Designing for Optimal Performance in SharePoint Online

@spmcdonough on Twitter (for heckling purposes)

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bitstream FOUNDRY

MVP Microsoft Most Valuable Professional

Our Agenda

- SharePoint Online Diagnostics and Tools
- Design and Development Guidance
- Samples and Examples
- Questions and Answers Throughout!
- References

But first ...


An important note

This is Microsoft (Office) 365

hanging and updating it"

Please don

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

We don't have time to cover the details of all of the networking, routing, and ways data can get into and out of SharePoint Online in this session ...

but please make a note of this:

If you've spent a lot of time in focus

We don't have time to cover the details of all of the networking, routing, and ways data can get into and out of SharePoint Online in this session ...

but please make a note of this:

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

So your users have registered complaints and *it feels like* you've got performance issues

So your users have registered complaints and *it feels like* you've got performance issues

How do you prove it objectively?

Before you do too much damage, put the computers and equipment down and take a deep breath ...

objectively?

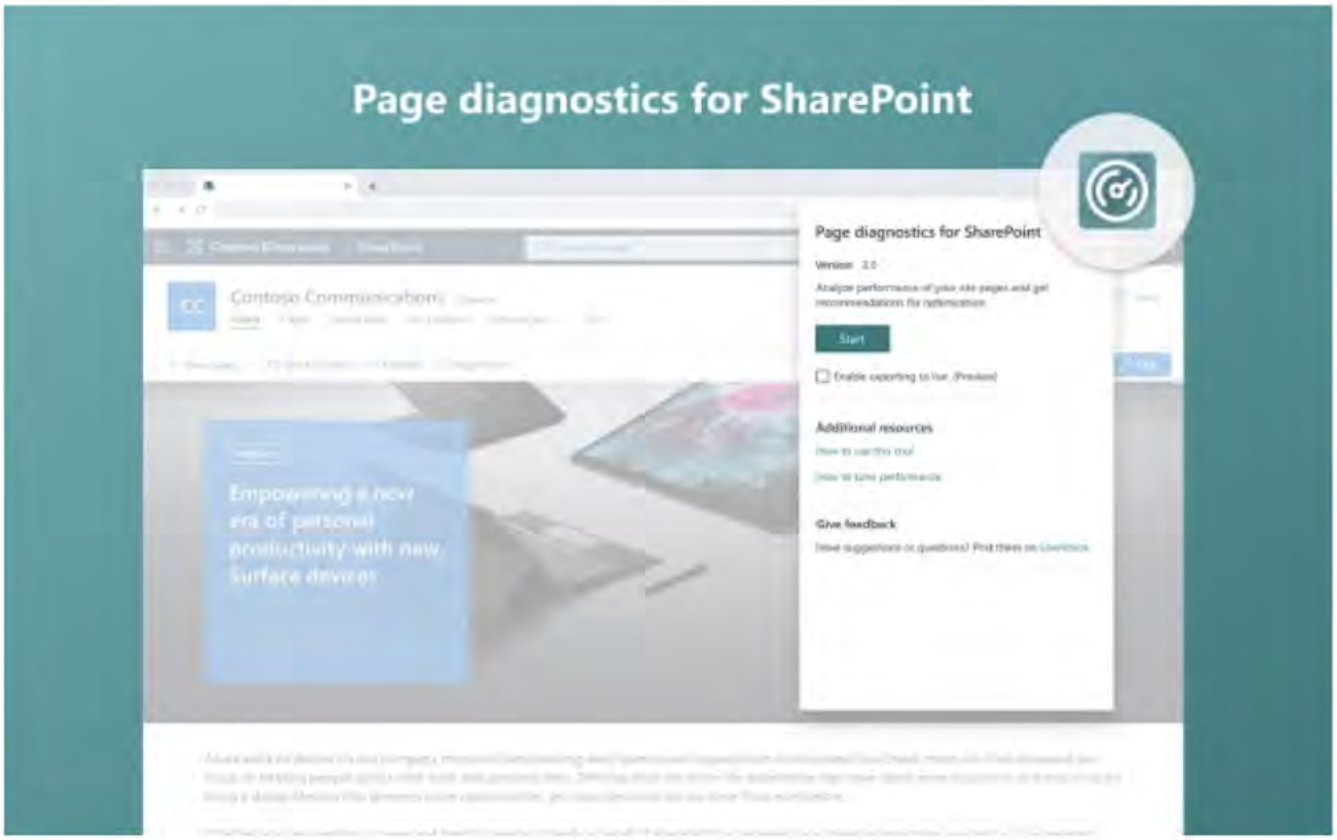
Allow me to introduce your primary diagnostic tool

You might have heard of

introduce your primary diagnostic tool

You might have heard of it, but maybe not ...

Allow me to introduce version 2.0 of the Page Diagnostics for SharePoint browser extension



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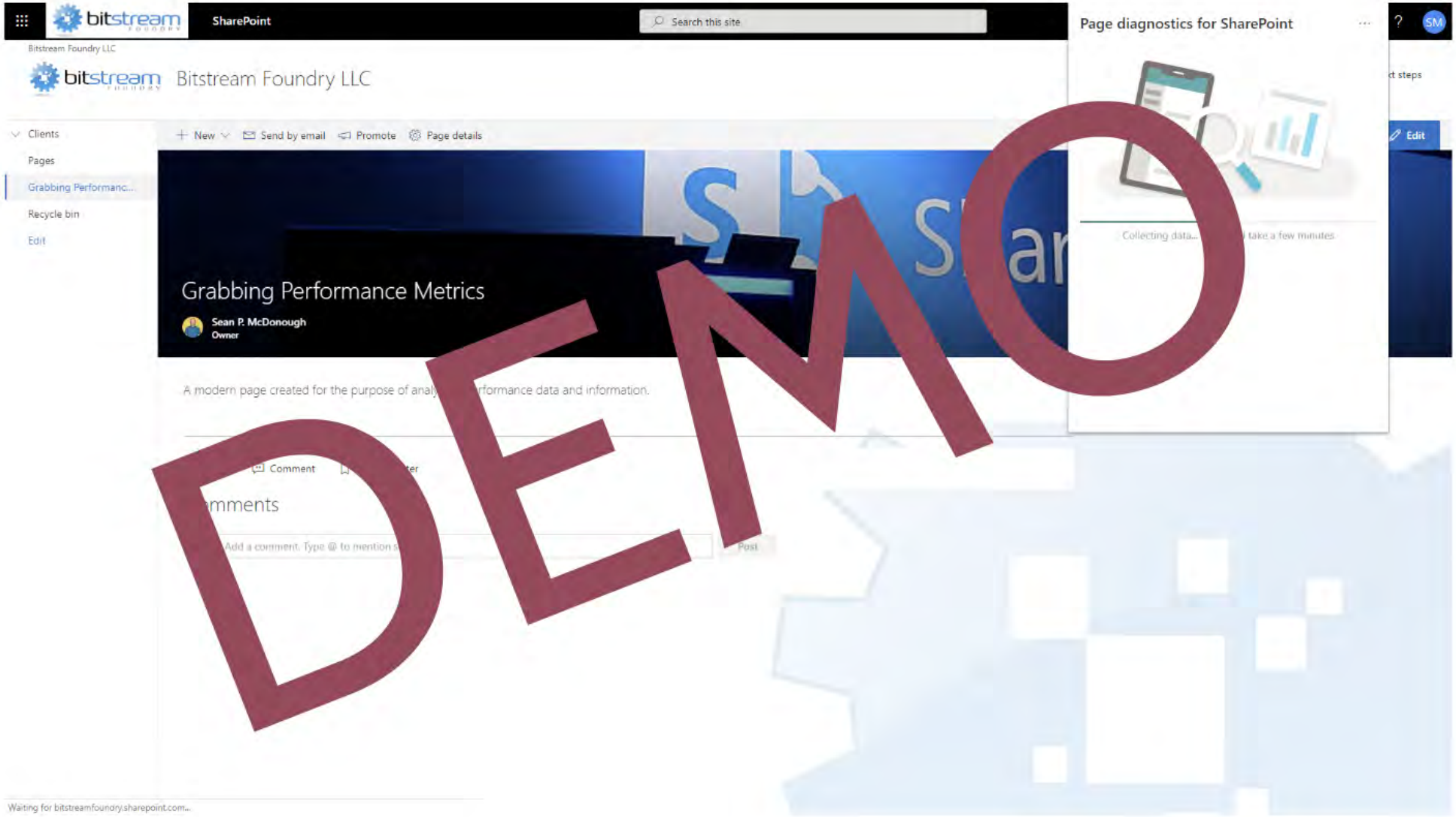
v1.0 put a stake in the ground, but we get a much more robust version with version 2.0


bitstream
SharePoint
Search this site
Bitstream Foundry LLC
bitstream Bitstream Foundry LLC
Clients
Pages
Grabbing Performanc...
Recycle bin
Edit
New
Send by email
Promote
Page details
Edit
Grabbing Performance Metrics
Sean P. McDonough
Owner
A modern page created for the purpose of anal rformance data and information.
Comment
mments
Add a comment. Type @ to mention
Post
Page diagnostics for SharePoint
Collecting data...
take a few minutes
DEMO
Waiting for bitstreamfoundry.sharepoint.com...

* potential routing issues (as in "number of hops")
* slow DNS lookups, proxy authentication, etc.

Demo Takeaways

HTTP Response Headers

waiting on server - generally zero or near zero

time spent processing on server (in ms) - ideally low

- SPIisLatency
- SPRequestDuration
- **X-SharePointHealthScore**

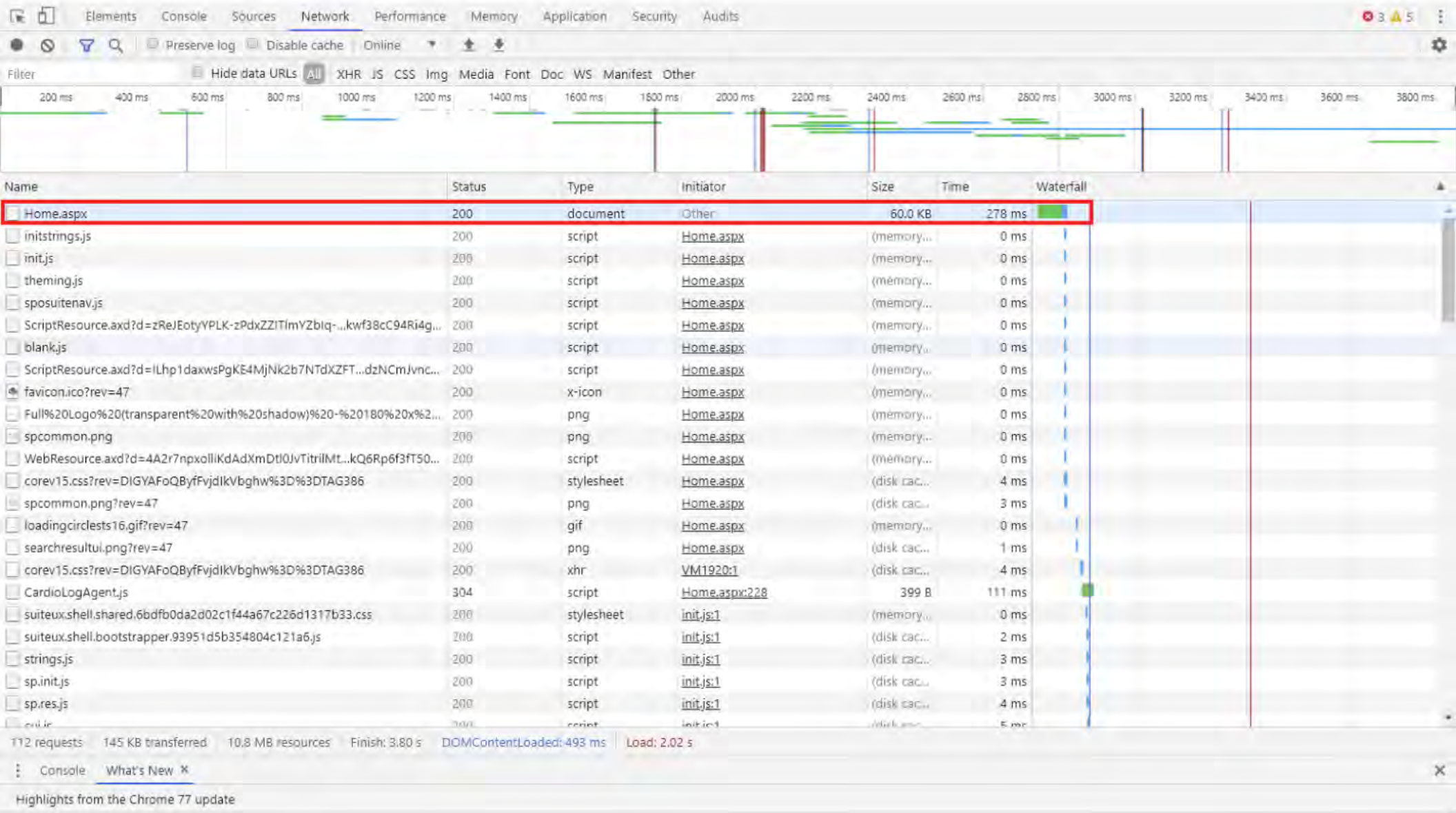
0 to 10 (you want 0)

Don't see the headers?

Don't panic!

The Page Diagnostics Tool reports data on classic publishing pages and modern SharePoint pages. Other tools can get you numbers for pages, too.

