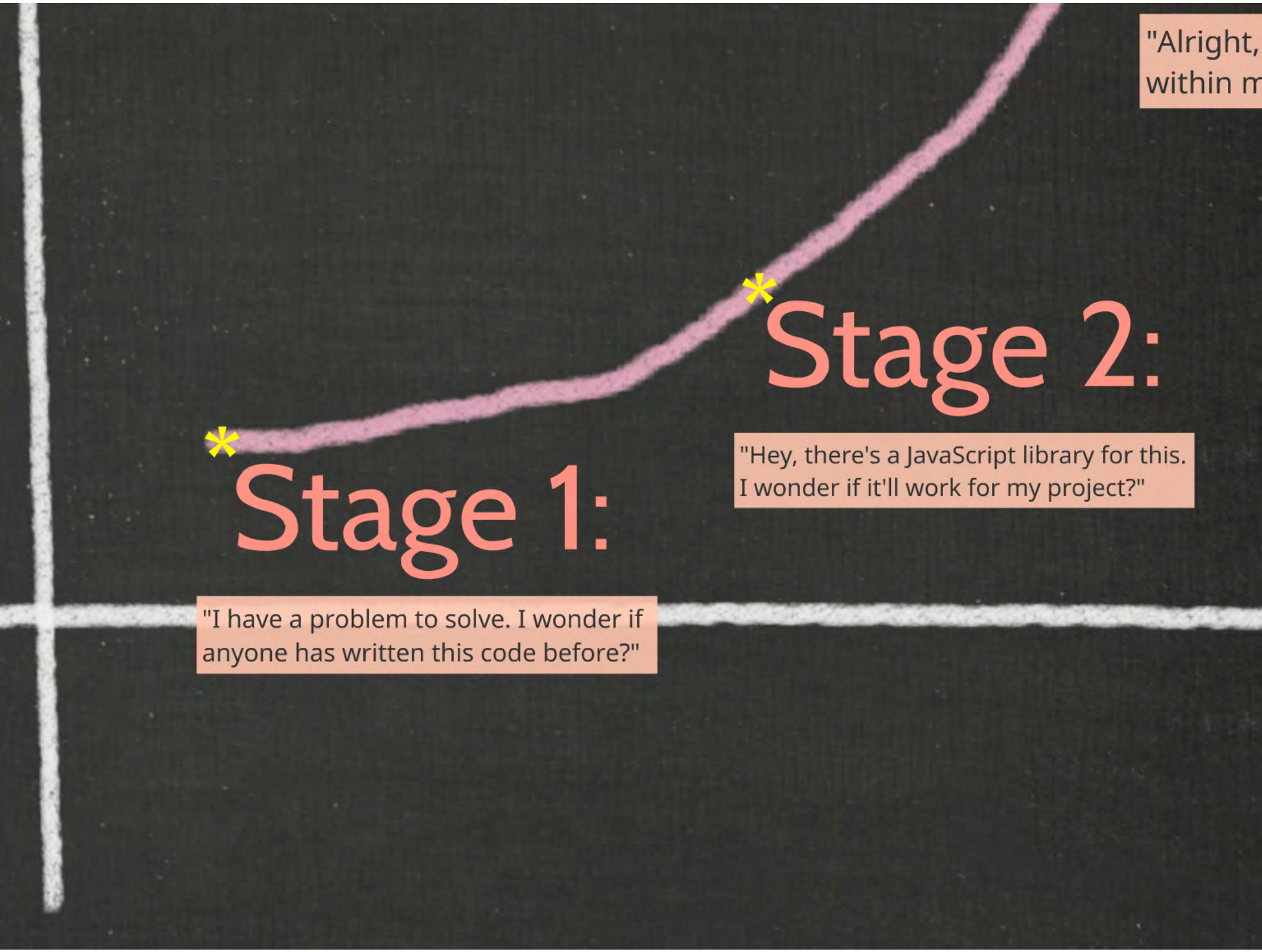
How well do I know the code and libraries I'm using?

