"Caching-In" for SharePoint Performance

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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

Web Part caching

HTCP

Office viewing service cache

object cache

disk-based caching

edge caching

CARP

virtual memory

BLOB cache

cacheability headers

in-memory cache

post-cache substitution

fragment caching

ICP

buffer

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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

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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

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 validateIntegratedModeConfiguratio
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="Microso
462        <add name="RSRedirectModule" type="Microsoft
463        <add name="PublishingHttpModule" type="Micro
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"
```
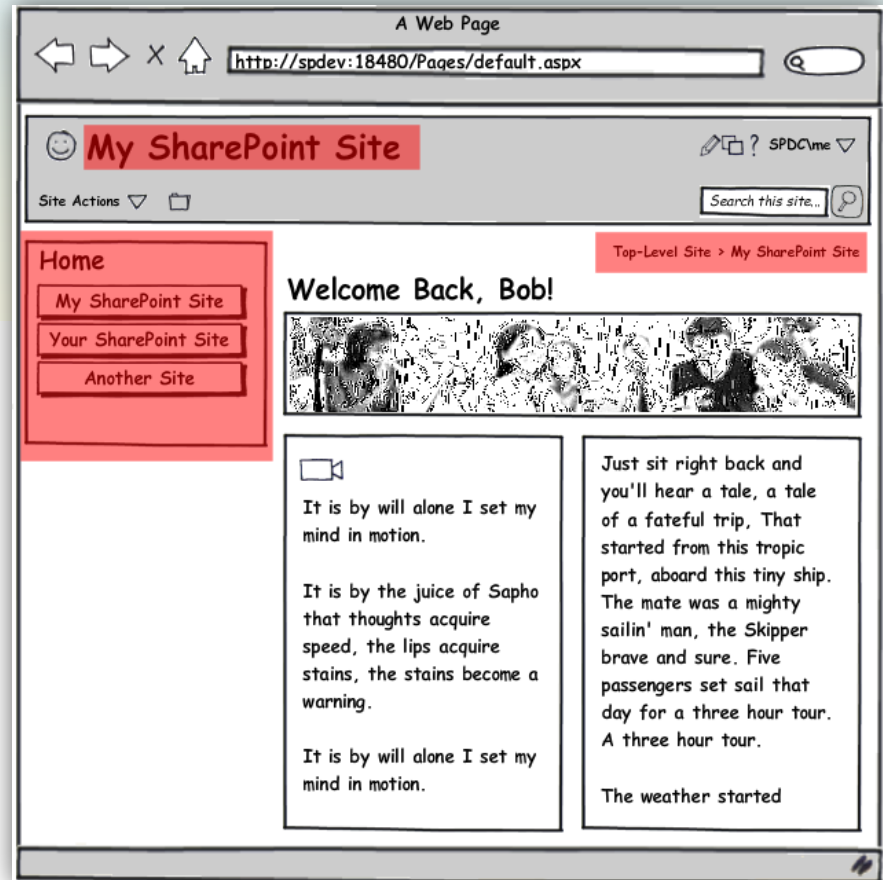
Consider a sample page …
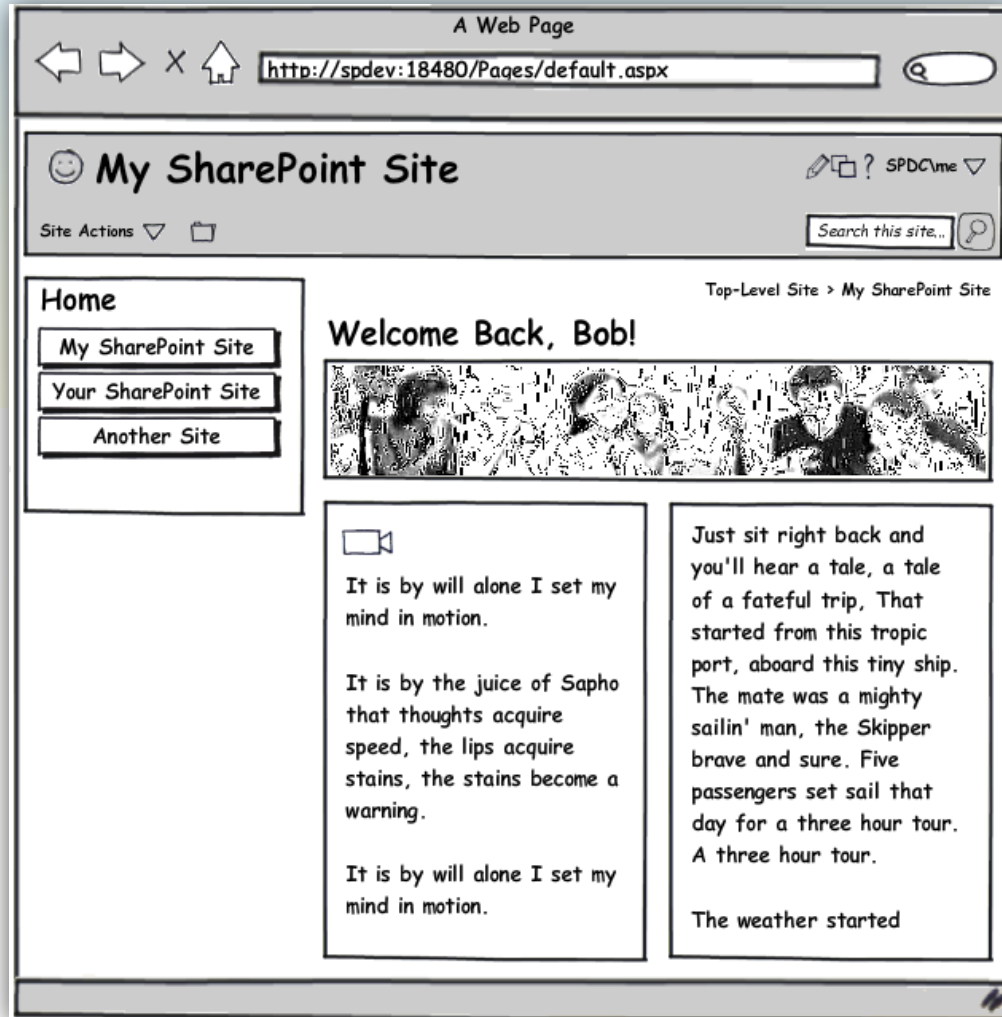
Object caching