HTTP Response Headers


Elements
Console
Sources
Network
Performance
Memory
Application
Security
Audits
Preserve log
Disable cache
Online
Filter
Hide data URLs
All
XHR
JS
CSS
Img
Media
Font
Doc
WS
Manifest
Other
200 ms
400 ms
600 ms
800 ms
1000 ms
1200 ms
1400 ms
1600 ms
1800 ms
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2200 ms
2400 ms
2600 ms
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3200 ms
3400 ms
3600 ms
3800 ms
Name
Status
Type
Initiator
Size
Time
Waterfall
Home.aspx 200 document Other 60.0 KB 278 ms
initstrings.js 200 script Home.aspx (memory... 0 ms
init.js 200 script Home.aspx (memory... 0 ms
theming.js 200 script Home.aspx (memory... 0 ms
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blank.js 200 script Home.aspx (memory... 0 ms
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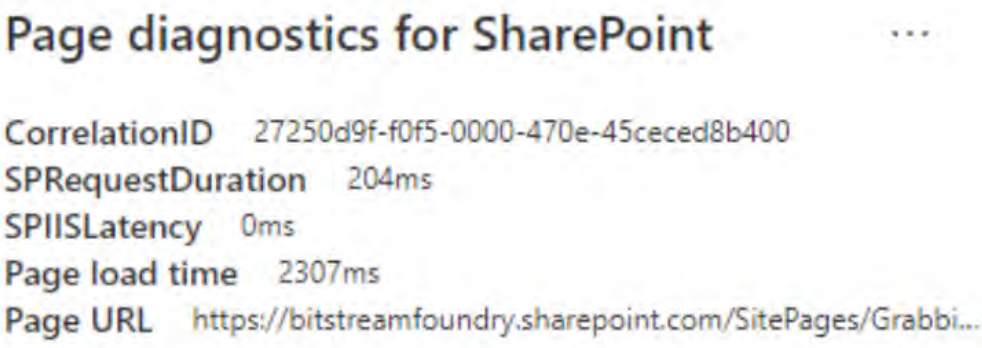
favicon.ico?rev=47 200 x-icon Home.aspx (memory... 0 ms
Full%20Logo%20(transparent%20with%20shadow)%20-%20180%20x%2... 200 png Home.aspx (memory... 0 ms
spcommon.png 200 png Home.aspx (memory... 0 ms
WebResource.axd?d=4A2r7npxolliKdAdXmDtl0JvTitrilMt...kQ6Rp6f3fT50... 200 script Home.aspx (memory... 0 ms
corev15.css?rev=DIGYAFoQByfFvjdIkVbghw%3D%3DTAG386 200 stylesheet Home.aspx (disk cac... 4 ms
spcommon.png?rev=47 200 png Home.aspx (disk cac... 3 ms
loadingcirclests16.gif?rev=47 200 gif Home.aspx (memory... 0 ms
searchresultui.png?rev=47 200 png Home.aspx (disk cac... 1 ms
corev15.css?rev=DIGYAFoQByfFvjdIkVbghw%3D%3DTAG386 200 xhr VM1920:1 (disk cac... 4 ms
CardioLogAgent.js 304 script Home.aspx:228 399 B 111 ms
suiteux.shell.shared.6bdfb0da2d02c1f44a67c226d1317b33.css 200 stylesheet init.js:1 (memory... 0 ms
suiteux.shell.bootstrapper.93951d5b354804c121a6.js 200 script init.js:1 (disk cac... 2 ms
strings.js 200 script init.js:1 (disk cac... 3 ms
sp.init.js 200 script init.js:1 (disk cac... 3 ms
sp.res.js 200 script init.js:1 (disk cac... 4 ms
112 requests
145 KB transferred
10.8 MB resources
Finish: 3.80 s
DOMContentLoaded: 493 ms
Load: 2.02 s
Console
What's New
Highlights from the Chrome 77 update

Roughly approximating for a page ...



Page load time - (SPRequestDuration + SPIisLatency) = "time lost elsewhere"

* network latency
* potential routing issues (as in "number of hops")
* slow DNS lookups, proxy authentication, etc.

Demo Takeaways

HTTP Response	waiting on server - generally zero or	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 maybe your X-SharePointHealthScore is low,

but ...

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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?

(if you're into that sort of thing)

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In all likelihood: blame the lousy* devs.

*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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- Compare processing and respon
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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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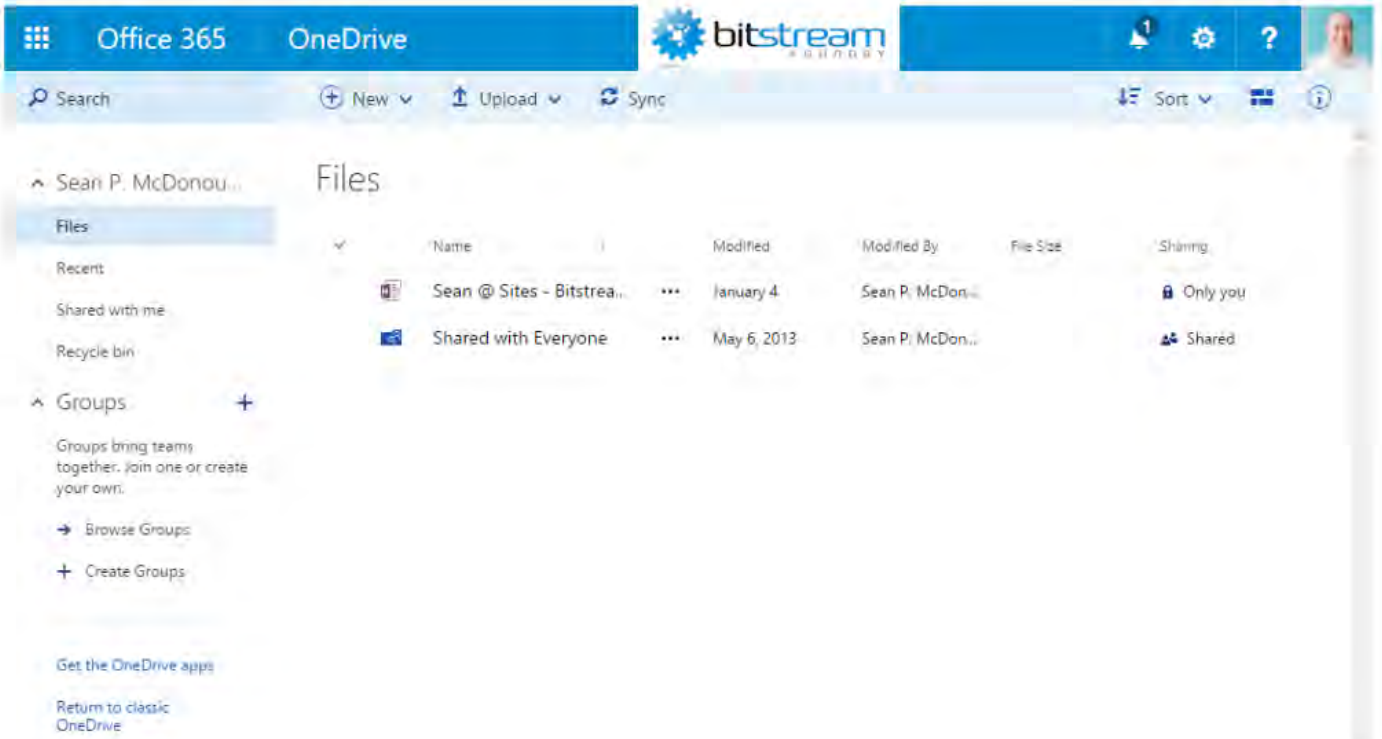
Don't believe me?

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."

u're probably thinking "What can I do

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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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As obvious as that sounds, I continually see

acknowledgement:

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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.

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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

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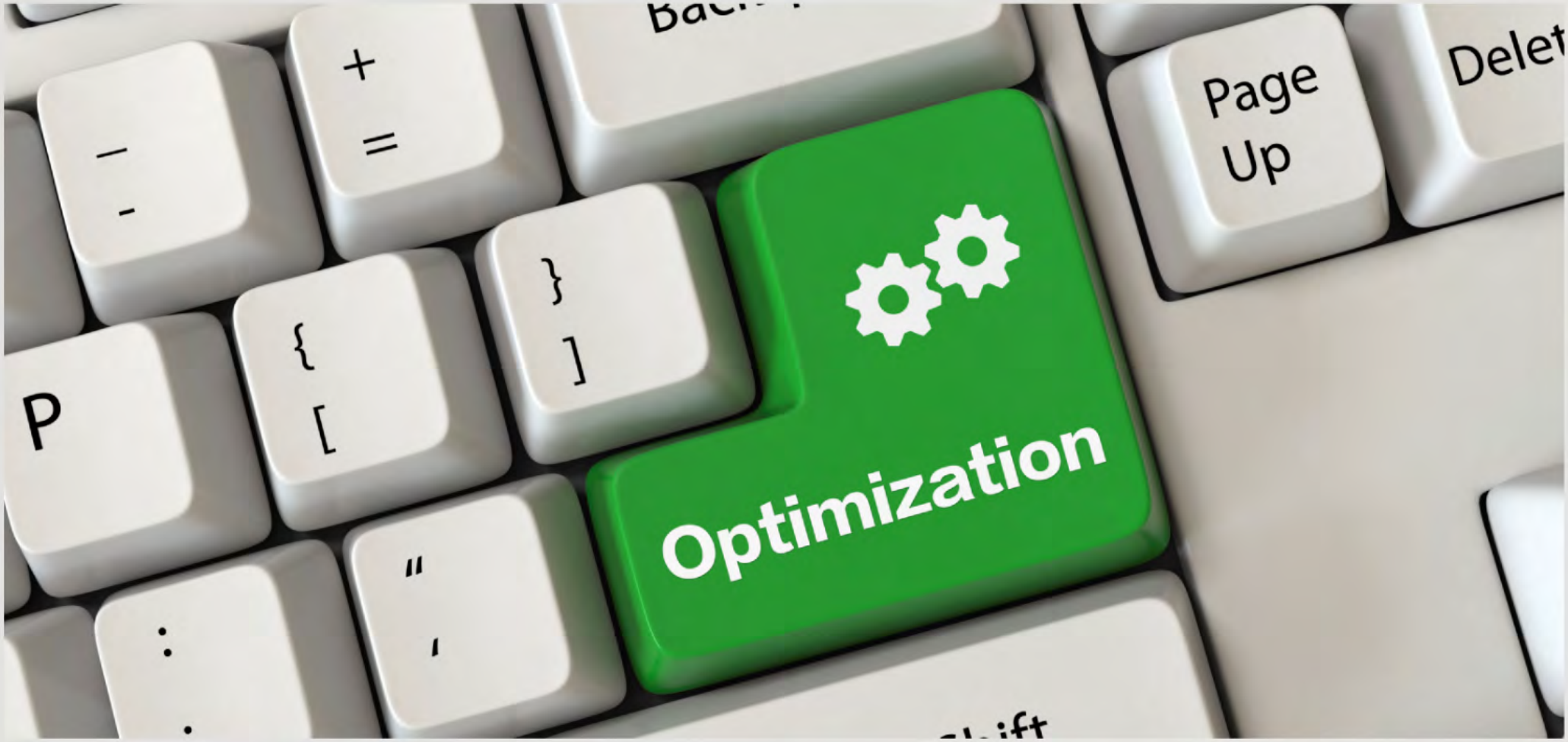
Too Many, Too Big

- 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.



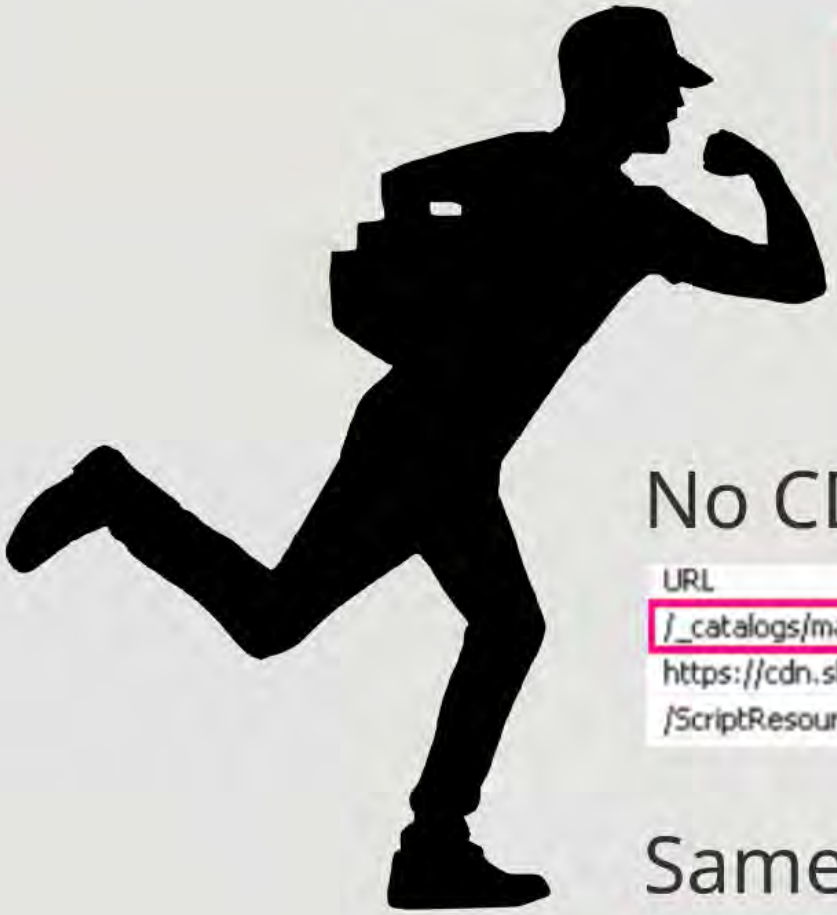
Consider one or more of the following:

- 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)

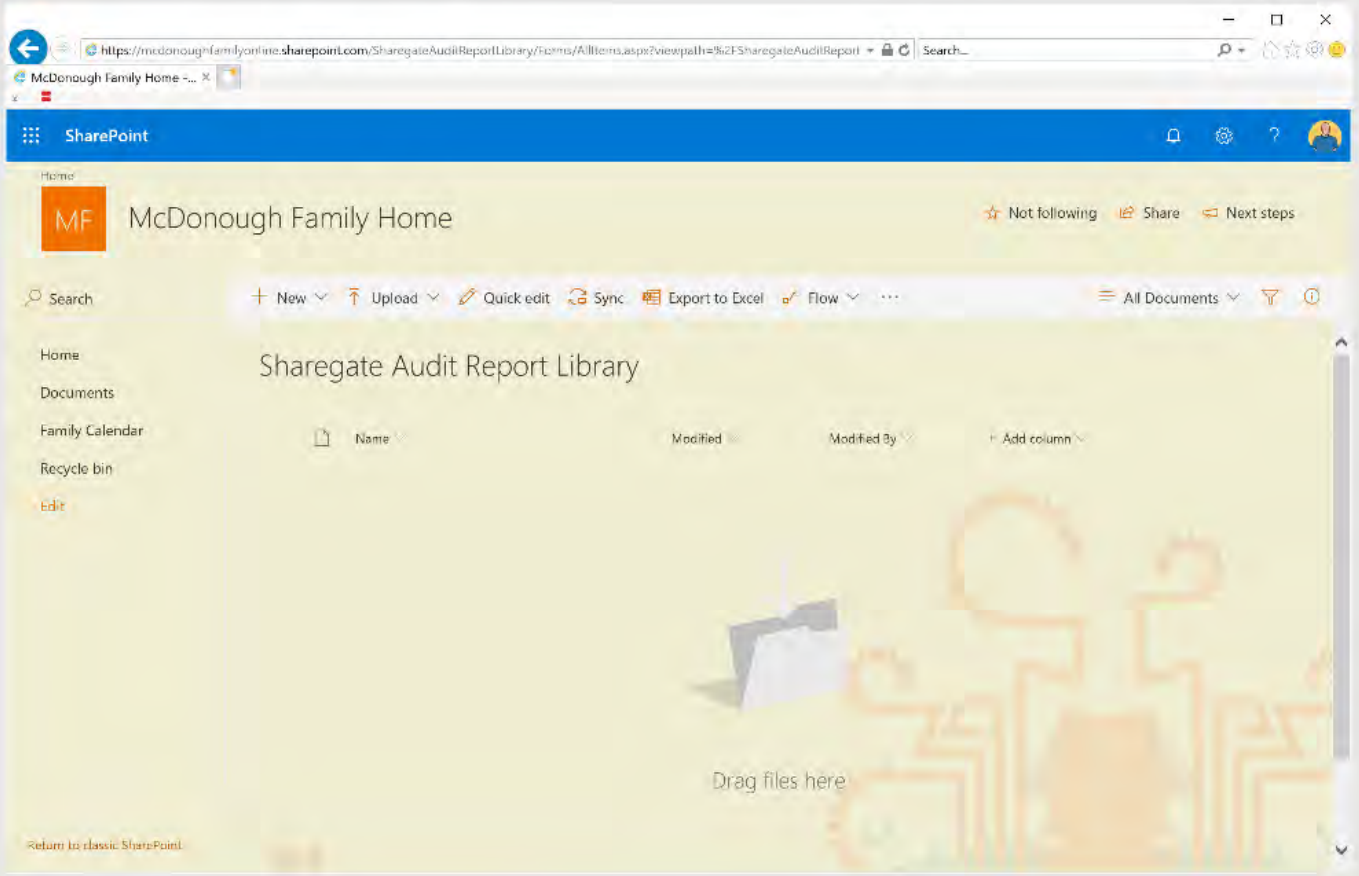
No CDN in use (i.e., SPO library direct)

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

Each page yields a series of resource requests



- Images
- JavaScript
- CSS
- Movies
- Audio
- …

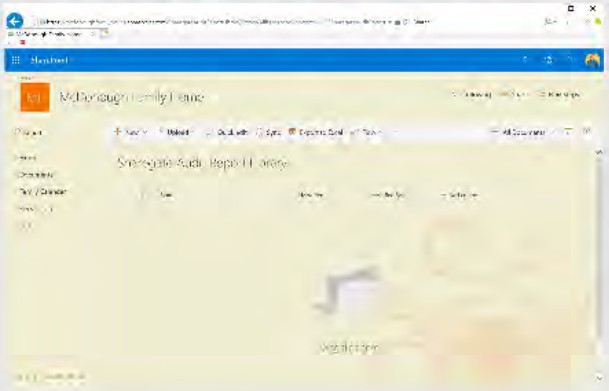
Limited number of concurrent connections/requests to fetch resources (images, JS, etc.)

- Typically six per URL/domain
- Defined in RFC2616

<= 6 at once

abc.com/res1.png
abc.com/res2.js
abc.com/res3.css
abc.com/res4.txt
abc.com/res5.jpg
abc.com/res6.gif

Each page yields a series of resource requests



- Images
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- Movies
- Audio
- ...

With a CDN (in a different domain), w

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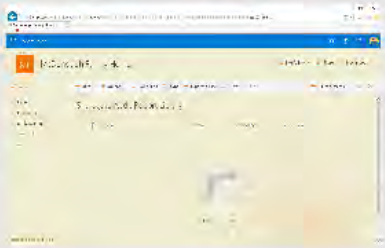


- Images
- JavaScript
- CSS
- Movies
- Audio
- ...

<= 6 at once

abc.com/res1.png
abc.com/res2.js
abc.com/res3.css
abc.com/res4.txt
abc.com/res5.jpg
abc.com/res6.gif

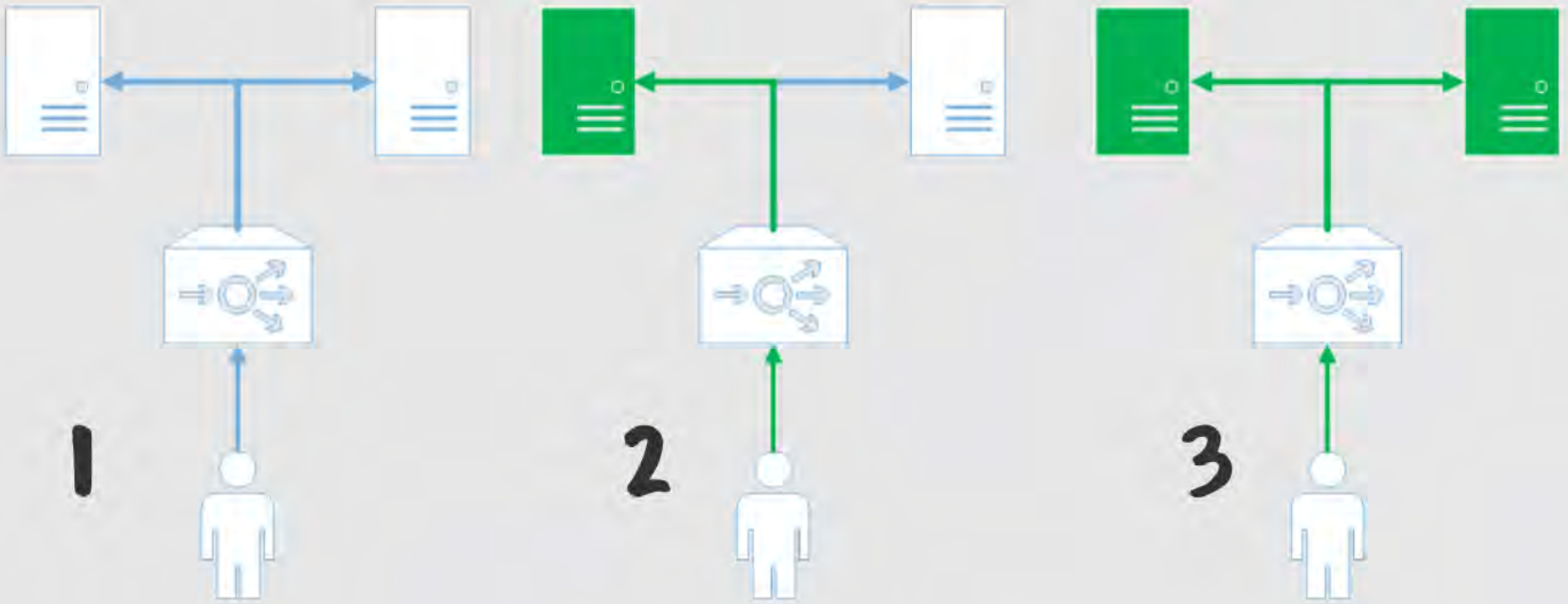
CDN.com/res7.css
CDN.com/res8.jpg
CDN.com/res9.js
CDN.com/res10.js
CDN.com/res11.jpg
CDN.com/res12.png

With a CDN (in a different domain), we can spin up six more concurrent requests to fully render more quickly

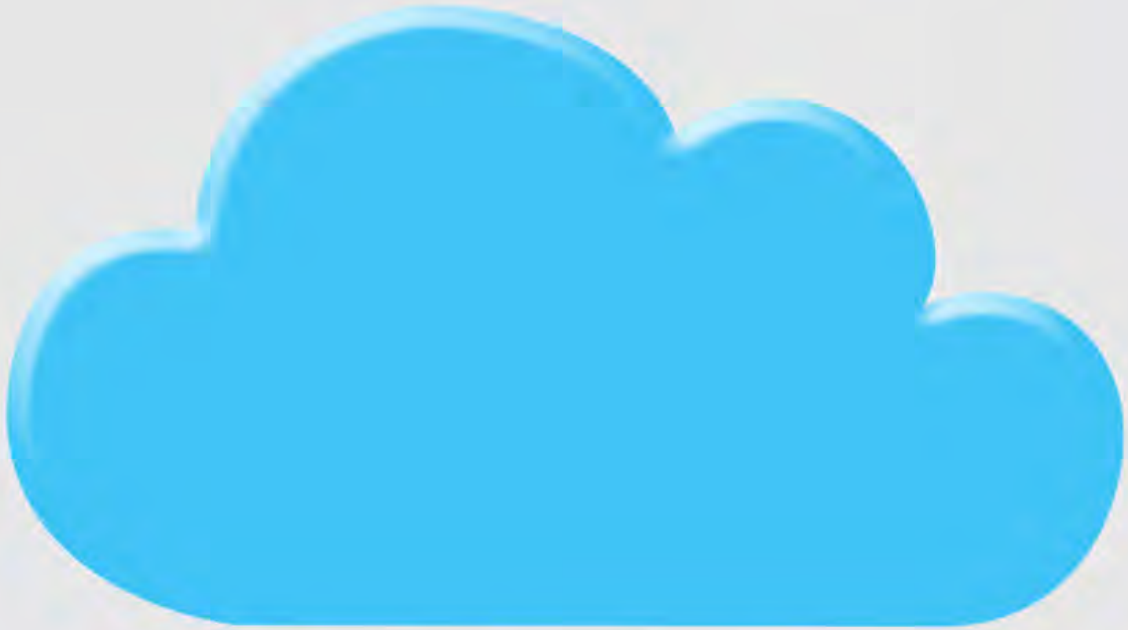

You are now in the cloud!
Let's compare:
COMING ATTRACTIONS
Path to Better Performance

Conventional wisdom says caching is good.

says caching is good.

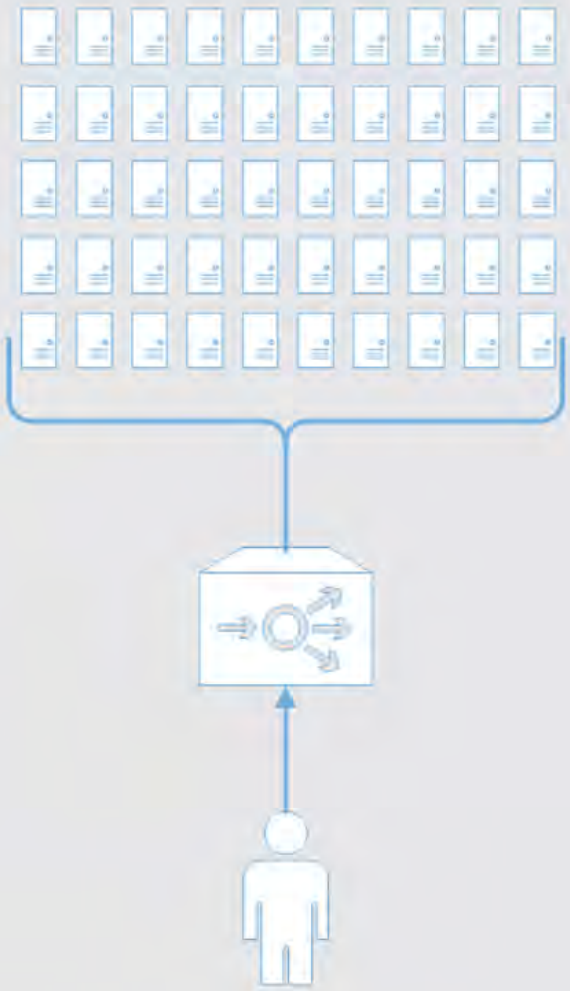


After just a few requests, the on-premises Object Cache can be "ready for action."