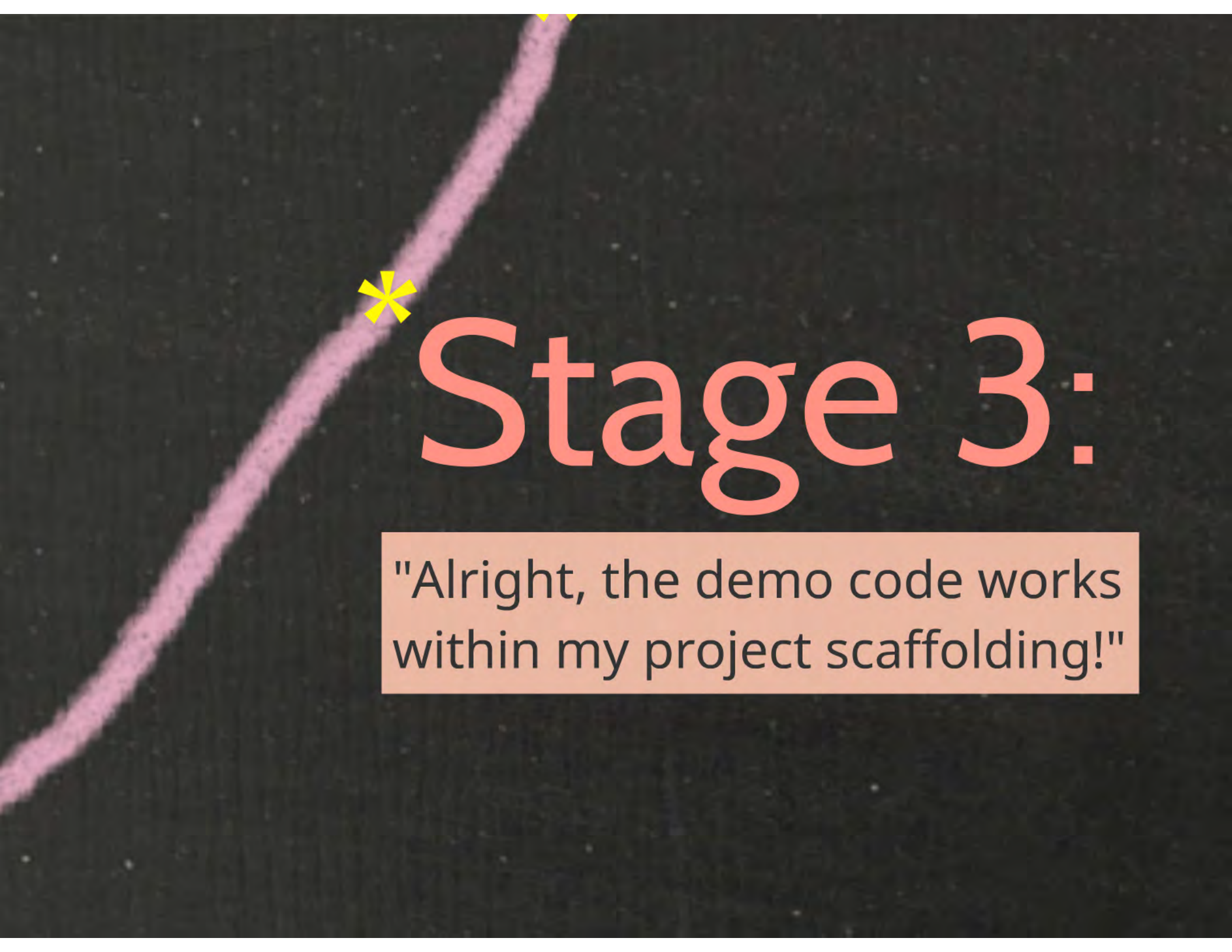
Reason I ask: when troubleshooting performance issues, I commonly encounter a pattern that can be illustrated with the following diagram of stages:

