

“Caching-In” for SharePoint Performance

Sean McDonough

Product Manager, SharePoint Products

Idera

Session overview

- Caching 101
- Understanding each of SharePoint's platform caching options
- How to leverage and control caching
- Warnings and watch-outs
- Q&A

Why I care about caching

- Formerly the architect for a Fortune 50's publicly facing SharePoint presence
- Highly trafficked environment
 - ~75,000 page views per hour peak (2009)
 - Usually 40 SP-hosted assets per page or more
 - Greater than 1000 requests/second into IIS
- Supported with a single farm (4 WFEs)
- Tired of “SharePoint doesn't scale” claims

Caching 101

Cache: what is it?

browser cache

page-output cache

HTCP Web Part caching

Office viewing service cache

object cache disk-based caching

edge caching

virtual memory

CARP

BLOB cache cacheability headers

in-memory cache

fragment caching

post-cache substitution

ICP

buffer

Cache: what is it?

- A temporary storage area where frequently accessed data can be stored for rapid access
- Rapid access facilitated in two ways
 - Data is placed on a faster medium
 - Data is moved closer to point of usage
- Typically used for data that is expensive to fetch or calculate

Why caching for SharePoint?

- Consider a page request from a client
 - Page rendering requires constituent control rendering w/ merging of file system & DB data
 - Each page request can generate multiple DB lookups for content, navigation, security, etc.
 - Page itself links and references images, CSS, JavaScript, and other resources
- SharePoint request lifecycle is complex
- Better performance, better user experience

SharePoint caching: whatcha got?










- Of interest to administrators (and what I will be discussing)
 - Object caching
 - BLOB caching
 - Page output caching
 - Office web applications cache
- Of interest but not included
 - Dev-related caching (Web Part cache, ASP.NET cache, IVaryByCustomHandler implementation, post-cache substitution, fragment caching, etc.)

Caching in SharePoint

Some plumbing information

- Caching activation
 - “Turned on” with (Office) SharePoint Server Publishing Infrastructure
- Potentially bad news
 - *Not* part of WSSv3 or SharePoint Foundation
 - Some caching can be used with non-publishing sites, though

This workflow can be edited in SharePoint Designer.

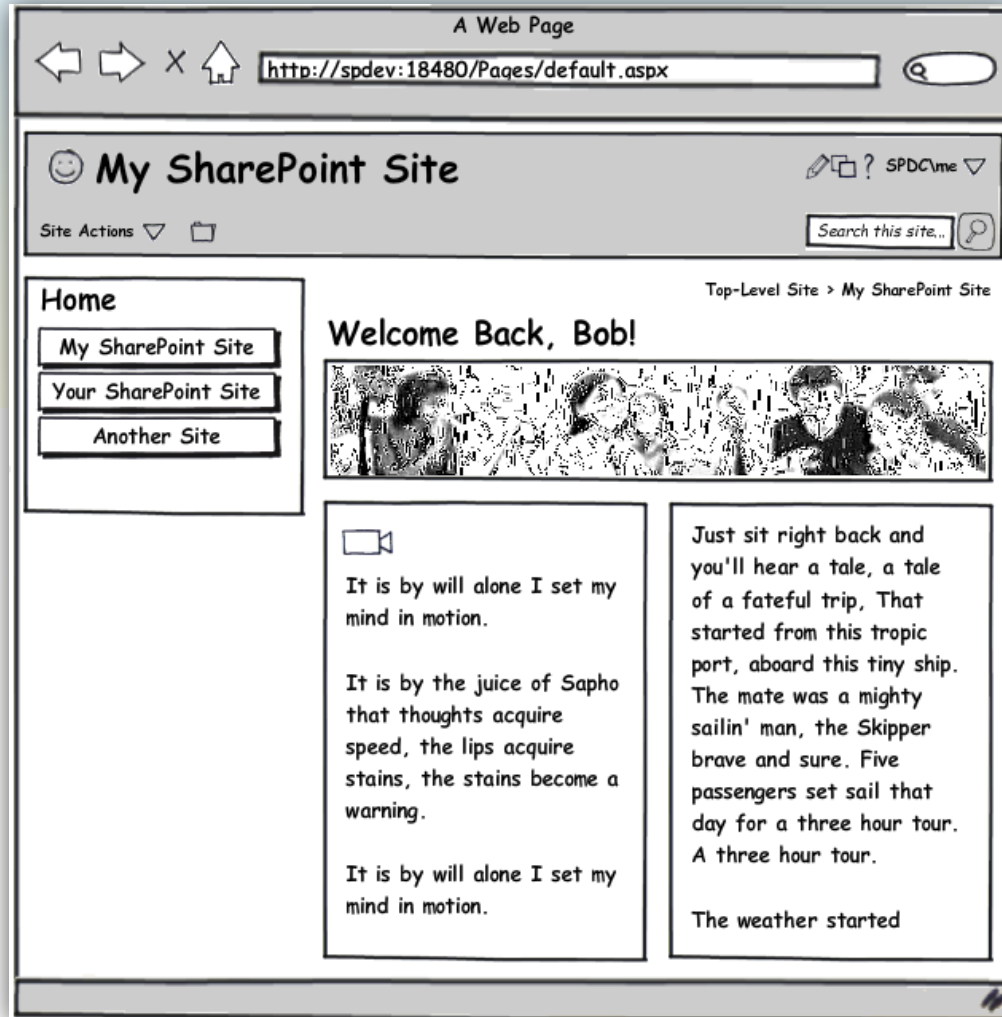
	Report Server Integration Feature Enables rich reporting using Microsoft SQL Server Reporting Services.	Deactivate	Active
	Reporting Creates reports about information in Microsoft SharePoint Foundation.	Activate	
	Search Server Web Parts This feature uploads all web parts required for Search Center.	Activate	
	SharePoint 2007 Workflows Aggregated set of out-of-box workflow features provided by SharePoint 2007.	Activate	
	SharePoint Server Enterprise Site Collection features Features such as InfoPath Forms Services, Visio Services, Access Services, and Excel Services Application, included in the SharePoint Server Enterprise License.	Activate	
	SharePoint Server Publishing Infrastructure Provides centralized libraries, content types, master pages and page layouts and enables page scheduling and other publishing functionality for a site collection.	Deactivate	Active
	SharePoint Server Standard Site Collection features Features such as user profiles and search, included in the SharePoint Server Standard License.	Activate	
	Three-state workflow Use this workflow to track items in a list.	Activate	
	Workflows Aggregated set of out-of-box workflow features provided by SharePoint.	Deactivate	Active