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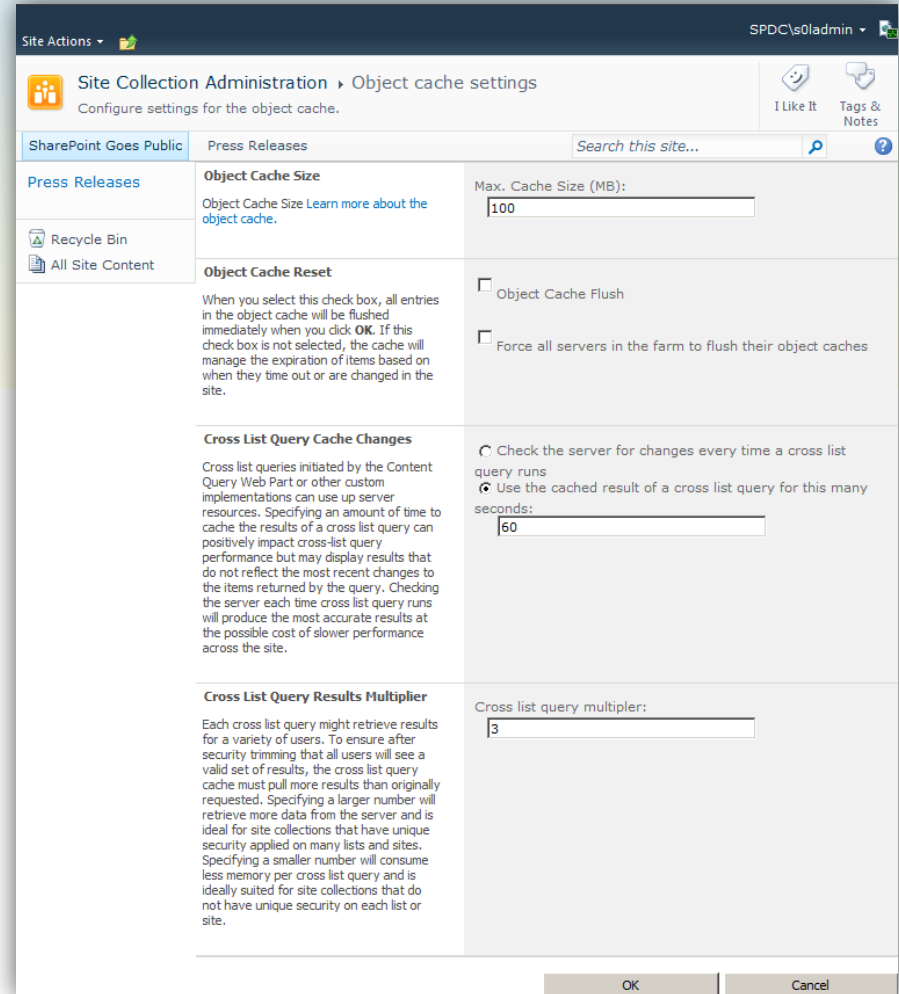 - Site properties
  - Page layouts

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

Object caching

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

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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*

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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

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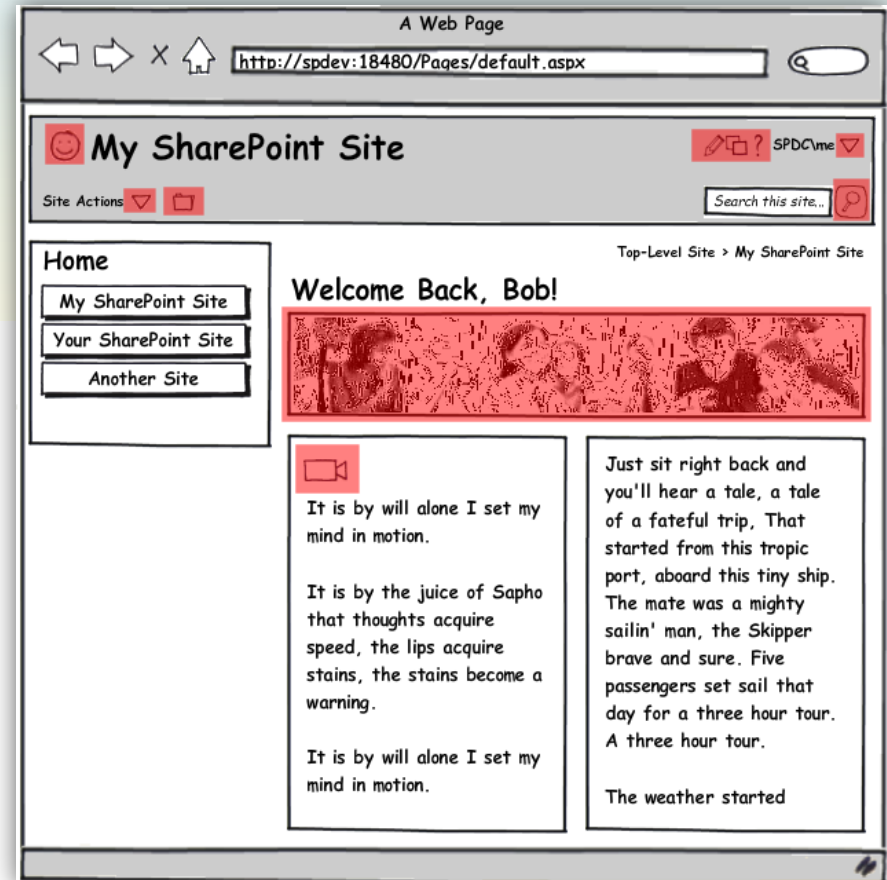