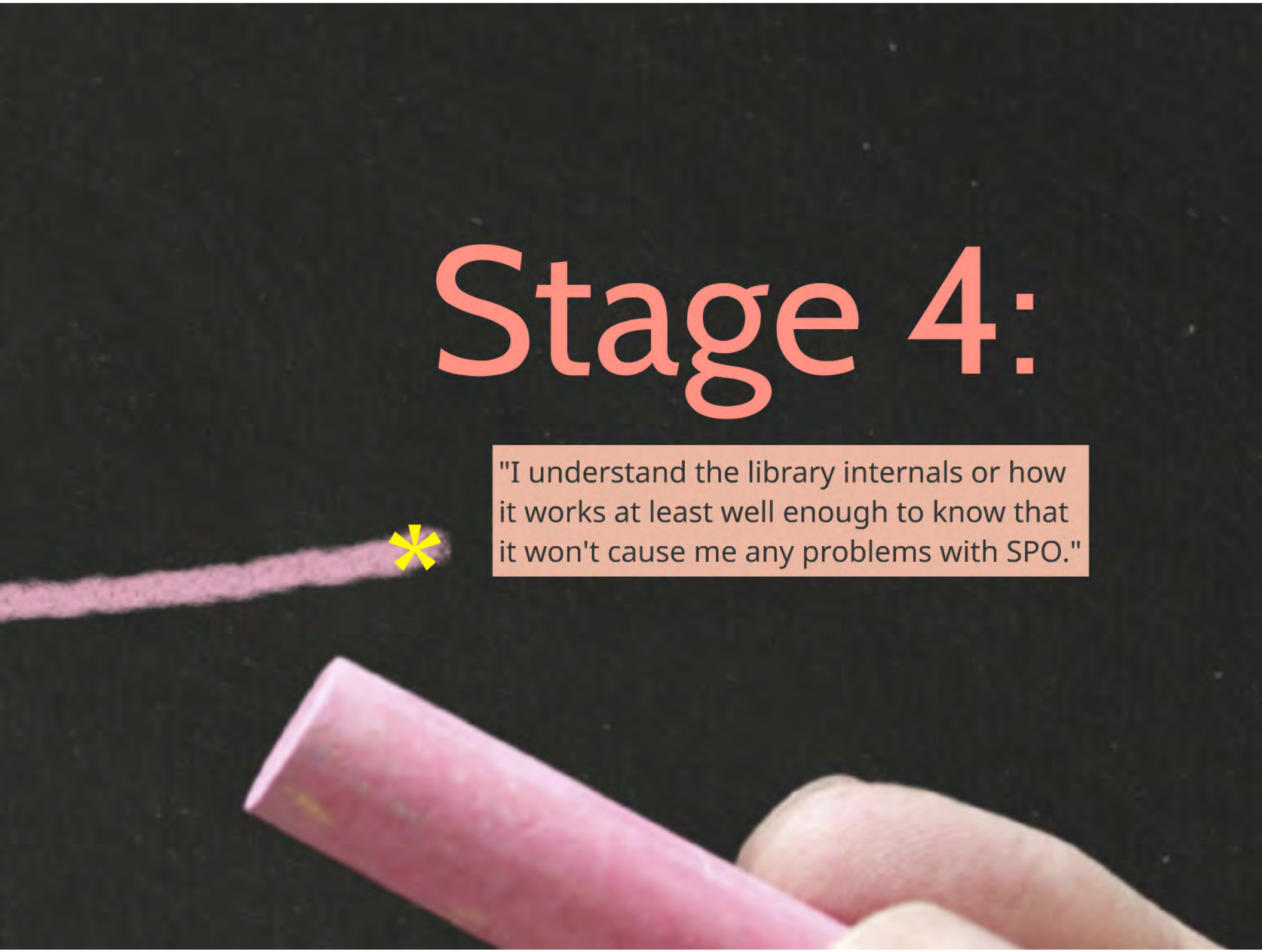


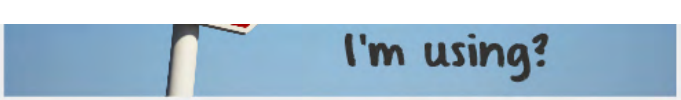
be illustrated with the following diagram of stages:




"Alright,
within m
*Stage 2:
"Hey, there's a JavaScript library for this.
I wonder if it'll work for my project?"
*Stage 1:
"I have a problem to solve. I wonder if
anyone has written this code before?"


Stage 3:
"Alright, the demo code works within my project scaffolding!"


Stage 4:
"I understand the library internals or how it works at least well enough to know that it won't cause me any problems with SPO."
*