Some plumbing information

- How it's wired-in
 - Supported through the **PublishingHttpModule**
 - HttpModule wired into the ASP.NET request pipeline of all SharePoint web apps
- Management
 - Through web UI, STSADM, PowerShell, and web.config changes

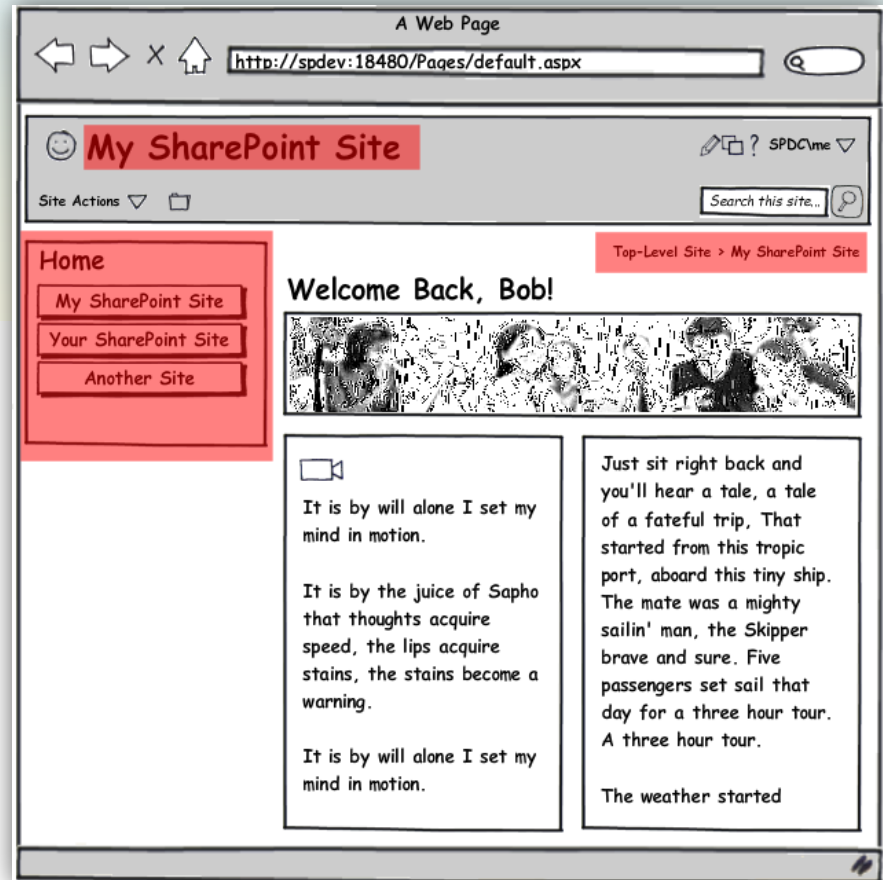
```
444 </system.web>
445 <system.webServer>
446   <security>
447     <requestFiltering allowDoubleEscaping="true"
448       <requestLimits maxAllowedContentLength="21
449     </requestFiltering>
450   </security>
451   <validation validateIntegratedModeConfiguratic
452   <modules runAllManagedModulesForAllRequests="t
453     <remove name="AnonymousIdentification" />
454     <remove name="FileAuthorization" />
455     <remove name="Profile" />
456     <remove name="WebDAVModule" />
457     <remove name="Session" />
458     <add name="SPRequestModule" precondition="in
459     <add name="ScriptModule" precondition="integ
460     <add name="SharePoint14Module" precondition=
461     <add name="StateServiceModule" type="Microsc
462     <add name="RSRedirectModule" type="Microsoft
463     <add name="PublishingHttpModule" type="Micr
464   </modules>
465   <handlers>
466     <remove name="OPTIONSVerbHandler" />
467     <remove name="WebServiceHandlerFactory-Integ
468     <remove name="svc-Integrated" />
469     <remove name="WebDAV" />
470     <add name="svc-Integrated" path="*.svc" verb
471     <add name="OwssvrHandler" scriptProcessor="C
472     <add name="ScriptHandlerFactory" verb="*" pa
473     <add name="ScriptHandlerFactoryAppServices"
474     <add name="ScriptResource" precondition="int
475     <add name="JSONHandlerFactory" path="*.json"
476     ..
```

Consider a sample page ...



Object caching

- Speeds access to frequently referenced structural, property, and result data
 - Navigational data
 - Query results (cross-list and cross-site)
 - Site properties
 - Page layouts