BLOB caching

- ## 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

user's browser

WFE

content database
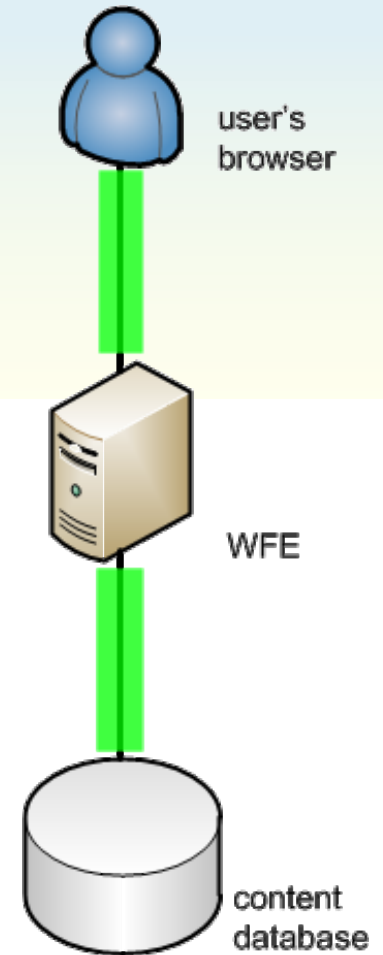
BLOB caching

- ## 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

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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

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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

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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