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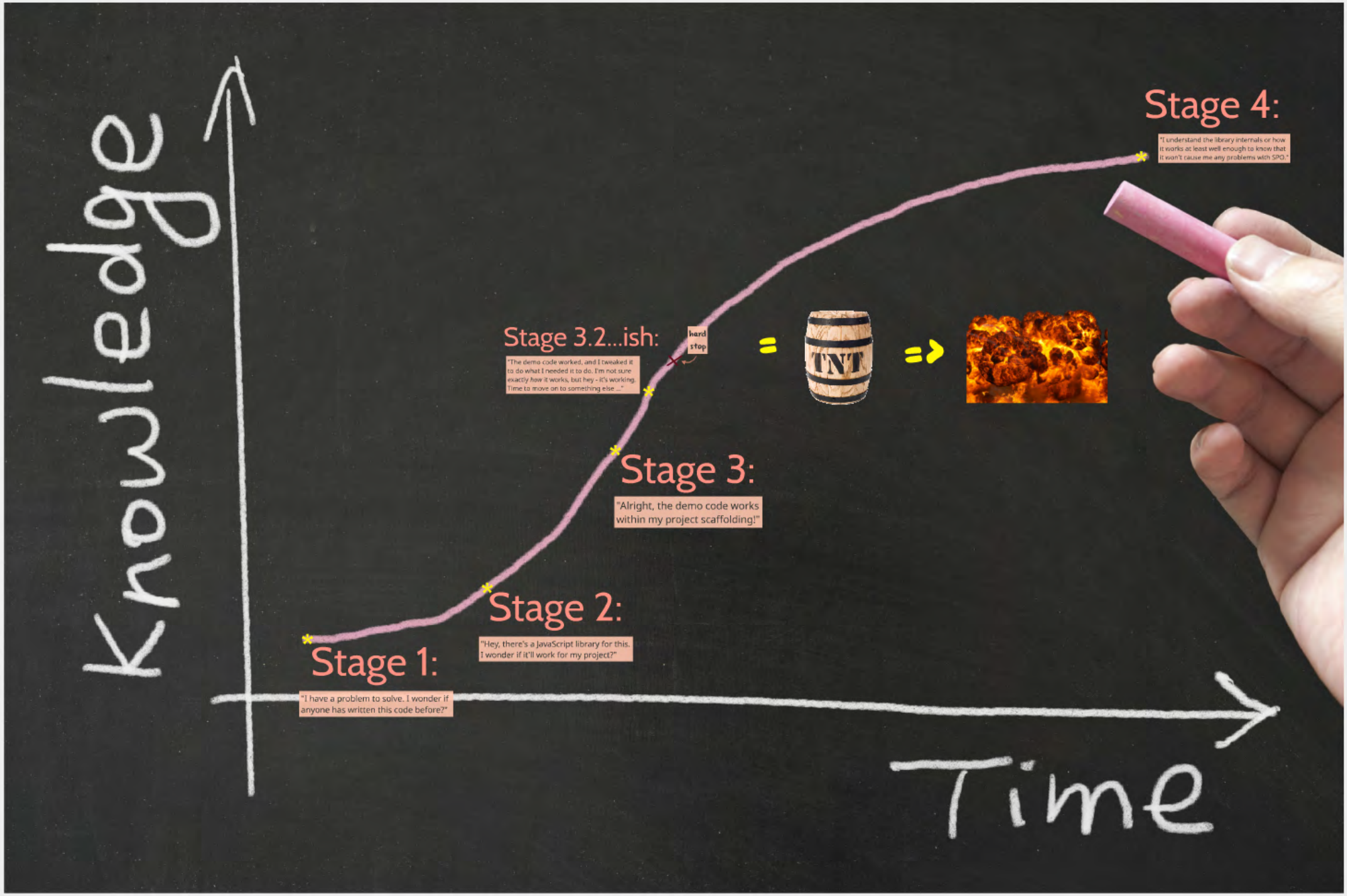
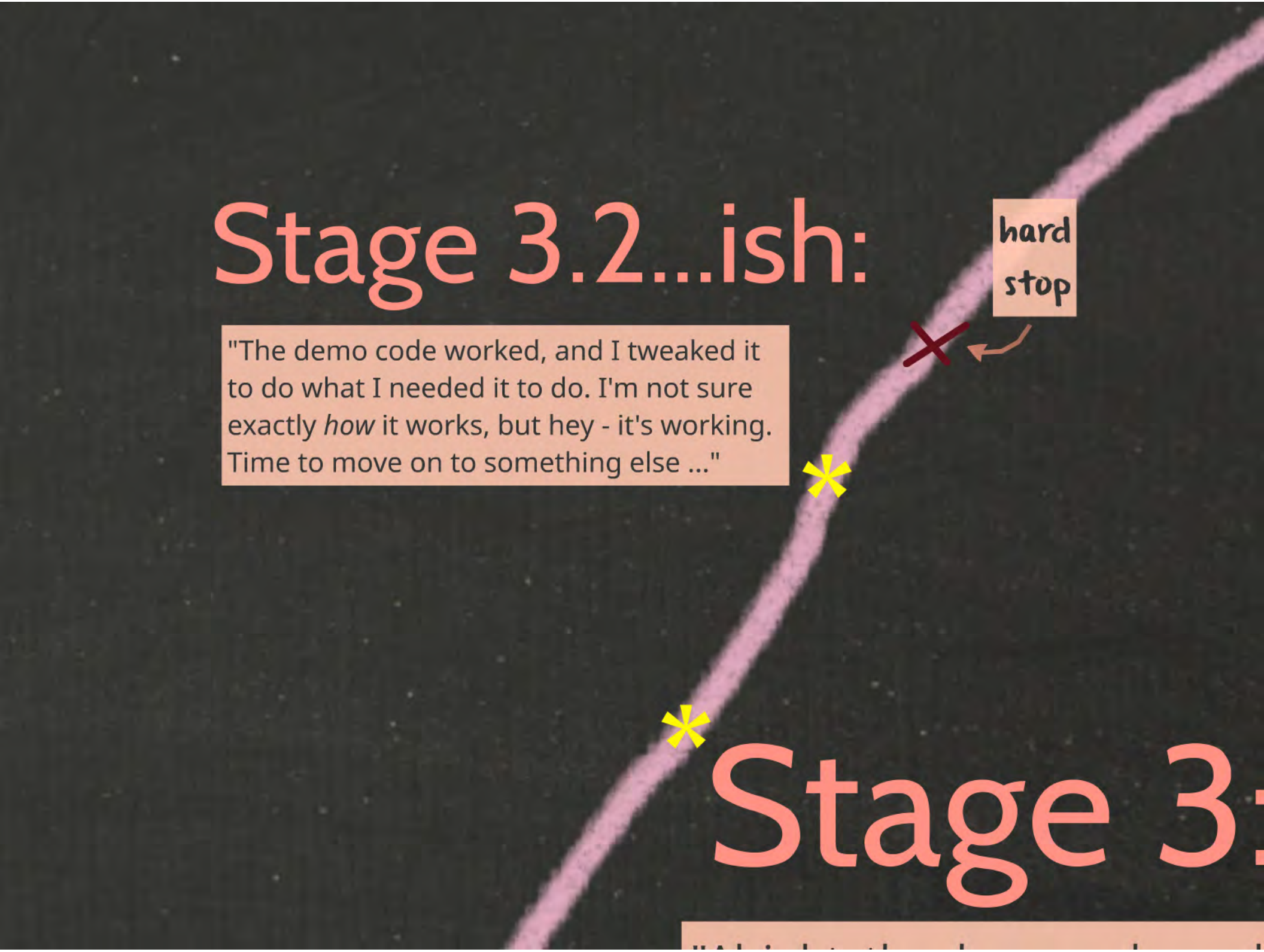
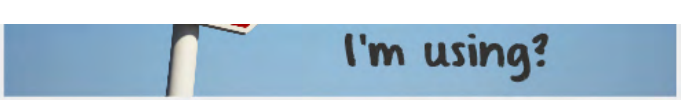