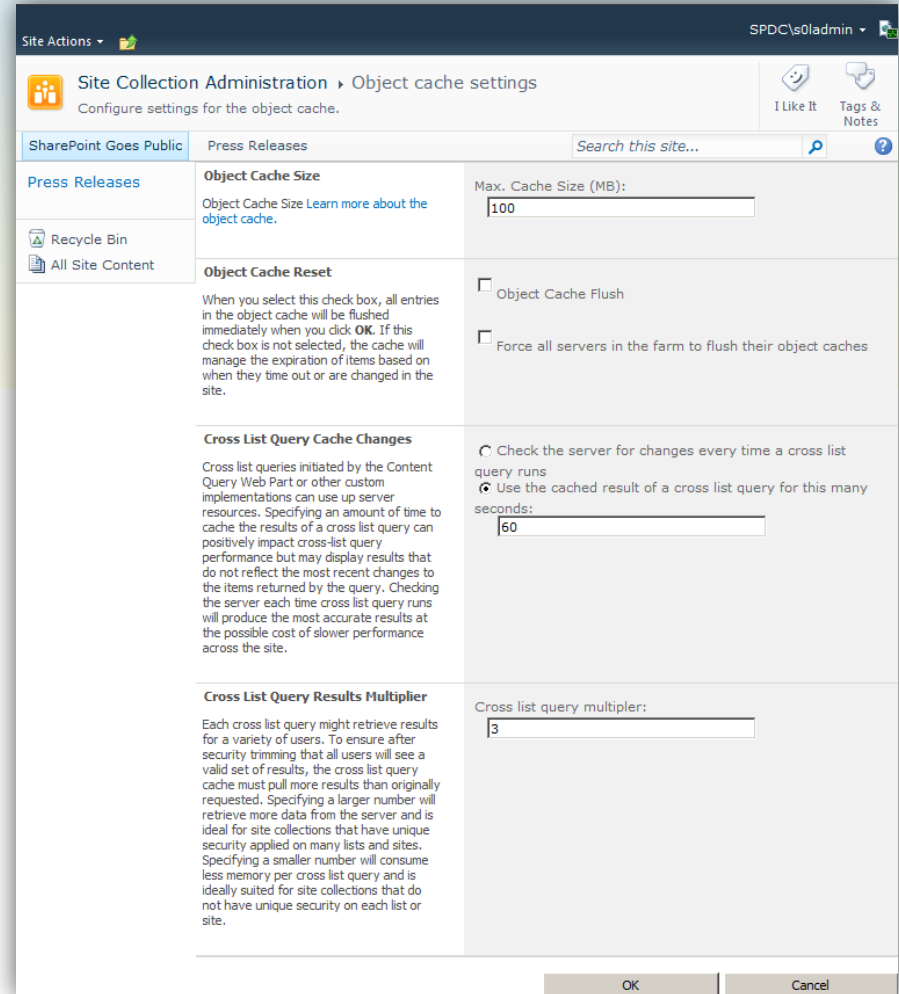


Object caching

- Structure and operation
 - A memory-backed cache on each WFE
 - Only cache that is “on” by default
 - Cache is assigned per site collection
 - 100MB *allocation* per site collection by default
 - Conservative cache durations employed to avoid displaying or using stale data
- Additional control with SharePoint 2010
 - **<ObjectCache>** in web.config to govern maximum size

Object caching

- Getting to it
 - Via Site Collection Administration section on Site Settings page
 - Site Collection Object Cache link



The screenshot shows the 'Object cache settings' page in Site Collection Administration. The page is titled 'Site Collection Administration > Object cache settings' and includes a search bar and navigation links like 'I Like It' and 'Tags & Notes'. The main content area is divided into several sections:

- Object Cache Size:** Includes a text input for 'Max. Cache Size (MB)' with the value '100'.
- Object Cache Reset:** Includes two checkboxes: 'Object Cache Flush' (unchecked) and 'Force all servers in the farm to flush their object caches' (unchecked). A descriptive paragraph explains that selecting this checkbox flushes all entries in the object cache.
- Cross List Query Cache Changes:** Includes a radio button for 'Check the server for changes every time a cross list query runs' (selected) and a text input for 'seconds' with the value '60'. A descriptive paragraph explains that checking this option produces the most accurate results at the cost of slower performance.
- Cross List Query Results Multiplier:** Includes a text input for 'Cross list query multiplier' with the value '3'. A descriptive paragraph explains that a larger number retrieves more data from the server, while a smaller number consumes less memory.

At the bottom of the page, there are 'OK' and 'Cancel' buttons.

Object caching

■ Configuration options

- Object Cache Size
- Object Cache Reset
- Cross List Query Cache Changes
- Cross List Query Results Multiplier

The screenshot shows the 'Object cache settings' page in Site Collection Administration. The page title is 'Object cache settings' and the subtitle is 'Configure settings for the object cache.' The page is divided into several sections:

- Object Cache Size:** Max. Cache Size (MB): 100
- Object Cache Reset:** When you select this check box, all entries in the object cache will be flushed immediately when you click **OK**. If this check box is not selected, the cache will manage the expiration of items based on when they time out or are changed in the site.
 - Object Cache Flush
 - Force all servers in the farm to flush their object caches
- Cross List Query Cache Changes:** Cross list queries initiated by the Content Query Web Part or other custom implementations can use up server resources. Specifying an amount of time to cache the results of a cross list query can positively impact cross-list query performance but may display results that do not reflect the most recent changes to the items returned by the query. Checking the server each time cross list query runs will produce the most accurate results at the possible cost of slower performance across the site.
 - Check the server for changes every time a cross list query runs
 - Use the cached result of a cross list query for this many seconds: 60
- Cross List Query Results Multiplier:** Each cross list query might retrieve results for a variety of users. To ensure after security trimming that all users will see a valid set of results, the cross list query cache must pull more results than originally requested. Specifying a larger number will retrieve more data from the server and is ideal for site collections that have unique security applied on many lists and sites. Specifying a smaller number will consume less memory per cross list query and is ideally suited for site collections that do not have unique security on each list or site.
 - Cross list query multiplier: 3

At the bottom of the page, there are 'OK' and 'Cancel' buttons.