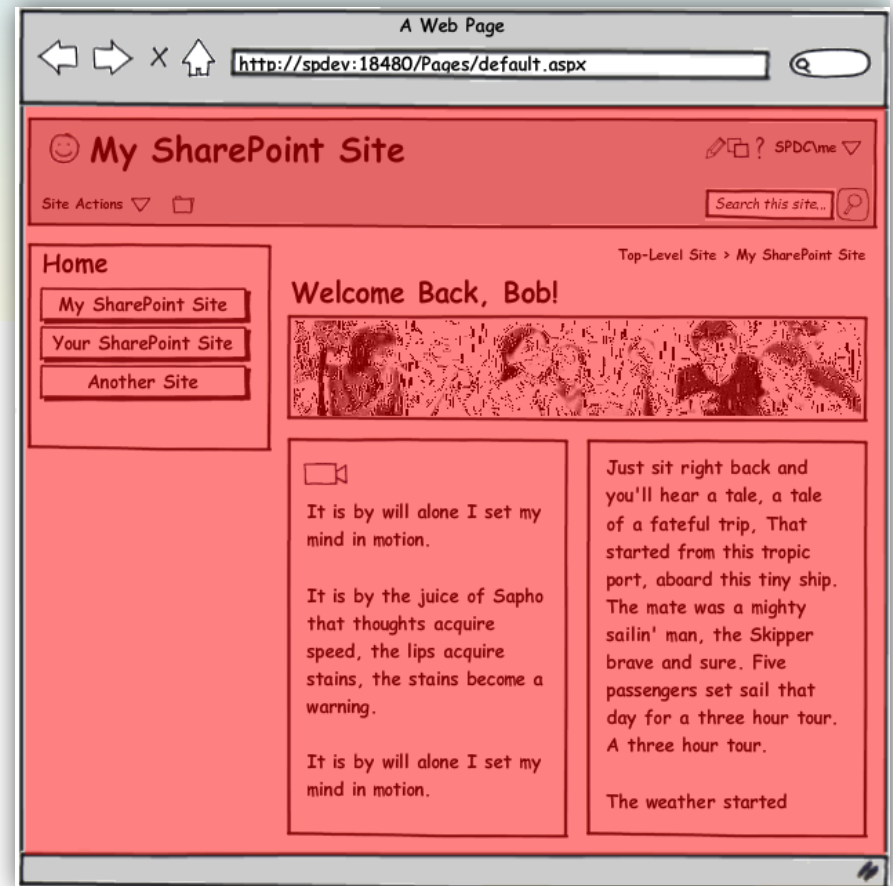
Page output caching

- ## 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

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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

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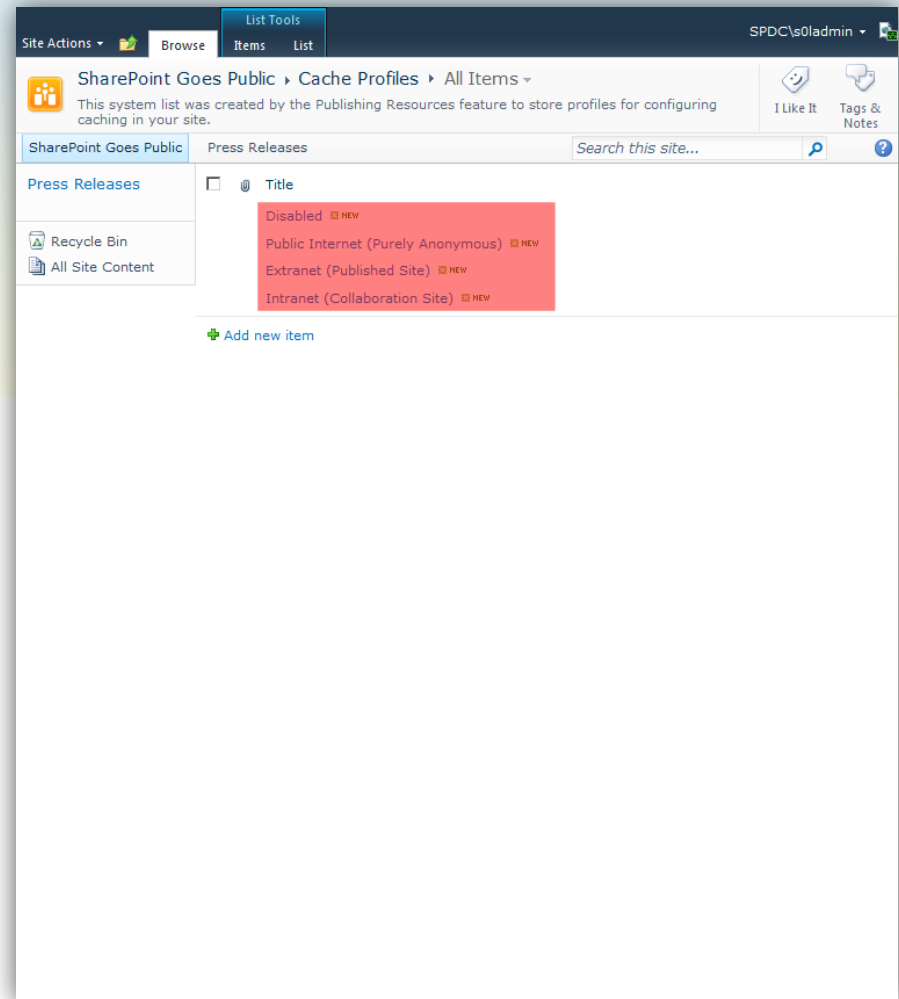
Page output caching

- ## 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

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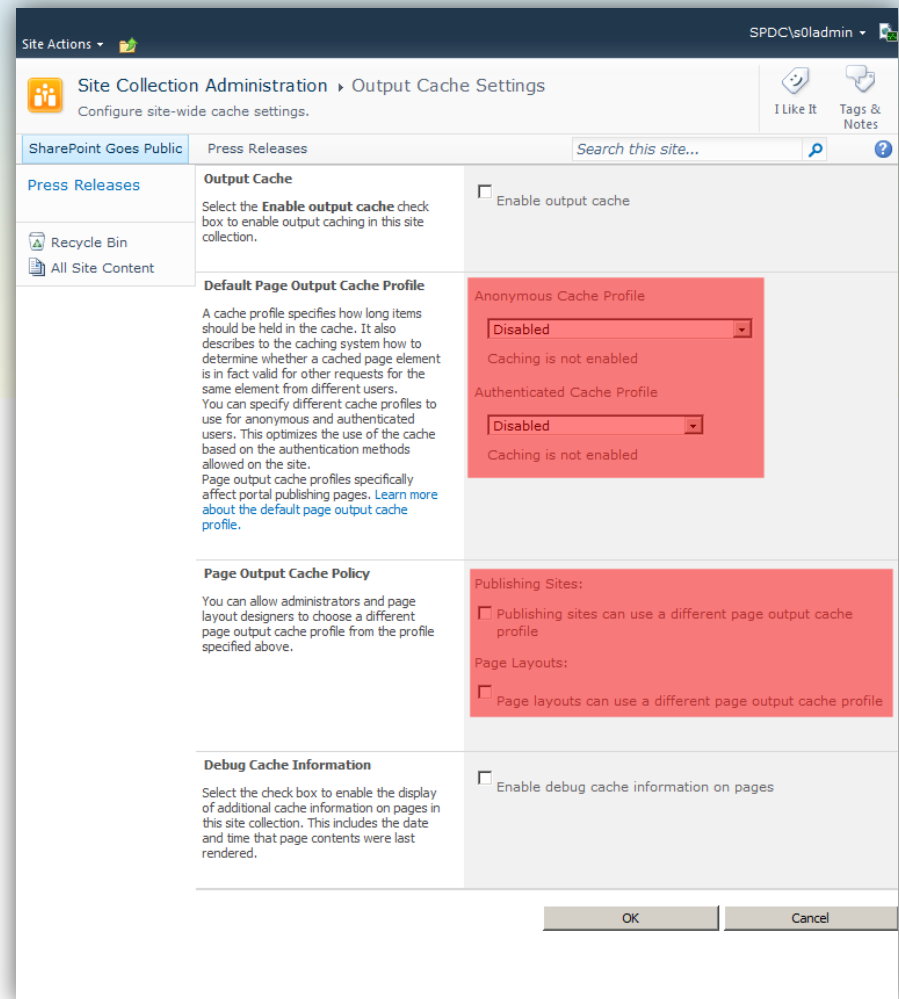