Stage 3.2...ish:
hard stop
"The demo code worked, and I tweaked it to do what I needed it to do. I'm not sure exactly *how* it works, but hey - it's working. Time to move on to something else ..."
Stage 3:



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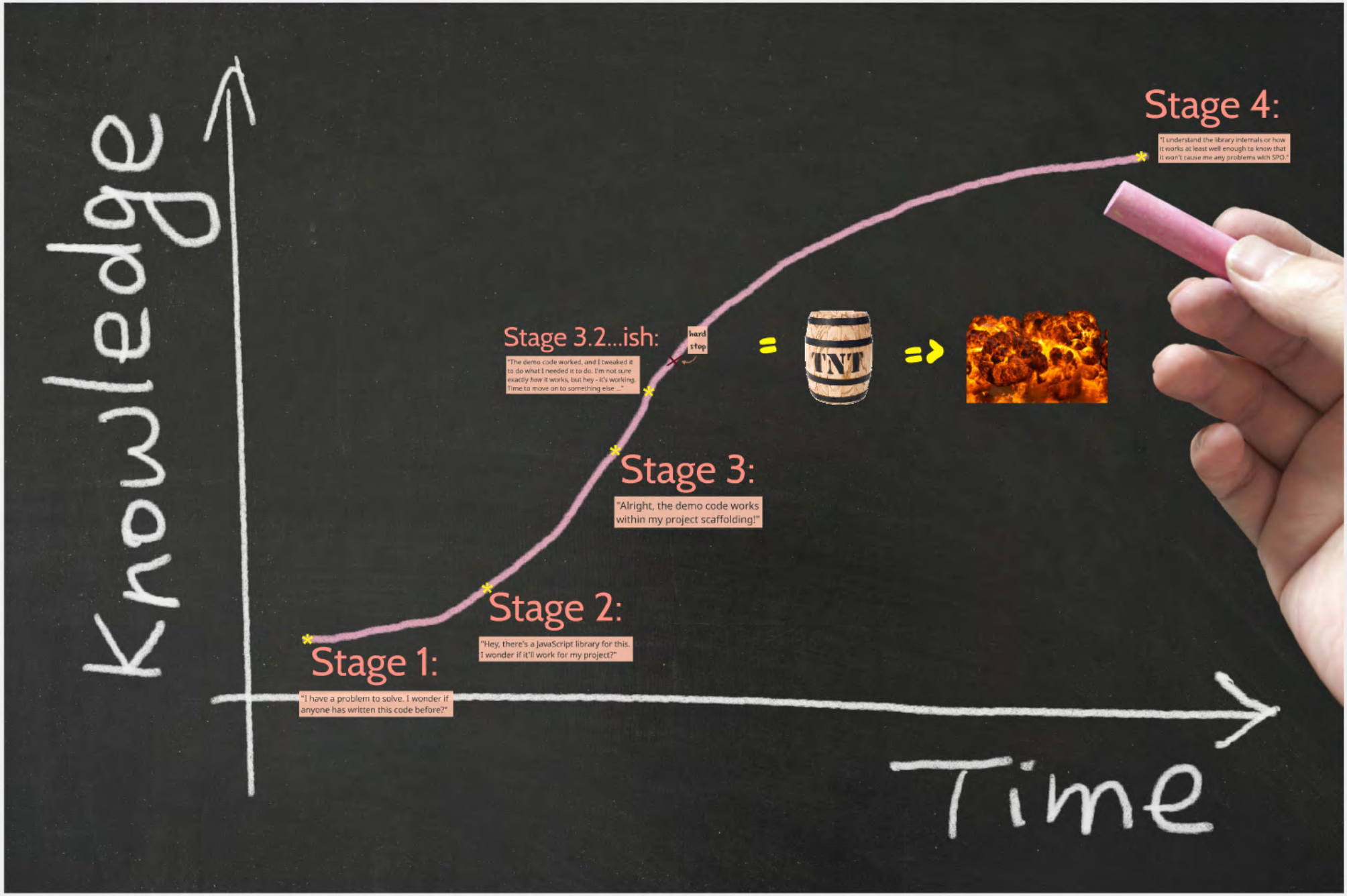