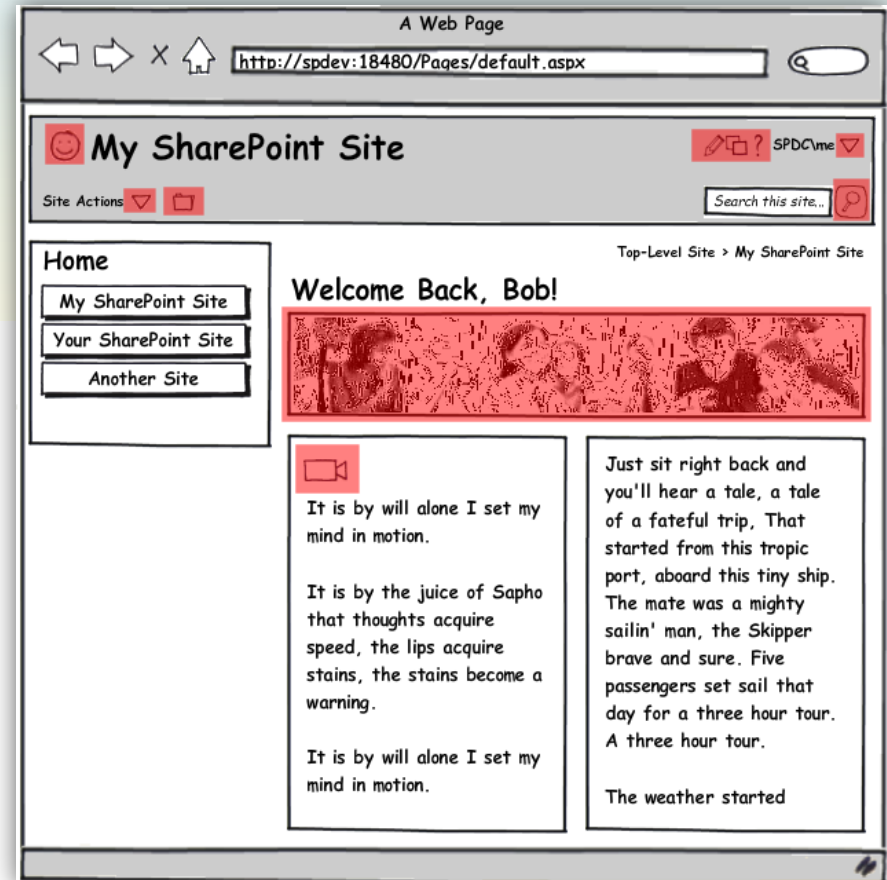
Object caching

■ Recommendations

- Be careful with the Object Cache Size allocation!
- Cross List Query Cache Changes
 - *Off by default for MOSS, on by default for SharePoint 2010*
 - *Turn off or reduce time if queries are run against volatile data*
 - *Turn on to reduce system loading and increase response time*
- Cross List Query Results Multiplier
 - *Increase if per-site and per-list permissions are in use, especially if per-item permissions are also applied in lists*
 - *Reduce for sites where anonymous access prevails*

BLOB caching

- Improves efficiency and speed of serving BLOB (Binary Large Object) data in lists
 - Images and icons
 - Audio files
 - Video (including Flash)
 - Cascading style sheets
 - Javascript

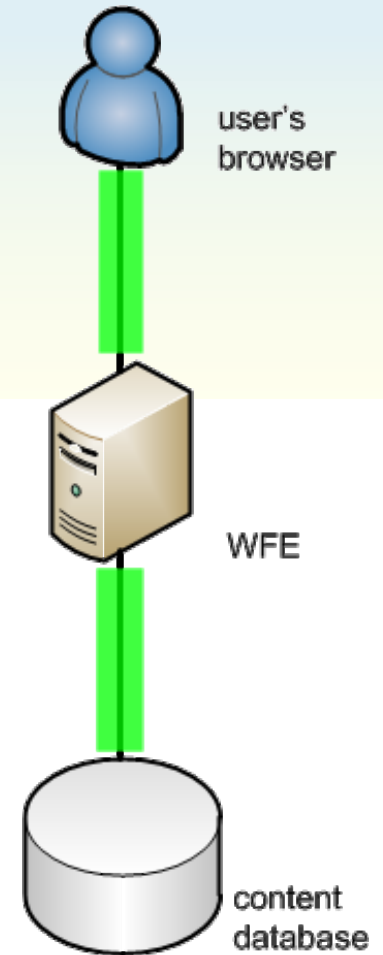


BLOB caching

- Structure and operation
 - Also known as “disk-based caching”
 - Cache is backed by file system storage on WFEs
 - Turned “off” by default
 - Enabled and disabled per IIS web site
 - Disk allocation, file types cached, and client cacheability settings are configurable

BLOB caching

- Yields performance improvements through (up to) two different offloads
 - Once enabled, reduces network traffic between WFEs and content databases
 - Can also reduce load on WFEs by instructing client browsers to cache
- New in SharePoint 2010
 - HTTP byte range support, throttling



BLOB caching

- Getting to it
 - Accessed through the web.config for each IIS site
- What can be configured
 - File system cache location
 - Pattern of files to be cached
 - Maximum disk space cache can consume
 - Client cacheability (**max-age**)
 - Some service-related params

```
337 <Action id="0ff1ce14-1014-0000-0000-00000000" />
338 <Action id="0ff1ce14-1015-0000-0000-00000000" />
339 <Action id="0ff1ce14-101f-0000-0000-00000000" />
340 <Action id="5055b13f-c200-45dd-8dbd-b046710e" />
341 <Action id="2ac909bc-29ed-42dd-8b47-548a927c" />
342 <Action id="ea2d54ca-cd14-48a7-a5ca-b10b2414" />
343 <Action id="0ff1ce14-1019-0000-0000-00000000" />
344 <Action id="0ff1ce14-101a-0000-0000-00000000" />
345 <Action id="0ff1ce14-101b-0000-0000-00000000" />
346 <Action id="0ff1ce14-101c-0000-0000-00000000" />
347 <Action id="0ff1ce14-101d-0000-0000-00000000" />
348 <Action id="0ff1ce14-101e-0000-0000-00000000" />
349 <Action id="0ff1ce14-1020-0000-0000-00000000" />
350 <Action id="0ff1ce14-1021-0000-0000-00000000" />
351 <Action id="ec0076ac-0c35-4880-8422-8062f592" />
352 <Action id="602bc8c3-9286-49a3-b973-3376ca78" />
353 <Action id="00e22a78-33ff-41ac-b0fb-ee46d163" />
354 <Action id="4b60e42e-e6fc-4188-80d2-ef39e7cc" />
355 <Action id="1d415973-1146-4bc2-8324-83dfff5b" />
356 </MergedActions>
357 <BlobCache location="C:\BlobCache\14" path="\." />
358 <ObjectCache maxSize="100" />
359 <OutputCacheProfiles useCacheProfileOverrides=
360 <RuntimeFilter Assembly="Microsoft.Office.Serv
361 </SharePoint>
362 <system.web>
363 <securityPolicy>
364 <trustLevel name="WSS_Medium" policyFile="C:
365 <trustLevel name="WSS_Minimal" policyFile="C
366 </securityPolicy>
367 <httpHandlers />
368 <customErrors mode="On" />
369 <httpRuntime maxRequestLength="51200" />
370 <authentication mode="Windows" />
371 <identity impersonate="true" />
372 <authorization>
```