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

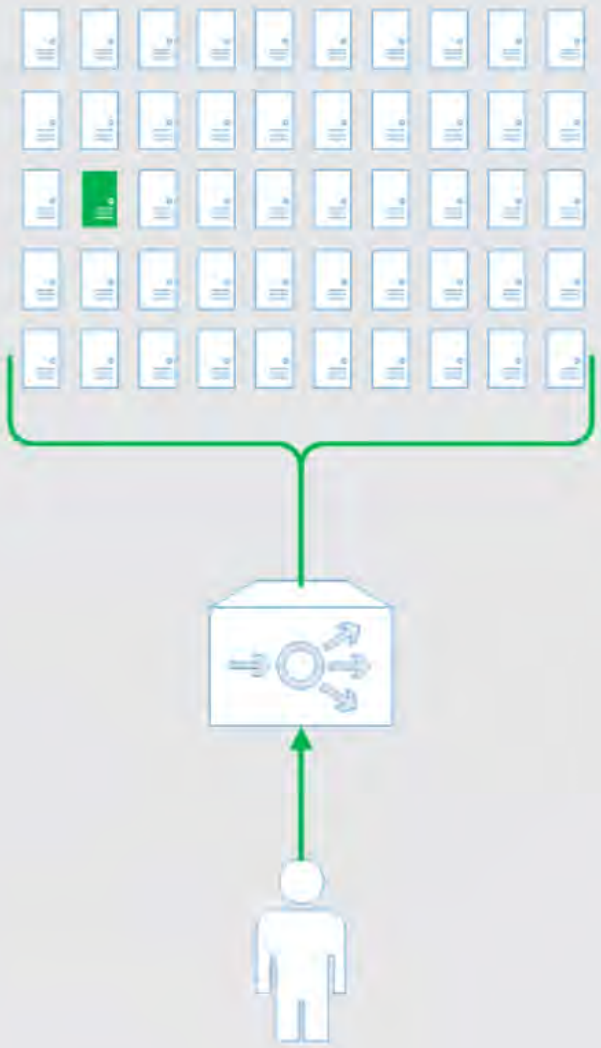
"differently" -
as in "not at all"



User's Initial Request

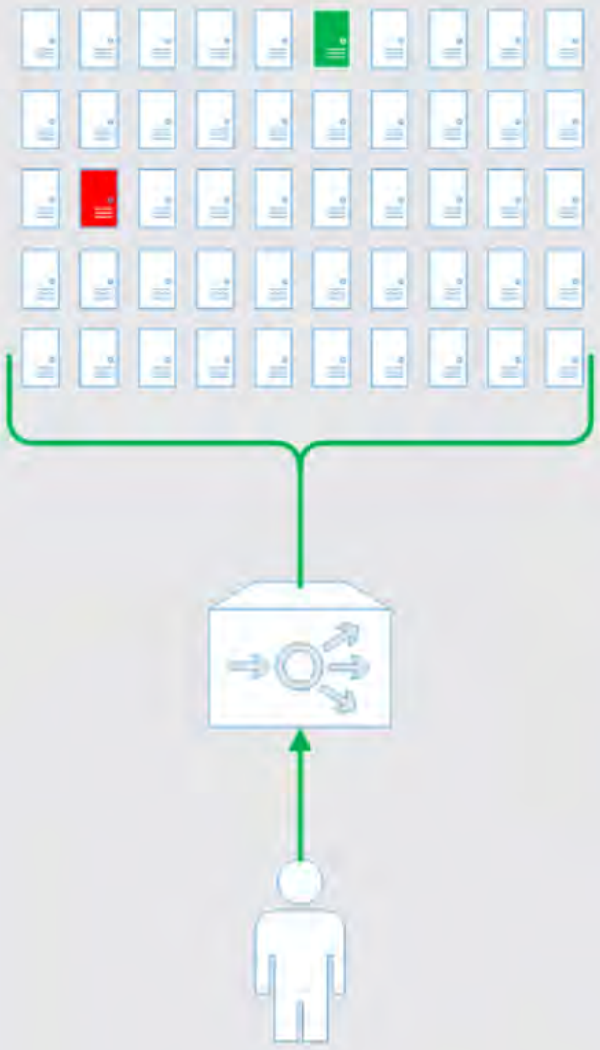
- First thing to note: the number of WFEs tends to be *much* higher in the cloud versus on-premises.

User's Second Request



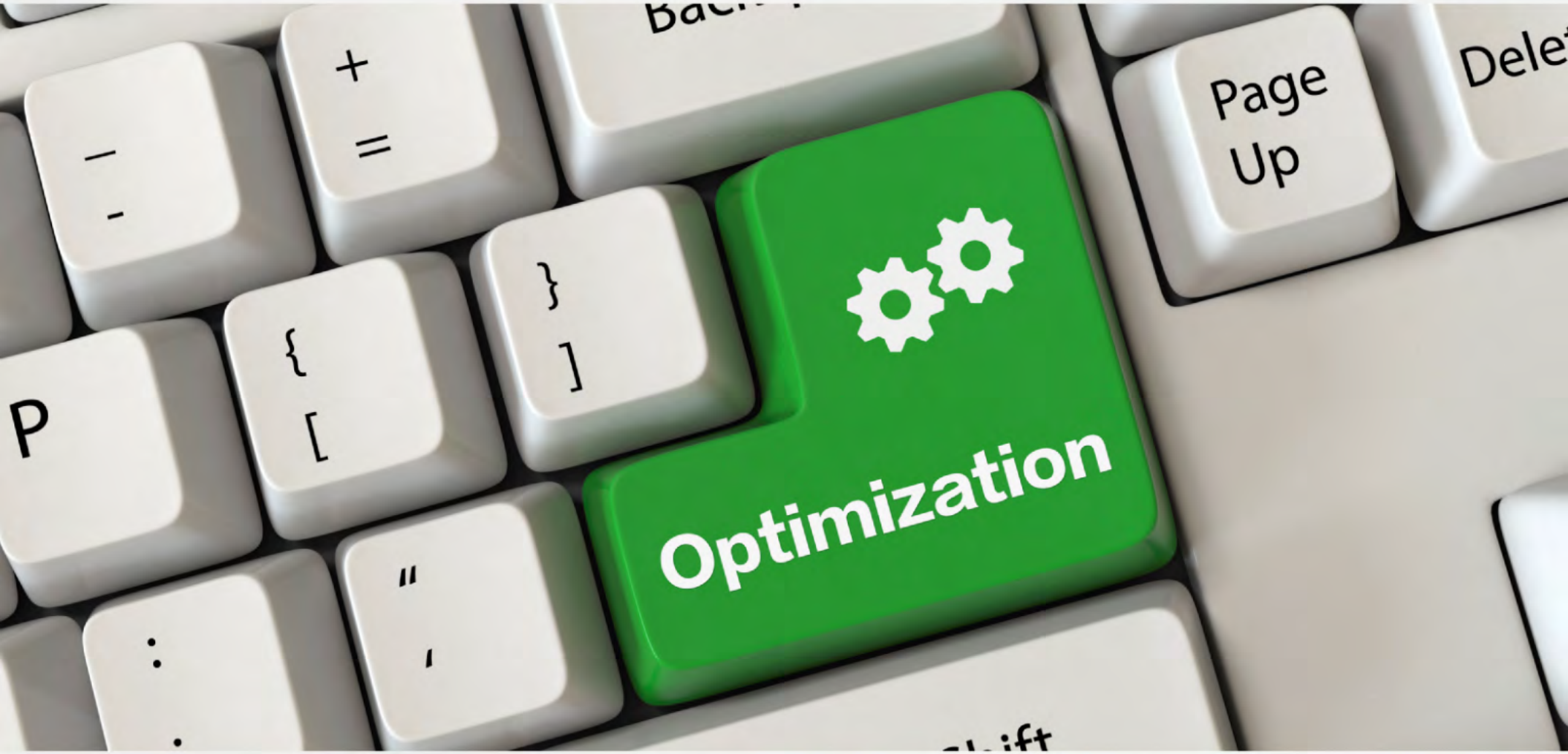
User's Second Request

- 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.

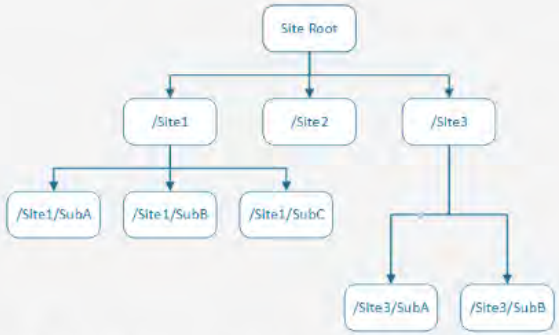
* These sitemaps are then stored in the Object

Navigation style has a huge impact on performance.

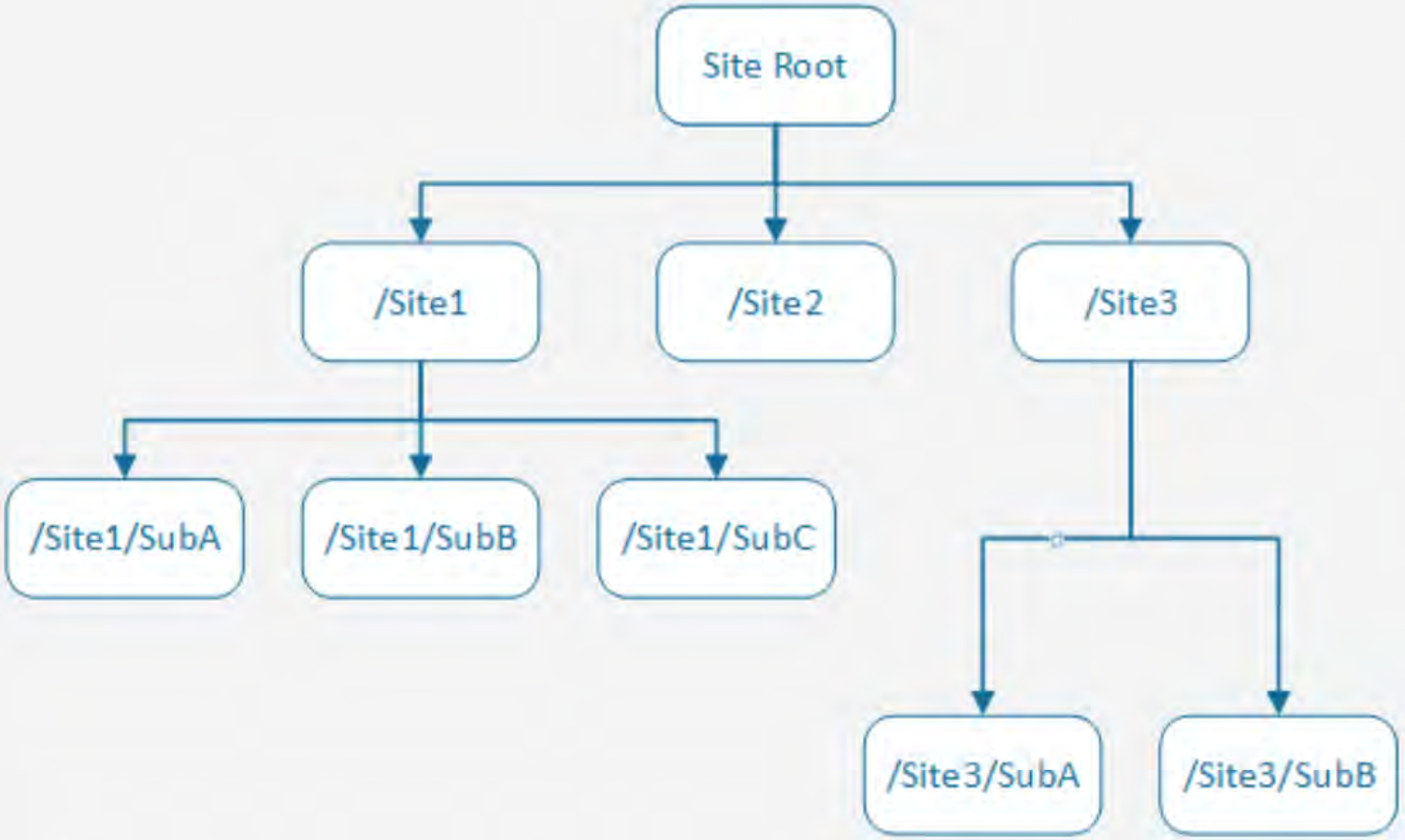
Using structural navigation is the default (but poor) choice for complex site hierarchies in the cloud.

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

Navigation style has a huge impact on performance.



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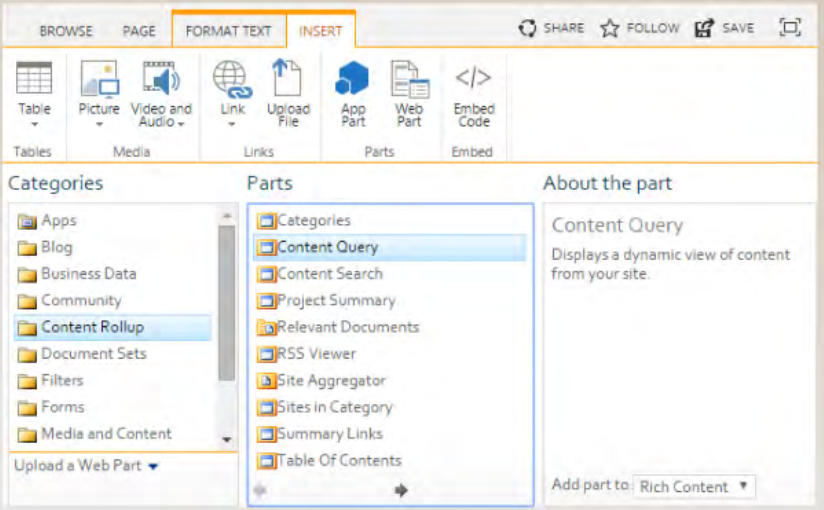
Do you like the Content Query Web Part (CQWP)?