How many of you

How many of you know who this man is?

Chances are at least one or two of you have used code that he has created to get things done in your client-side development projects ...

Before CSOM/JSOM and REST
Marc's library simplified acces
for developers everywhere. It

Marc D. Anderson

- **creator of SPServices**
- master of client-side development and associated techniques

Before CSOM/JSOM and REST APIs - and before WCF SVC endpoints - Marc's library simplified access to the older ASMX web service endpoints for developers everywhere. It's still used heavily today.

So, getting back to "know your code/libraries" and how they work ...

As Marc will tell you, SPServices works just

So, getting back to "know your code/libraries" and how they work ...

As Marc will tell you, SPServices works just fine with SharePoint Online. But even Marc will tell you that you probably shouldn't use all of SPServices' methods when accessing SPO.

```
1  //Pre-populate all "Contact" fields with current user
2  var thisUserName = $().SPServices.SPGetCurrentUser({
3      fieldName: "Title",
4      debug: false
5  });
6  $().SPServices.SPFindPeoplePicker({
7      peoplePickerDisplayName: "Contact",
8      valueToSet: thisUserName,
9      checkNames: true
10 });
11 $().SPServices.SPFindPeoplePicker({
12     peoplePickerDisplayName: "Author/Contact",
13     valueToSet: thisUserName,
14     checkNames: true
15 });
16 $().SPServices.SPFindPeoplePicker({
17     peoplePickerDisplayName: "Organizer/Contact",
18     valueToSet: thisUserName,
19     checkNames: true
20 });
```

Consider this code.

It works just fine and does exactly what the comment indicates.

But it has a big problem.

anyone ever used the SPServices.SPGetCurrentUser() met

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4       debug: false
5   });
6   $().SPServices.SPFindPeoplePicker({
7       peoplePickerDisplayName: "Contact",
8       valueToSet: thisUserName,
9       checkNames: true
10  });
11  $().SPServices.SPFindPeoplePicker({
12      peoplePickerDisplayName: "Author/Contact",
13      valueToSet: thisUserName,
14      checkNames: true
15  });
16  $().SPServices.SPFindPeoplePicker({
17      peoplePickerDisplayName: "Organizer/Contact",
18      valueToSet: thisUserName,
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```

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Has anyone ever used the SPServices.SPGetCurrentUser() method?

Switching over to REST-based calls

WANTED: MARC ANDERSON

- Under the hood, SPGetCurrentUser() is generating an additional call to /_layouts/userdisp.aspx to “scrape” the contents of the page that is returned.
- If you (innocently) use SPGetCurrentUser() in your JavaScript files (especially multiple times in the context of a single page), you're creating all sorts of additional load on SPO and delaying the final results of your executing scripts.