BLOB caching

- **<BlobCache>** element in MOSS 2007

```
<BlobCache location="C:\blobCache" path="\. (gif|jpg|png|css|js)$" maxSize="10" enabled="false" />
```

- **<BlobCache>** element in SharePoint 2010

```
<BlobCache location="C:\BlobCache\14" path="
\". (gif|jpg|jpeg|jpe|jfif|bmp|dib|tif|tiff|ico|png|wdp|hdp|css|js|asf|avi|flv|m4v|mov|mp3|mp4|mpeg
|mpg|rm|rmvb|wma|wmv)$" maxSize="10" enabled="false" />
```

- **max-age** attribute
 - Easily added to yield client-side caching of BLOB assets
 - Client will use local assets without round-trips to server

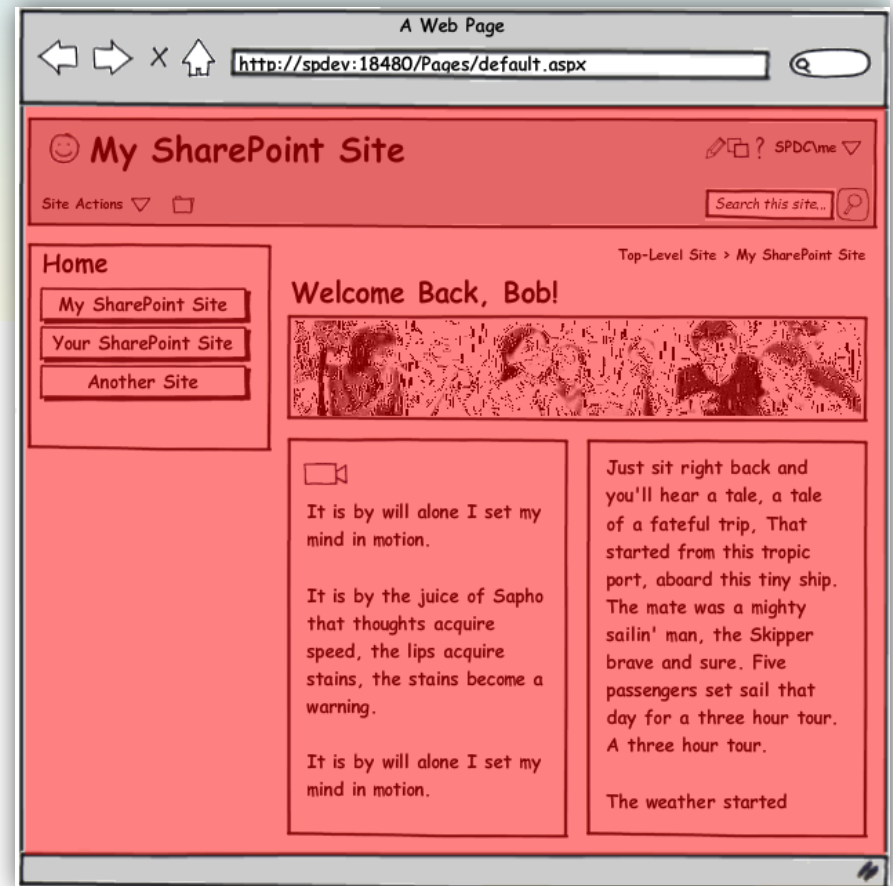
BLOB caching

■ Recommendations

- Turn it on (that is, set **enabled="true"**)
- Adjust the **location** attribute to point to a data disk
- Ensure enough disk space on WFEs to support sum of **maxSize** attribute values (in GB) across web.config files
- Do not attempt to manually manage BLOB cache contents.
 - *Do not delete individual cached files*
 - *Use built-in flushes (2010) or CodePlex add-on (2007)*
 - *If required, cache folder associated with IIS web site can be deleted, but only when associated app pool is spun-down*
- If using the **max-age** attribute, understand the implications

Page output caching

- Allows pages that were rendered for one user to be stored and served to other users
- Piggybacks on ASP.NET's output caching mechanism



Page output caching

- Structure and operation
 - Pages are rendered and stored in memory by key
 - *Key is composed of attributes specified by a caching profile*
 - *Users with matching attributes can be served cached page*
 - Cache is enabled per site collection
 - Page output cache is off by default
 - Primarily managed through a system of profiles
- Additional control in SharePoint 2010
 - **<OutputCacheProfiles>** override in web.config file