Page output caching

- ## 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

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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*

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Page output caching

- ## Step 5
  - Enable output cache
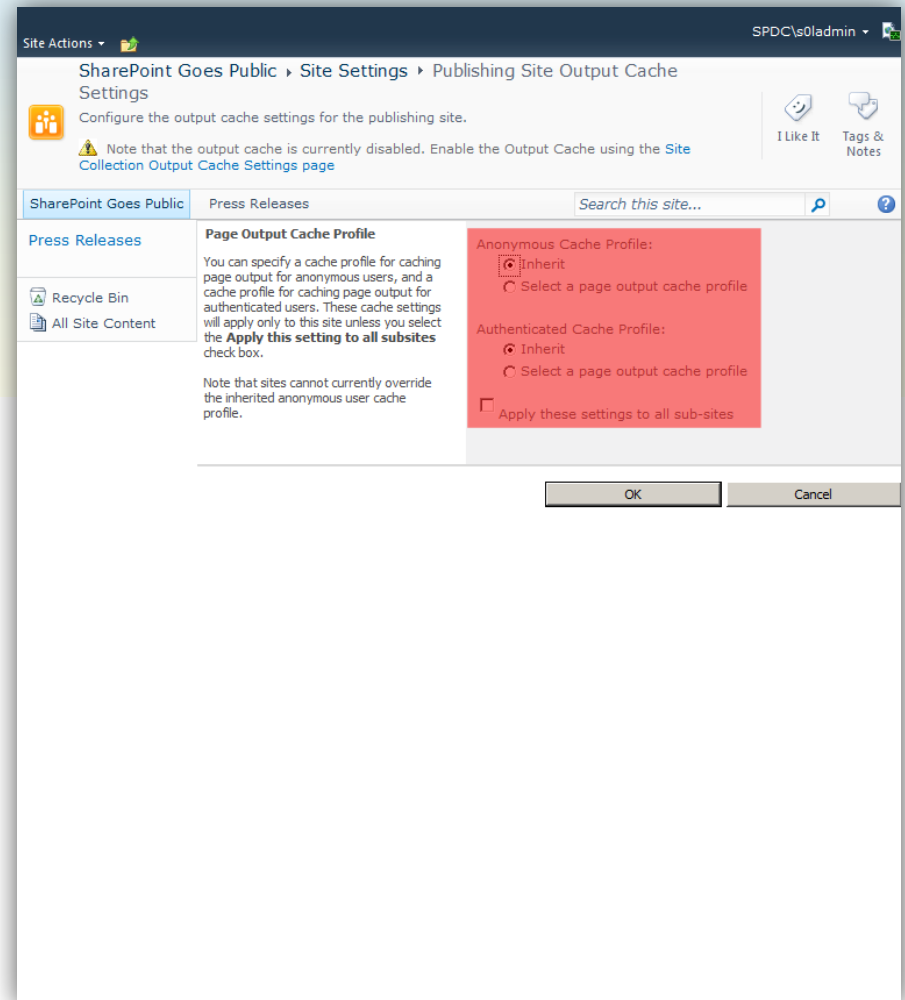   - *Via Site Collection Administration section on Site Settings menu*
    - *Site Collection Output Cache link*
  - Optional debug info can be written as HTML comments to bottom of each page