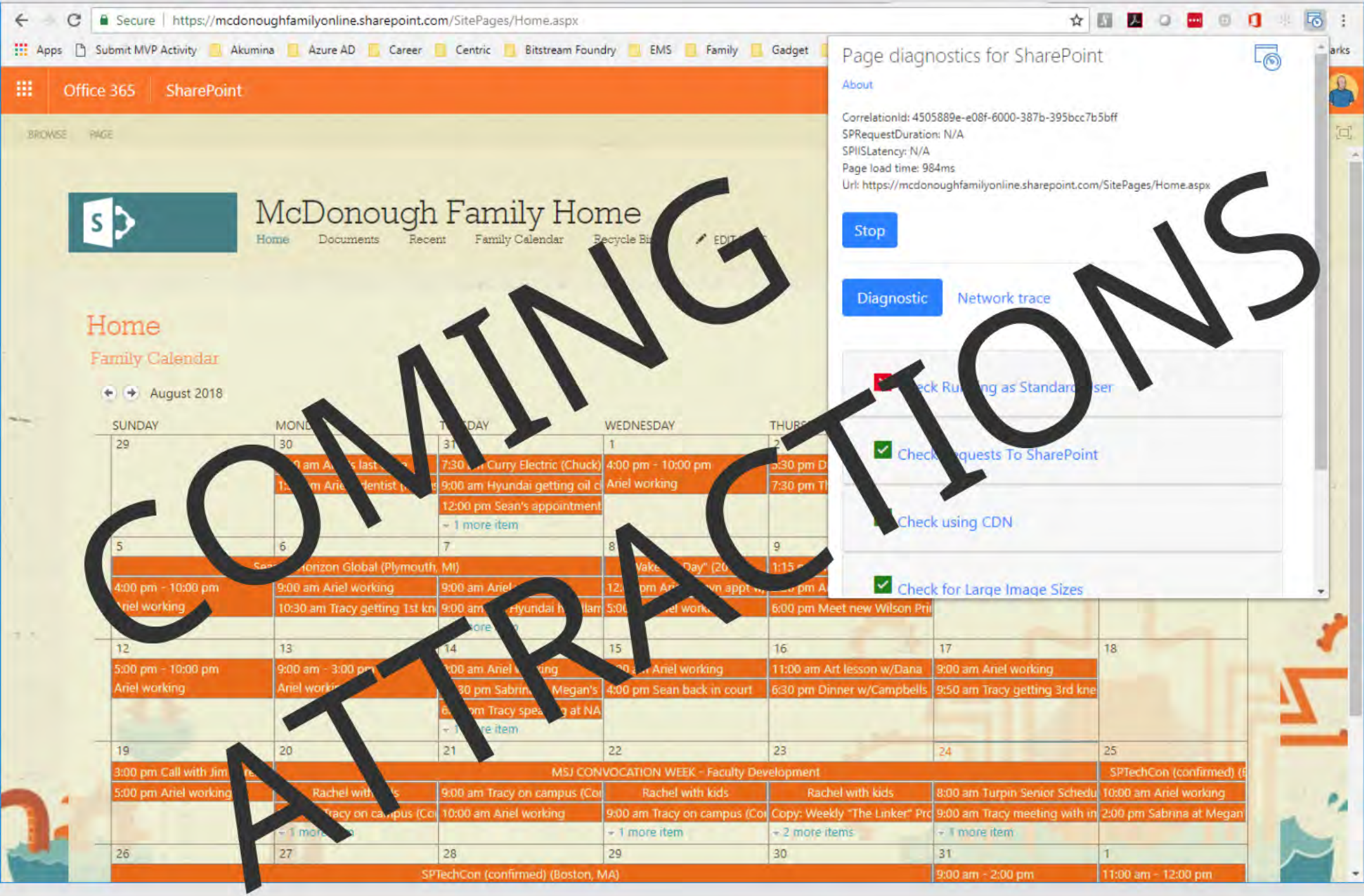
Switching over to REST-based calls to get current user information can dramatically reduce execution time.

We had a script where SPGetCurrentUser() was being called several times. The results from swapping-in REST-based calls for the SPGetCurrentUser() calls:

I also performed some basic tests to capture the speed differences. I performed each test 10 times and here are the results:

* Without the fix or browser caching - avg. 14.47 seconds
* With the fix without browser caching - avg. 7.17 seconds
* With the fix and browser caching - avg. 5.84 seconds