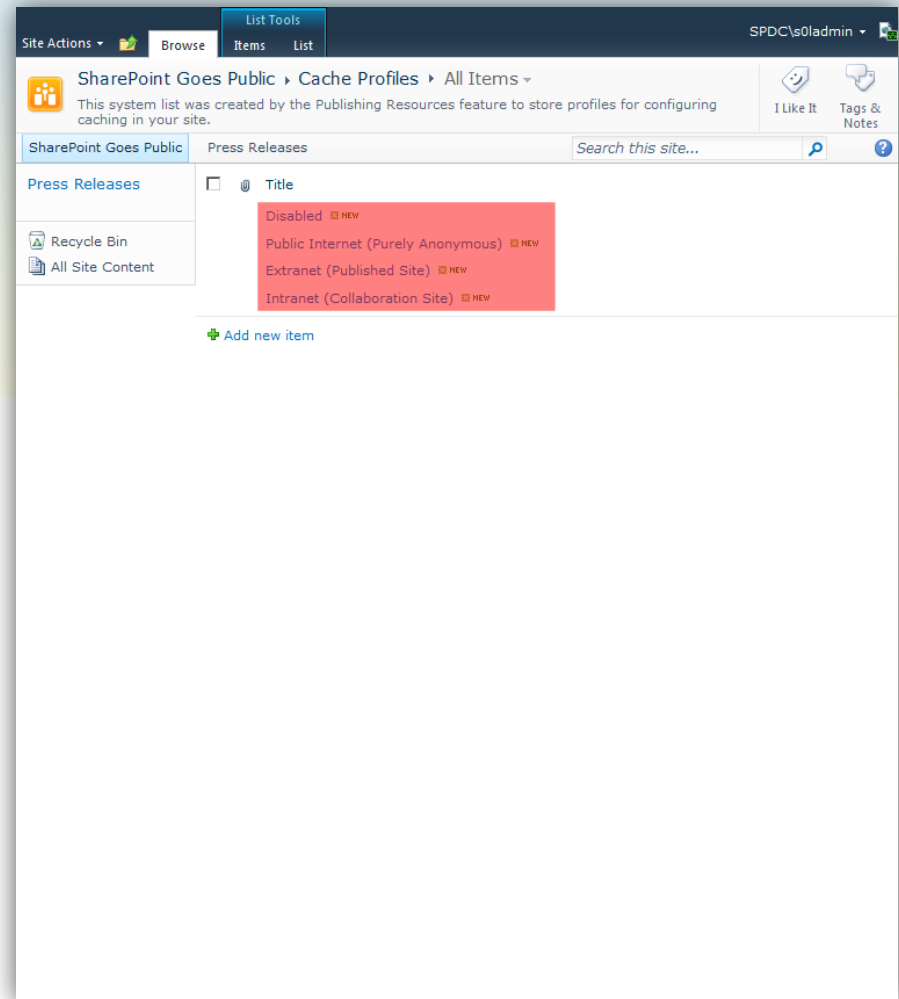
Page output caching

- Profiles specify caching characteristics
 - User equivalence (cache key generation) criteria
 - How long pages are cached
 - Whether or not to check for updates on each request
 - How pages are cached on server and client
 - Custom caching parameters
- Profiles can vary based on access type
 - Authenticated profile assignment
 - Anonymous profile assignment

Page output caching

■ Step 1

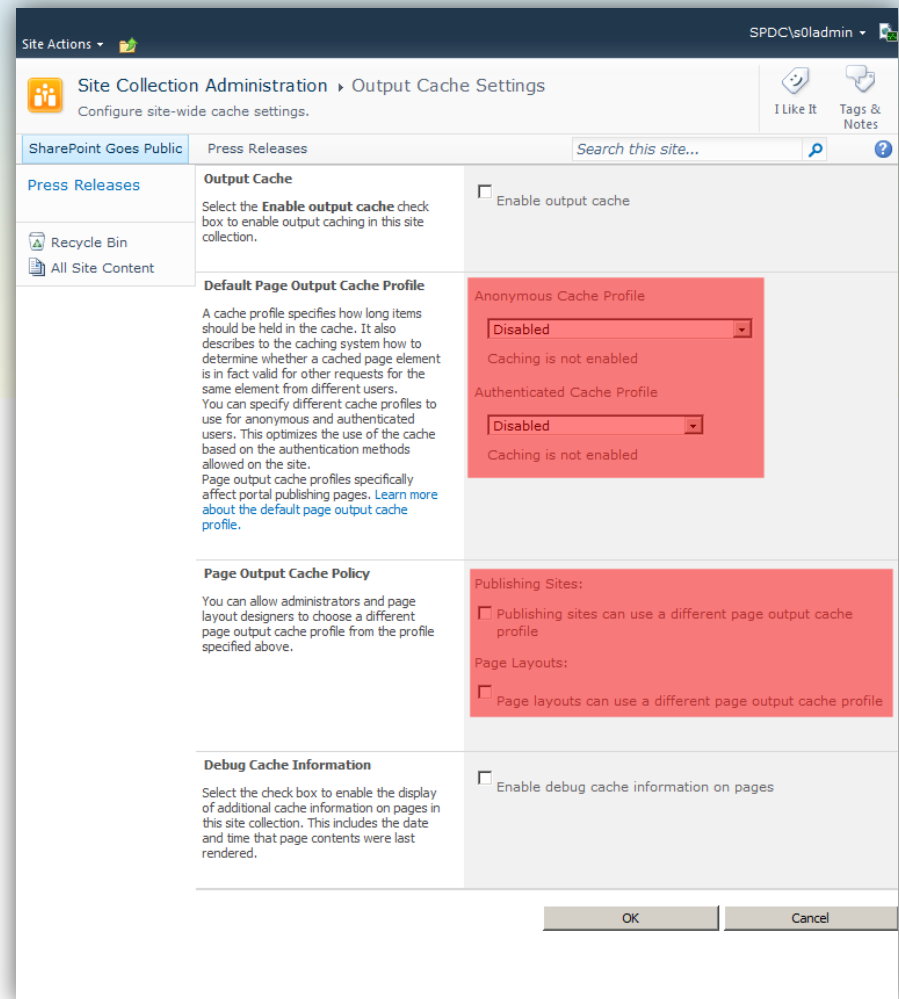
- Review the cache profiles that are defined
 - *Via Site Collection Administration section on Site Settings menu*
 - *Site Collection Cache Profiles link*
- Create your own profiles if desired