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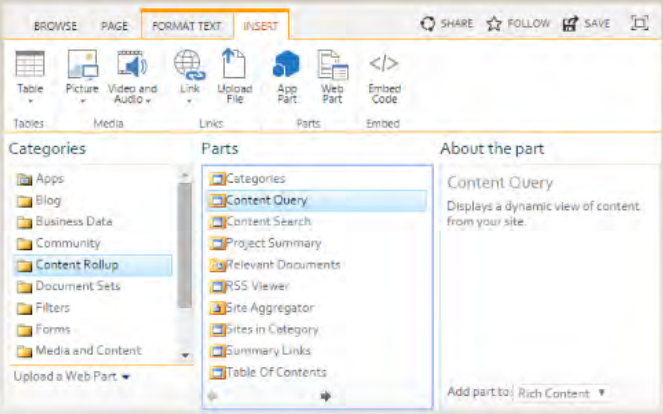


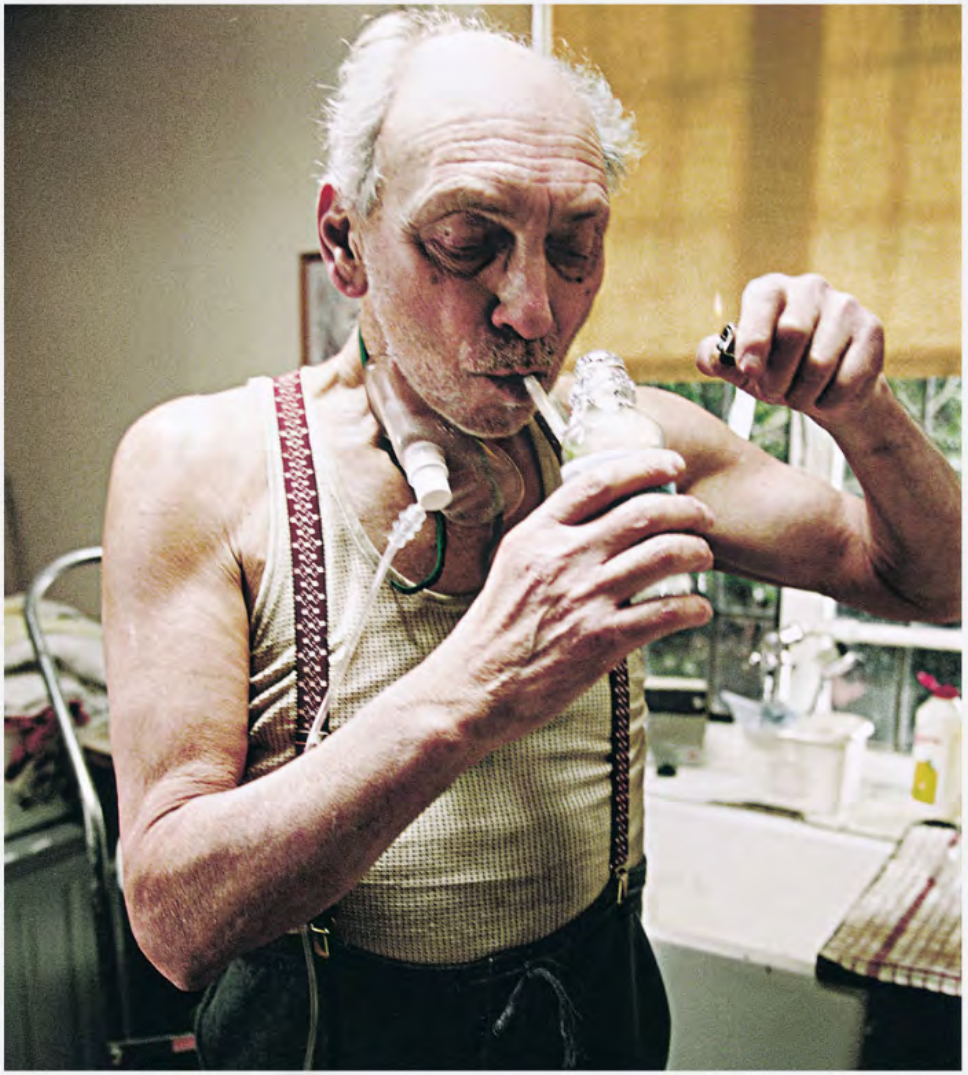
In the cloud, the CQWP can cause some significant performance hits.

- 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!

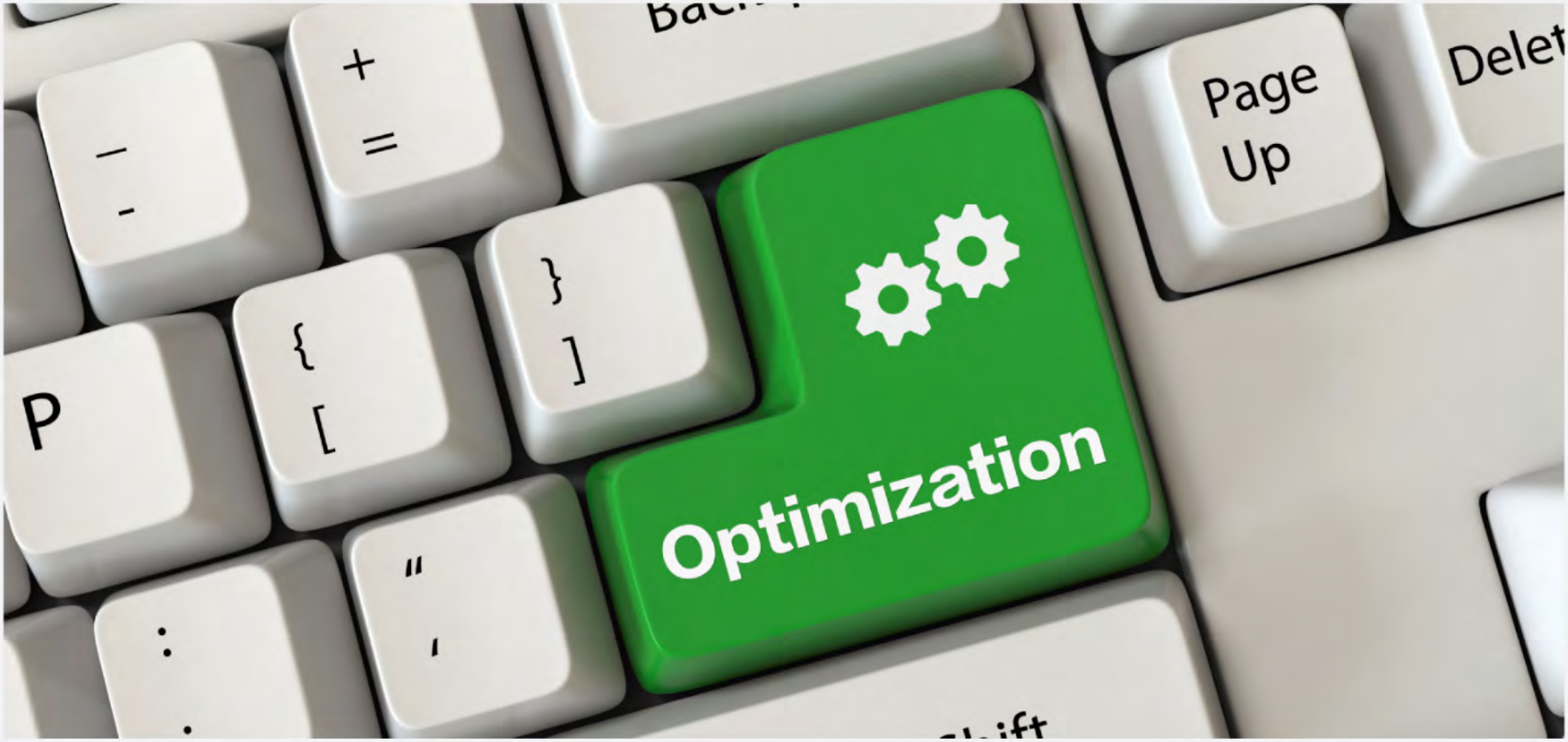

You are now in the cloud!
Let's compare:
COMING ATTRACTIONS
Path to Better Performance

Okay, time for a serious question ...

Are you a web part junkie?

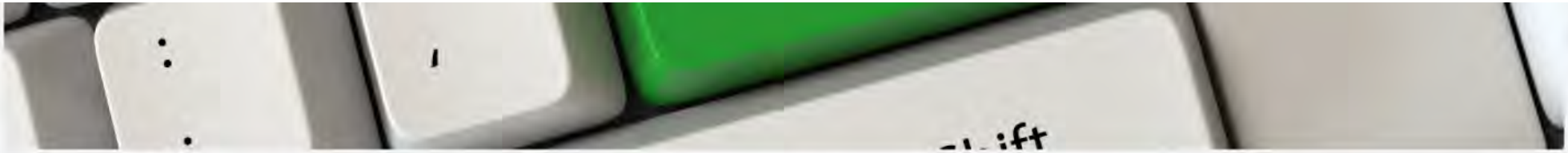


If so, it's time to talk rehab.



What's the alternative to freebasing web parts?

There's no single



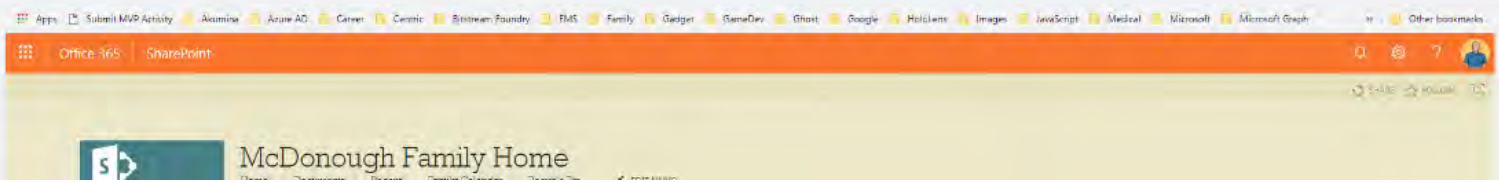
What's the alternative to freebasing web parts?

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.

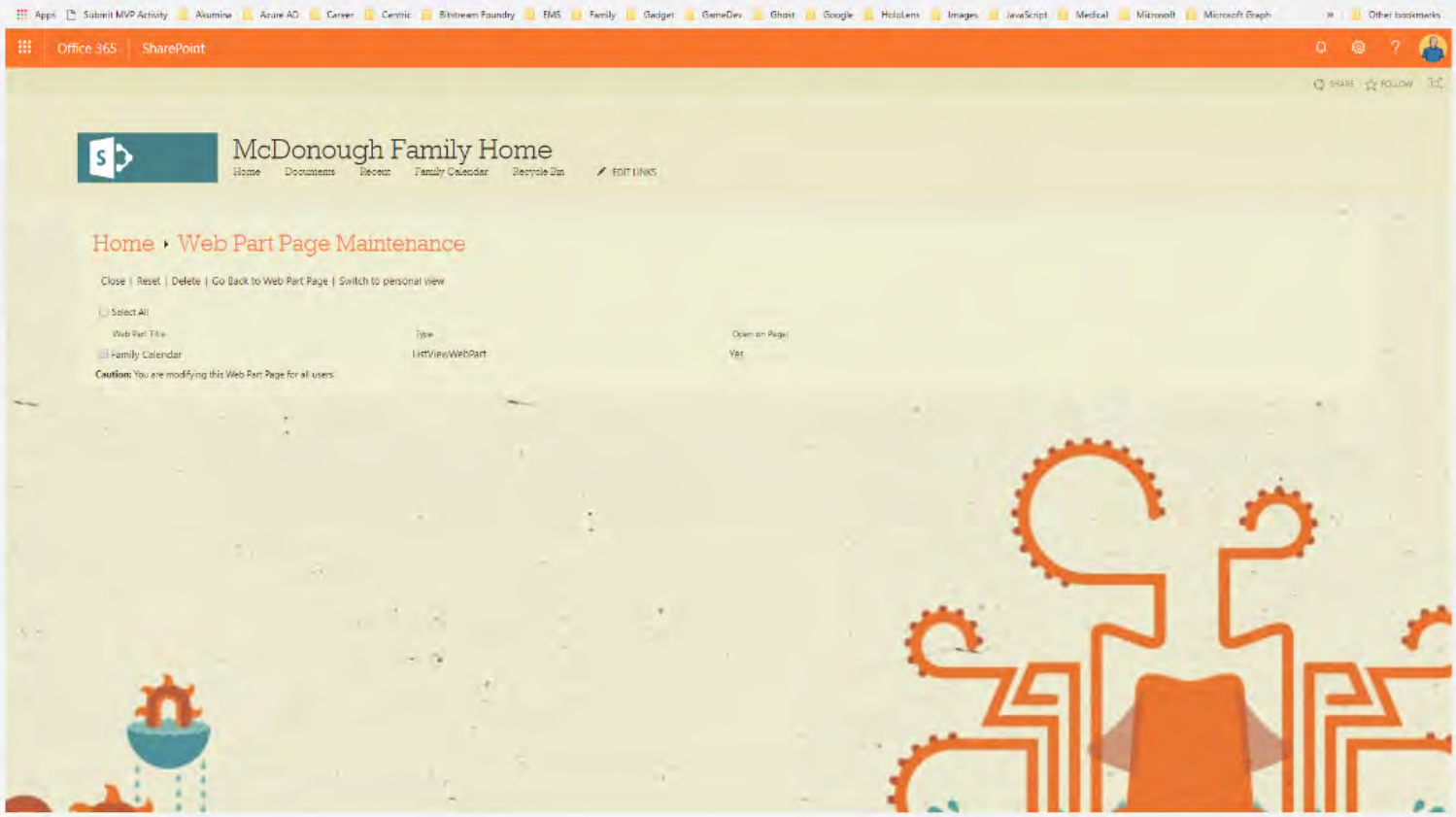
but ...