You are now in the cloud!
Let's compare:
COMING ATTRACTIONS
Path to Better Performance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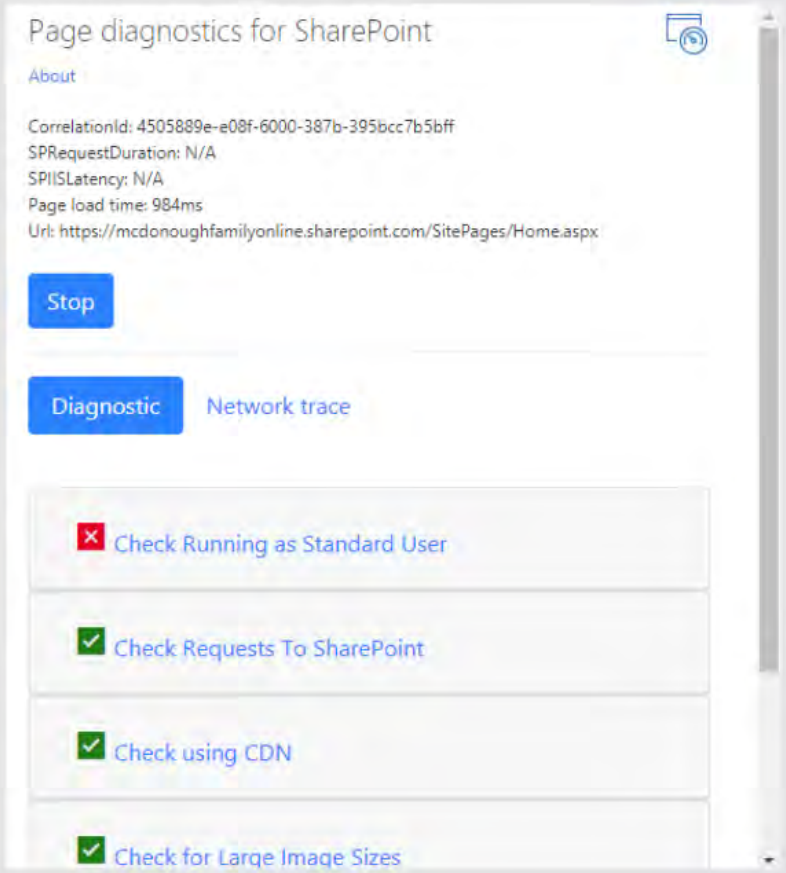
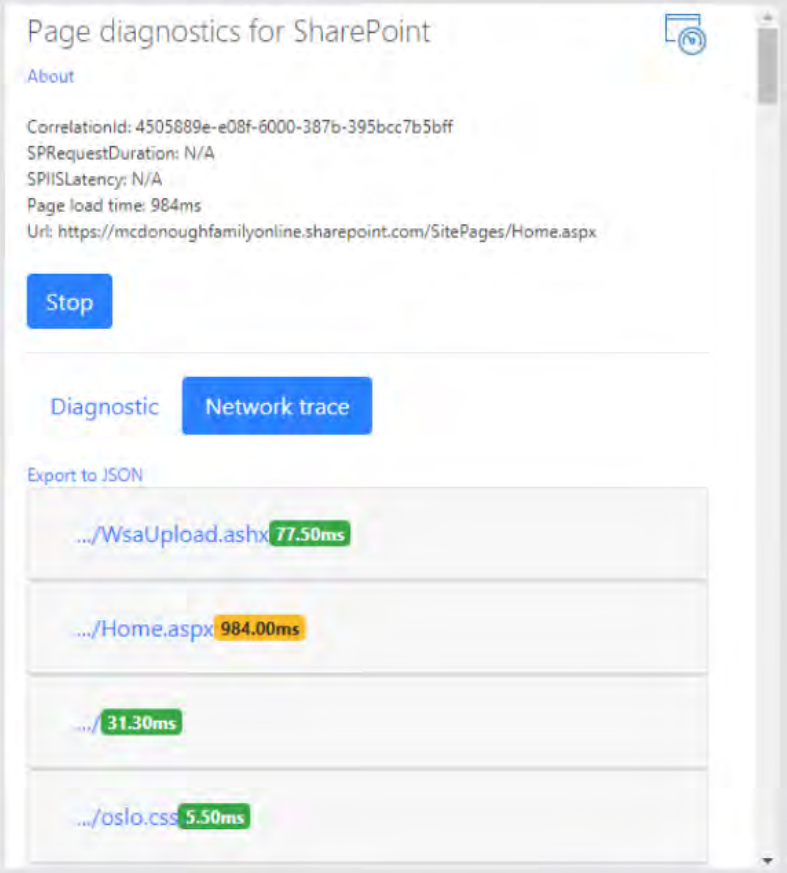
Office 365 SharePoint
BROWSE PAGE
McDonough Family Home
Home Documents Recent Family Calendar Recycle Bin EDIT
Home
Family Calendar
August 2018
SUNDAY MONDAY TUESDAY WEDNESDAY THURSDAY
Page diagnostics for SharePoint
About
CorrelationId: 4505889e-e08f-6000-387b-395bcc7b5bff
SPRequestDuration: N/A
SPIISLatency: N/A
Page load time: 984ms
Url: https://mcdonoughfamilyonline.sharepoint.com/SitePages/Home.aspx
Stop
Diagnostic
Network trace
Check using CDN
Check for Large Image Sizes
COMING ATTRACTIONS





Big thanks to Scott Stewart and his team at Microsoft!


You are now in the cloud!
Let's compare:
COMING ATTRACTIONS
Path to Better Performance

The Quick Summary

- Don't treat SPO like your on-premises SharePoint farm. The two operate differently.
- Server-based caching isn't your friend (generally speaking) in SPO.
- Your browser can be your best friend when trying to troubleshoot SPO performance issues.
- Know the code you implement - or at least profile it before release.

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Thank you

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