Page output caching

■ Step 2

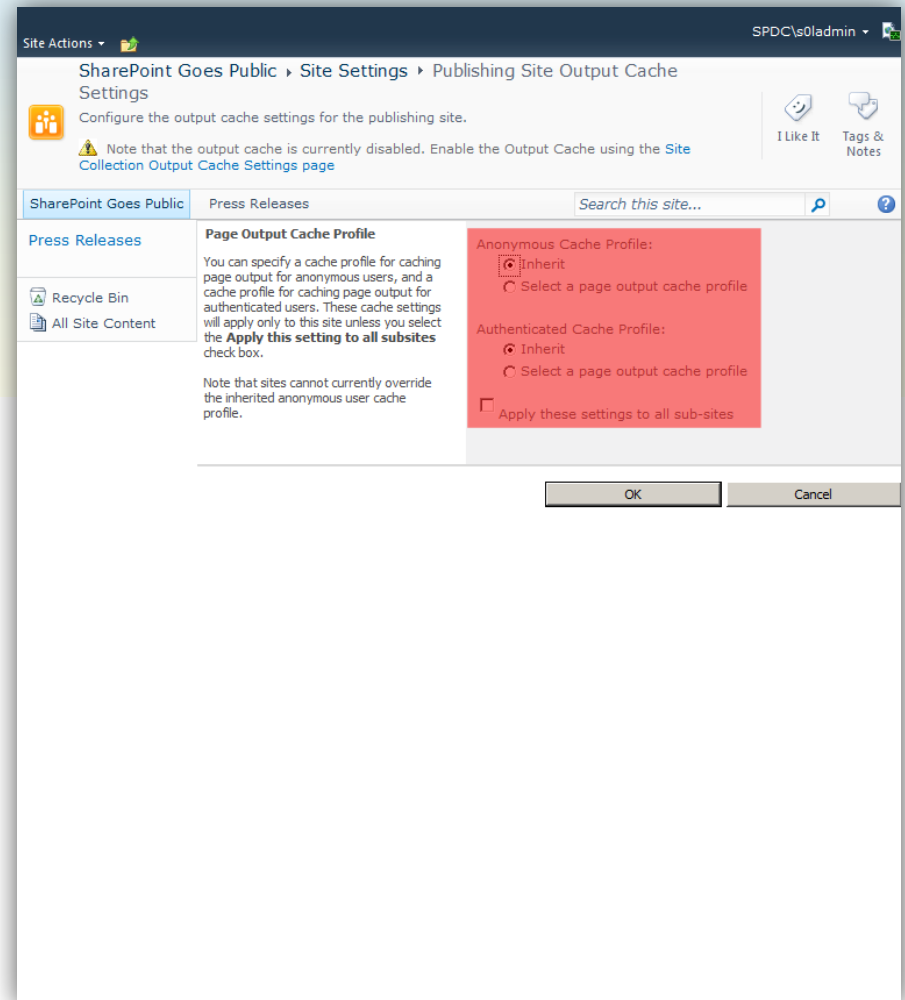
- Apply caching profiles for site collection
 - *Via Site Collection Administration section on Site Settings menu*
 - *Site Collection Output Cache link*
- Indicate if profiles can vary by sub-site and layout page type



Page output caching

■ Step 3

- Optionally apply different profiles to sub-sites as needed
 - *Via each Site Administration section on Site Settings menu*
 - *Site Output Cache link*
- Inheritance model used
- Can push down the hierarchy with checkbox



Page output caching

■ Step 4

- Optionally apply different profiles per page layout type
 - *Via Galleries section on Site Settings menu*
 - *Master Pages And Page Layouts link*
 - *Edit properties of target page layout*
 - *Save and check-in*

Master Page Gallery - PageLayoutTemplate.aspx

Name * PageLayoutTemplate.aspx

Title

Description

Contact

Preview Image

Hidden Page

Associated Content Type

Content Type Group: _Hidden

Content Type Name: Administrative Task

Description: An administrative work item that an administrator needs to complete.

Variations

Available Labels

Labels for Layout

Add >

< Remove

Authenticated Cache Profile: (None)

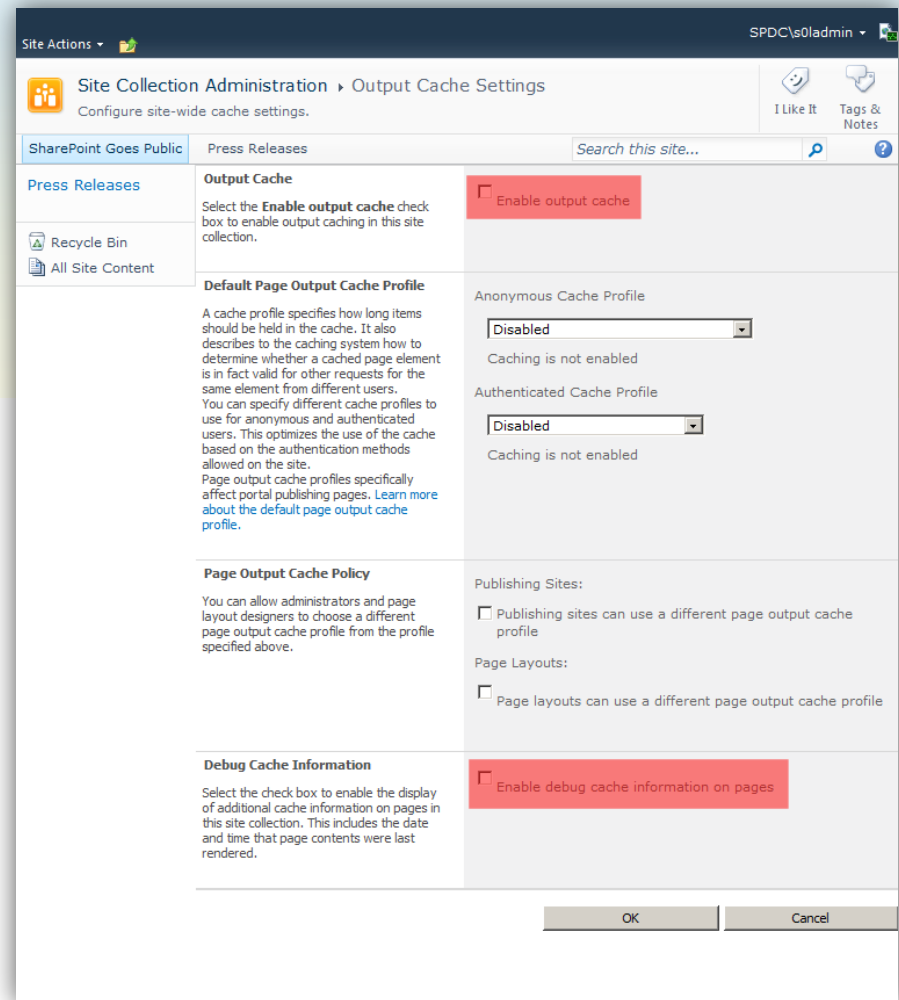
Anonymous Cache Profile: (None)

Open this Web Part Page in maintenance view to delete problem Web Parts and remove personal settings.
[Open Web Part Page in maintenance view](#)

Page output caching

■ Step 5

- Enable output cache
 - *Via Site Collection Administration section on Site Settings menu*
 - *Site Collection Output Cache link*
- Optional debug info can be written as HTML comments to bottom of each page