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!



which are closed
but not deleted!

also note ...

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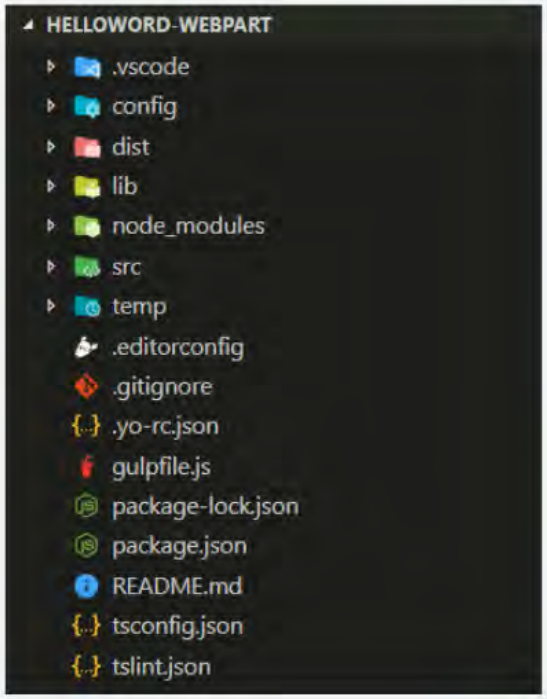

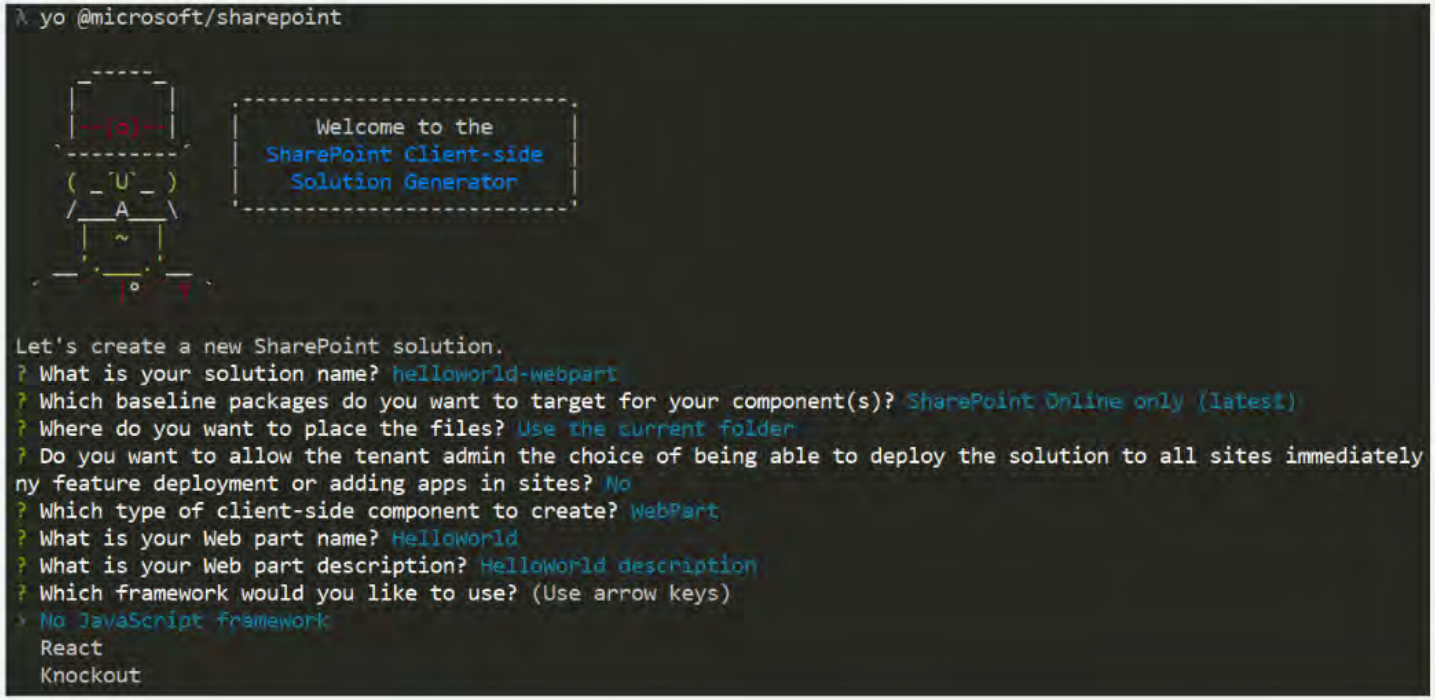

And a friendly reminder: use a CDN with those SPFx web parts!

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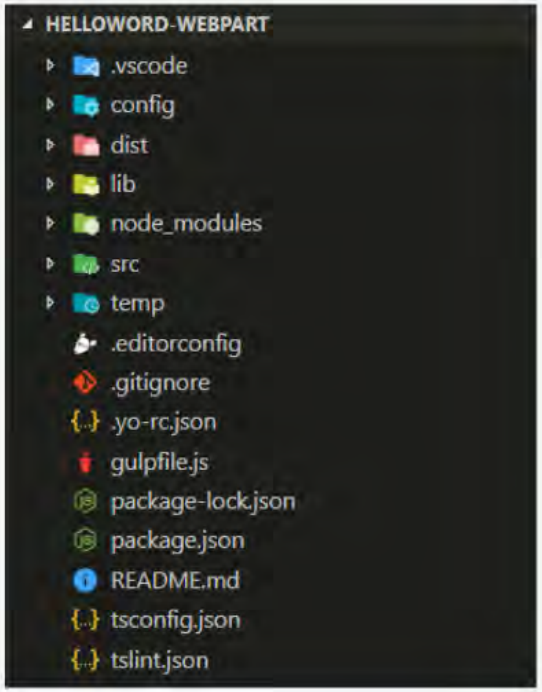

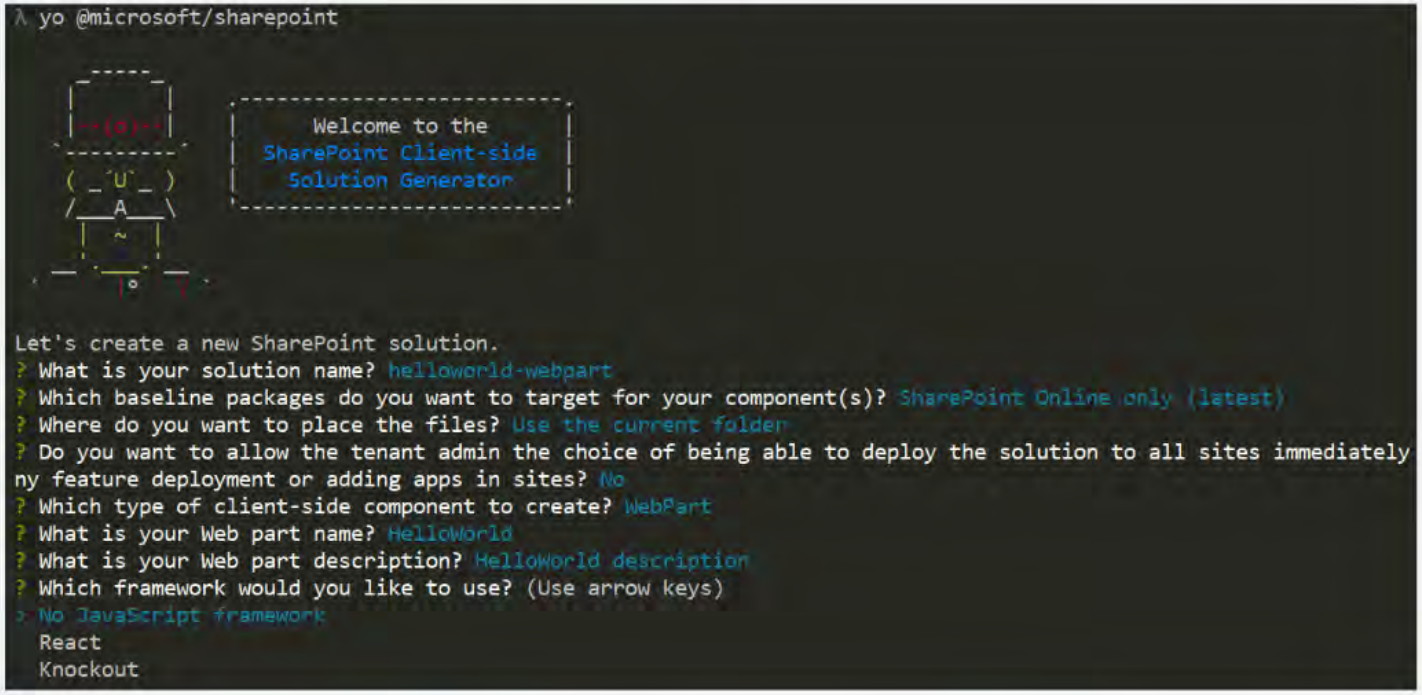

And a friendly reminder: use a CDN with those SPFx web parts!


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


You are now in the cloud!
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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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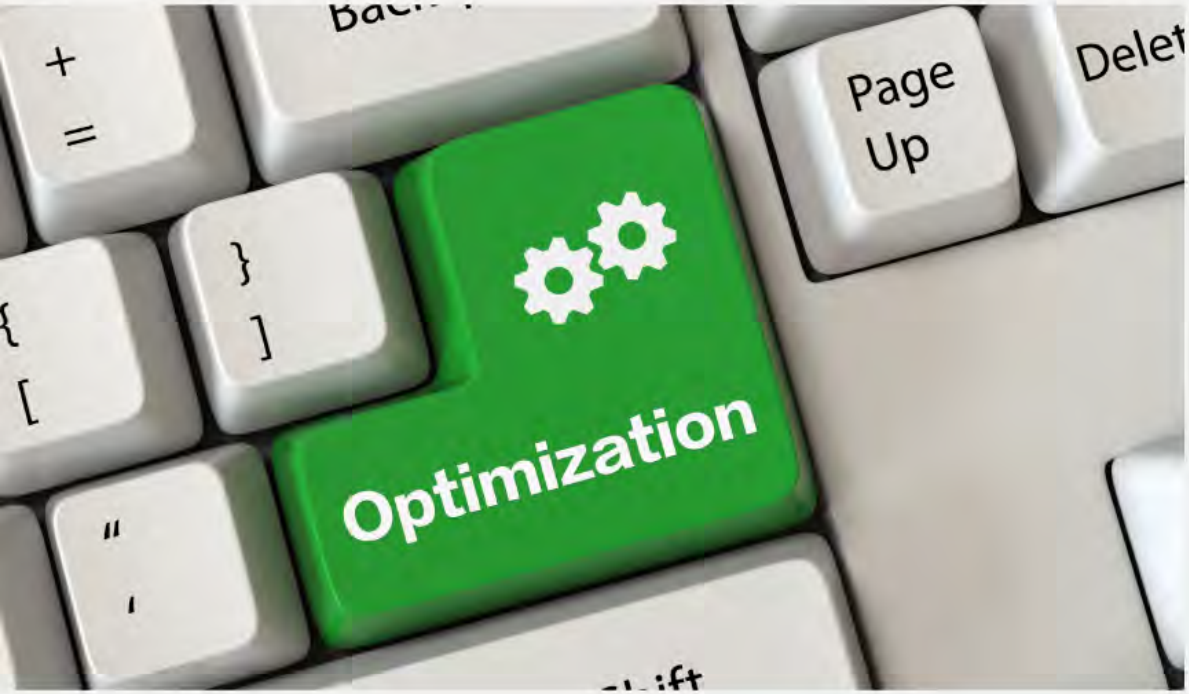
Develop your asynchronous programming techniques