Page output caching

■ Recommendations

- Biggest bang comes in purely anonymous usage scenarios
 - *Caching becomes less attractive as user equivalence drops*
- Perform extensive multi-user concurrent testing before implementing in production
 - *Test each profile scenario in-use (authenticated/anonymous)*
 - *Test deviation scenarios (per-site/per-layout profile use)*
 - *Failure to tune properly can result in information “leaking” from one user to another*
- Debug cache information is your friend
 - *Helps you understand how page was evaluated and rendered*

Office Web Apps Cache

The screenshot shows the SharePoint 2010 Central Administration interface. The top navigation bar includes 'Site Actions' and the user 'SPDC\s0ladmin'. The main header displays 'Microsoft SharePoint 2010 Central Administration > Site Collection List'. On the right, there are 'I Like It' and 'Tags & Notes' icons. A left-hand navigation pane lists various administration tasks, with 'Central Administration' selected. The main content area features a 'URL Search' field and a 'Web Application' dropdown set to 'http://spdev:18480/'. Below this is a table of site collections. The entry for '/sites/Office_Viewing_Service_Cache' is highlighted in yellow. To the right of the table is a detailed view for the selected site collection, showing its URL, title, description, primary administrator, email address, and database name. At the bottom right, there are 'OK' and 'Cancel' buttons.

URL	URL	Web Application
/	http://spdev:18480/sites/Office_Viewing_Service_Cache	http://spdev:18480/
/sites/Office_Viewing_Service_Cache	Team Site	
	Description	
	Primary administrator:	SPDC\s0ladmin
	E-mail address:	
	Database Name	WSS_Content_PublishingTestWeb

- Specific to SharePoint 2010

Office Web Apps Cache

■ What it is

- A standard SharePoint site collection (Team Site)
 - *Relative URL: /sites/Office_Viewing_Service_Cache*
- Office Web Apps Cache Creation timer job creates it
- Houses rendered images and XAML for Office docs
- One created per web application

■ Defaults

- Allowed to grow to 100GB
- Documents live for 30 days until they are removed by the Office Web Apps Expiration timer job

Office Web Apps Cache

■ Recommendations

- Relocate cache to a dedicated database using **Set-OfficeSPWebAppsCache** PowerShell cmdlet
 - *Once in its own DB, it can be excluded from backups*
- For web apps housing largely static Office docs
 - *Increase cache expiration period*
 - *Increase cache size*
- For web apps where Office content is volatile
 - *Decrease cache expiration period*
 - *Decrease cache size*

Warnings and Watch-outs

Object caching

■ ACTION

- Cache size reduced (significantly) below 100MB

■ POTENTIAL RESULT

- Object cache fills and becomes memory constrained
- Resource contention and ejections lead to cache compactions
- Under heavy load, nature of compaction process leads to thrashing
- SharePoint's ability to serve pages falls through the floor

■ WHAT TO WATCH

- **Total Number Of Cache Compactions** perf counter
- **Publishing Cache Hit Ratio** perf counter

Page output caching

■ OBSERVATION

- User A requests a page. User B requests same page.
- User B sees information tied to User A

■ POTENTIAL CAUSE

- Page output cache profile isn't granular enough

■ WHAT YOU CAN DO

- Refine the output profile in-use (use additional attributes)
- Set caching exclusions by sub-site or page layout type
- Use post-cache substitution (donut caching) in custom code
- Leverage custom caching handler (IVaryByCustomHandler)

Page output caching

■ OBSERVATION

- Memory consumption of ASP.NET worker process grows significantly; performance may deteriorate

■ POTENTIAL CAUSE

- Too many pages being cached (excessive memory load)

■ WHAT YOU CAN DO

- Adjust caching profiles if possible to reduce page load
- Selectively disable caching for highly varying sub-sites
- Adjust **cache** element values in web.config that control ASP.NET worker process (e.g., **privateBytesLimit**)

BLOB caching

■ OBSERVATION

- Path property is set correctly, but images stored in site collection aren't being cached in file system

■ POTENTIAL CAUSE

- BLOB cache only works with resources that are stored within list items in lists or document libraries

■ WHAT YOU CAN DO

- Leverage built-in libraries such as Site Collection Images
- Move resources to a custom list

BLOB caching

■ OBSERVATION

- Image is changed on a SharePoint site. Some client browsers show new image, others show old image.

■ POTENTIAL CAUSE

- **max-age** attribute is in-use with BLOB caching

■ WHAT YOU CAN DO

- Instruct clients to clear their browser cache
- Avoid using the **max-age** attribute with web apps serving site collections housing very volatile BLOB content
- This behavior is by design

Questions?

References and Resources

- “Caching in Office SharePoint Server 2007”
 - [http://technet.microsoft.com/en-us/library/cc298466\(office.12\).aspx](http://technet.microsoft.com/en-us/library/cc298466(office.12).aspx)
- “Configure cache settings for a Web application (SharePoint Server 2010)”
 - <http://technet.microsoft.com/en-us/library/cc770229.aspx>
- “Disk-Based Caching for Binary Large Objects”
 - <http://msdn.microsoft.com/en-us/library/aa604896.aspx>
- “Manually Clearing the MOSS 2007 BLOB Cache”
 - <http://sharepointinterface.com/2009/10/30/manually-clearing-the-moss-2007-blob-cache/>

References and Resources

- MOSS 2007 Farm-Wide BLOB Cache Flushing Solution
 - <http://blobcachefarmflush.codeplex.com/>
- “Manage the Office Web Apps cache”
 - <http://technet.microsoft.com/en-us/library/ee837422.aspx>
- “MOSS Object Cache Memory Tuning is not an Intuitive Process”
 - <http://sharepointinterface.com/2009/08/30/moss-object-cache-memory-tuning-is-not-an-intuitive-process/>
- “cache Element for caching (ASP.NET Settings Schema)”
 - <http://msdn.microsoft.com/en-us/library/ms228248.aspx>

Contact information

Sean McDonough

Blog: <http://SharePointInterface.com>

Email: sean@SharePointInterface.com

LinkedIn: <http://www.linkedin.com/in/smcdonough>

Twitter: @spmcdonough

The SharePoint 2007 Disaster Recovery Guide

<http://tinyurl.com/SPDRBook>

The SharePoint 2010 Disaster Recovery Guide

<http://tinyurl.com/SPDRBook2010>