- 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
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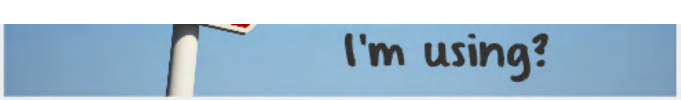
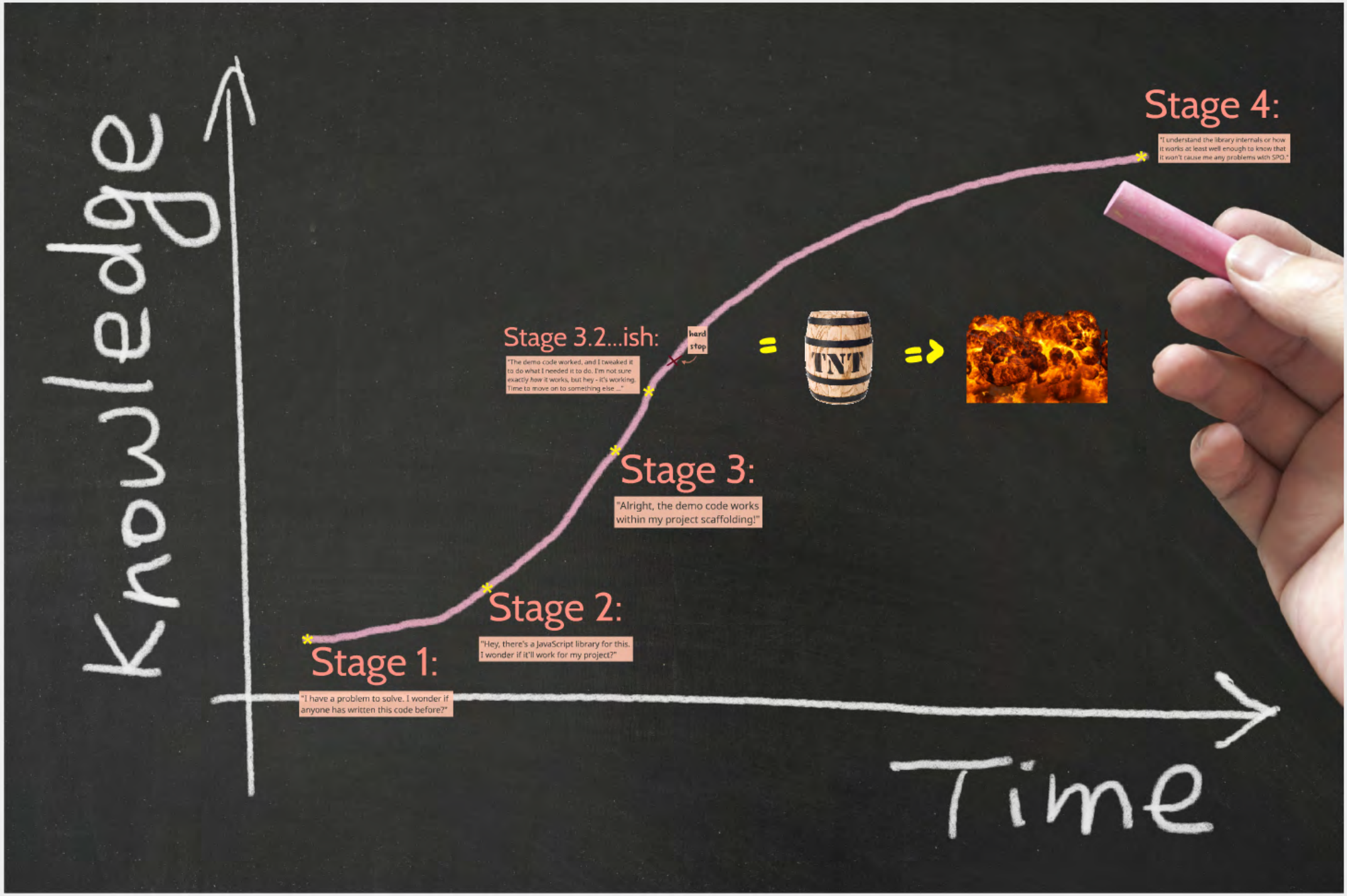
Ask yourself this question:

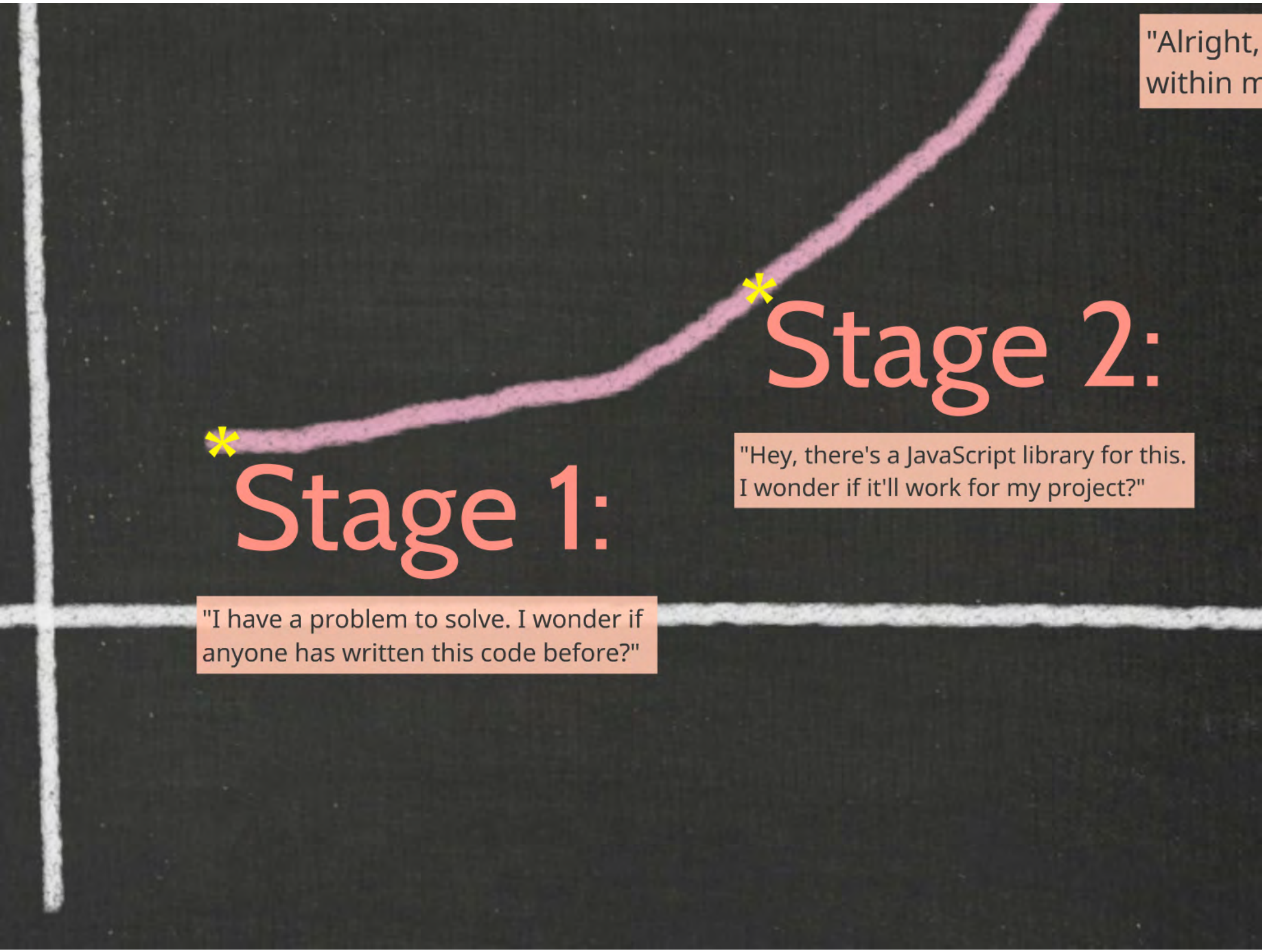
How well do I know the code and libraries I'm using?

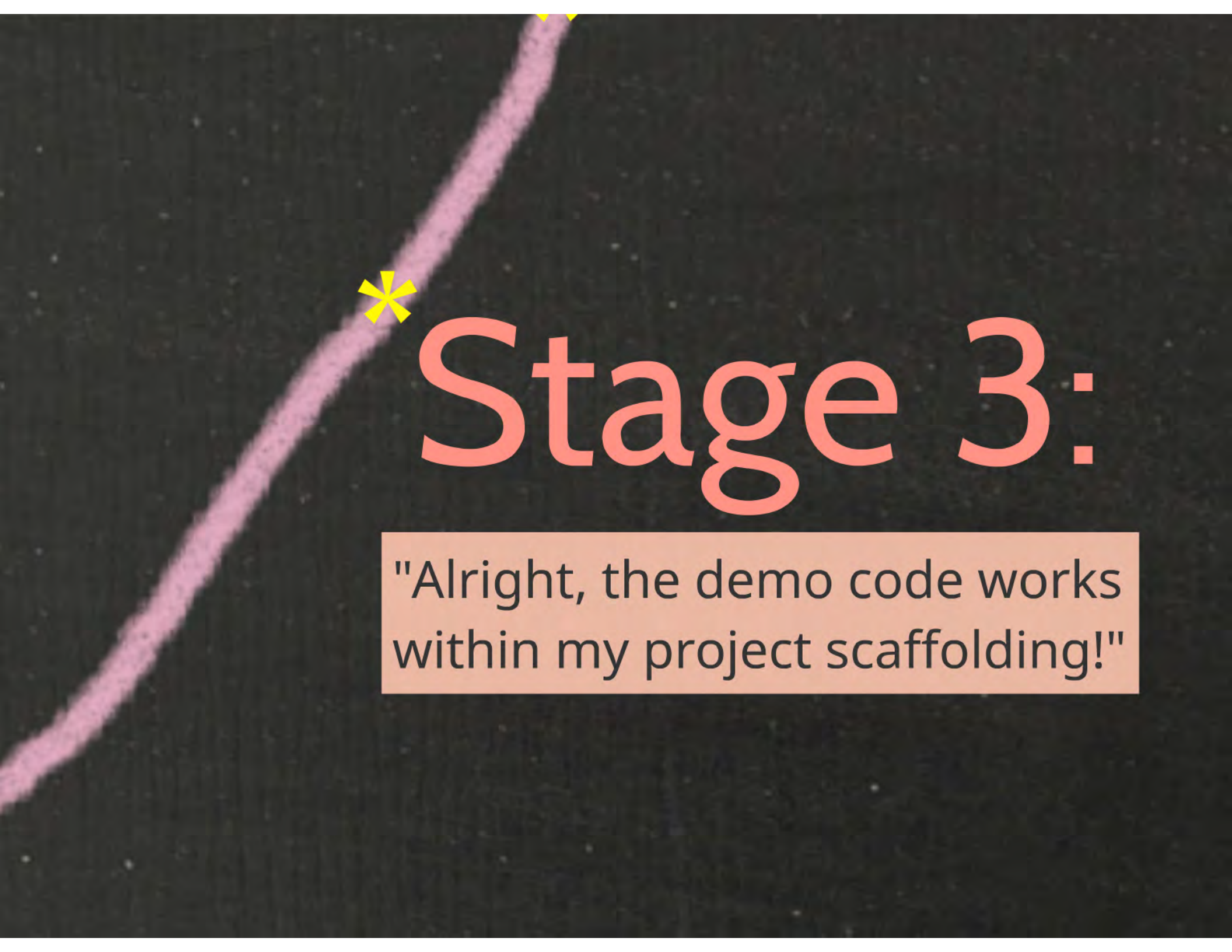
Reason I ask: when troubleshooting performance issues, I commonly encounter a pattern that can be illustrated with the following diagram of stages:

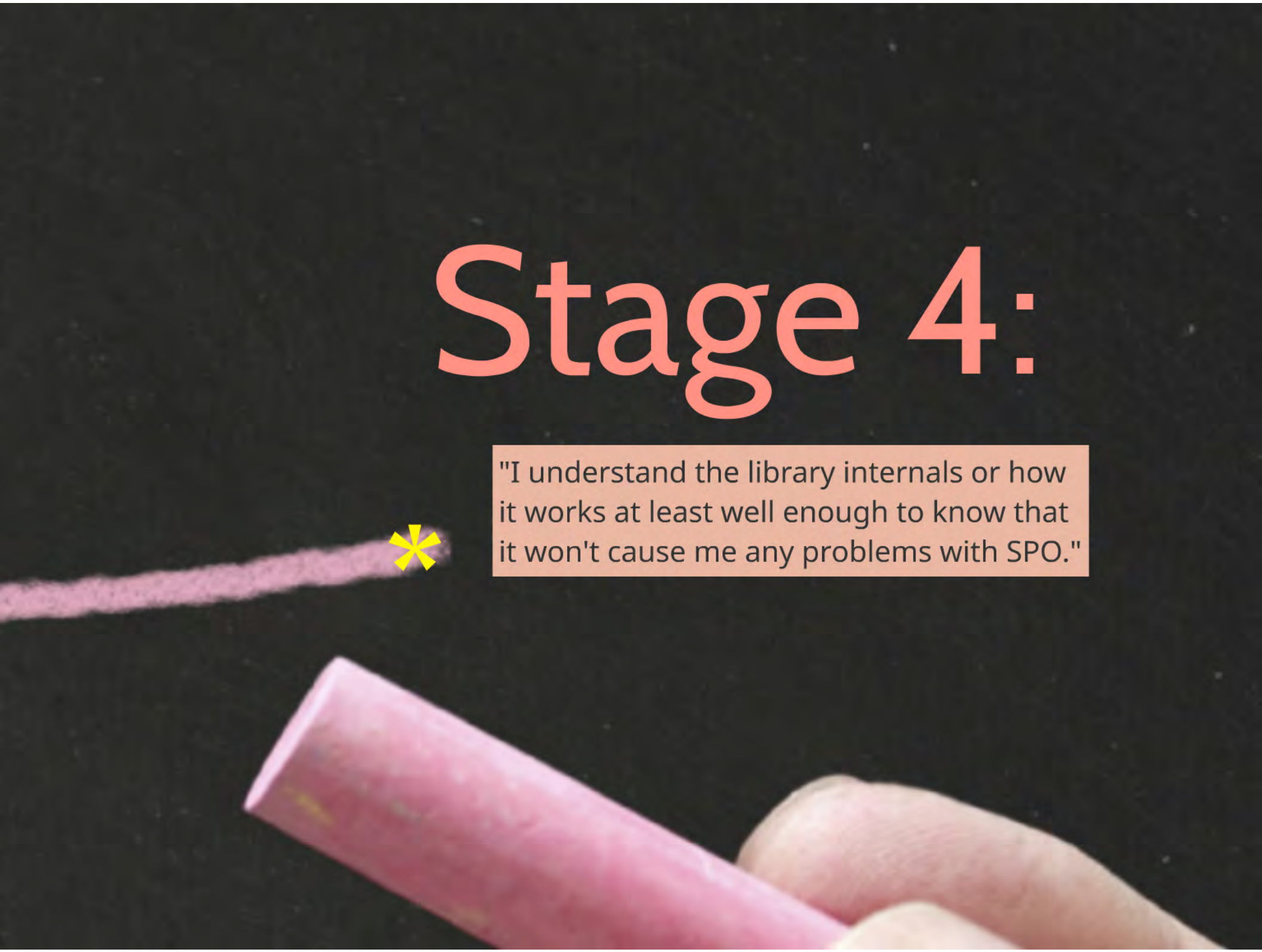


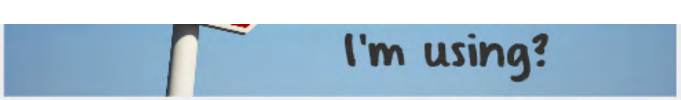
be illustrated with the following diagram of stages:




"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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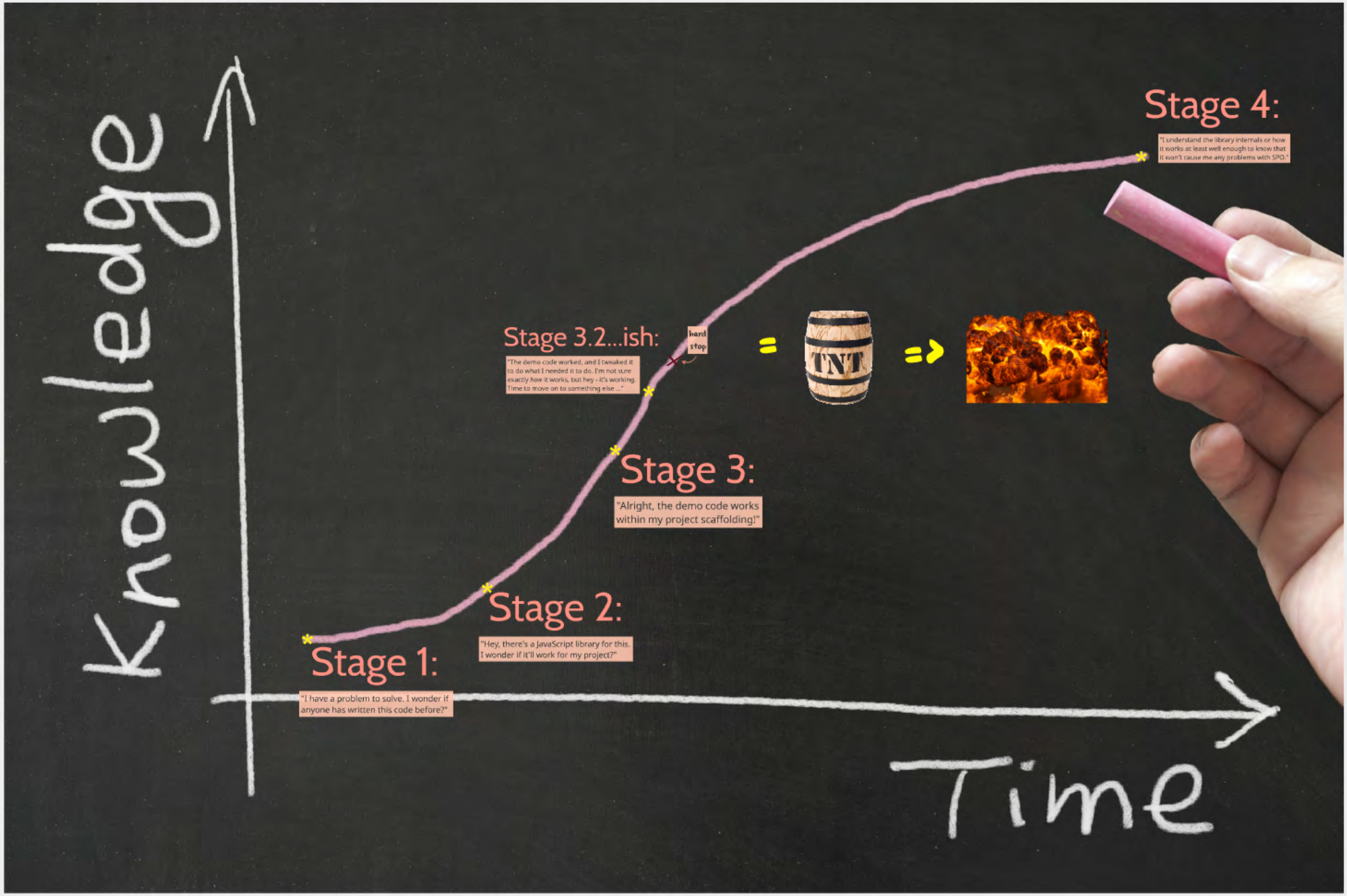
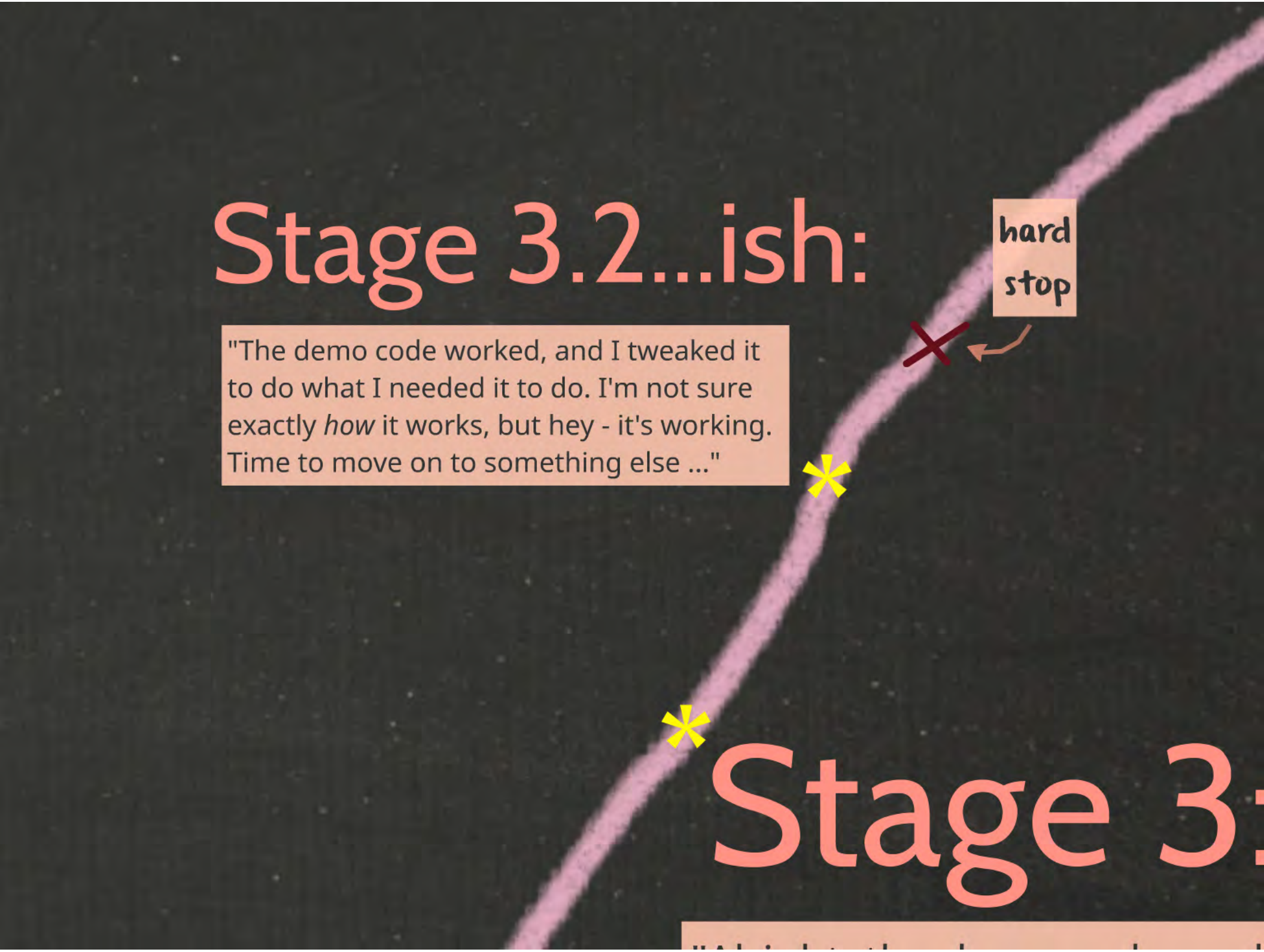
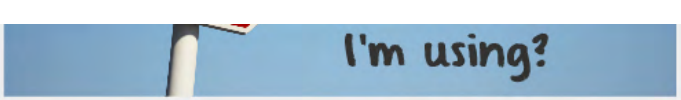



Stage 3.2...ish:
hard stop
"The demo code worked, and I tweaked it to do what I needed it to do. I'm not sure exactly *how* it works, but hey - it's working. Time to move on to something else ..."
Stage 3:



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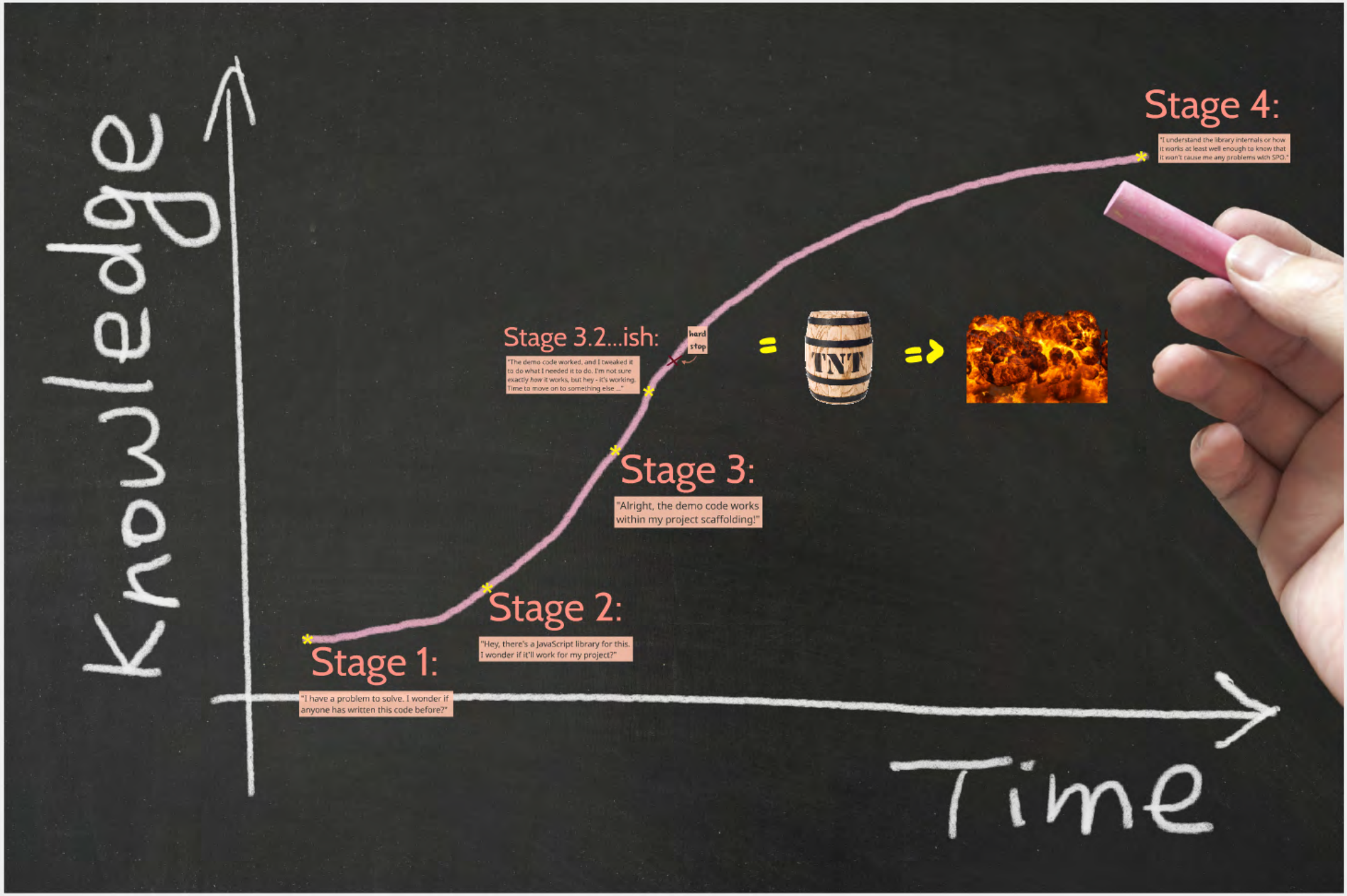

How many of you

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.

nyone ever used the **SPServices.SPGetCurrentUser()** met

```
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.

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


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COMING ATTRACTIONS
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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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