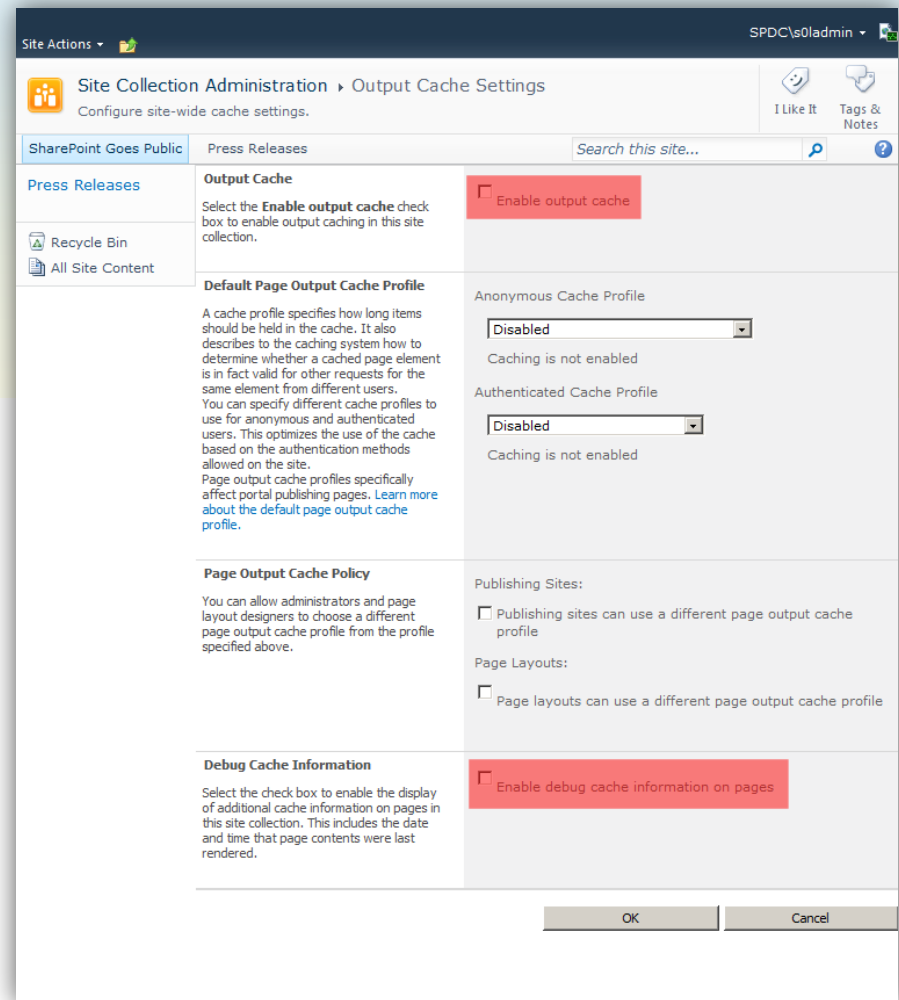
Page output caching

- 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

- 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

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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*

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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

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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
- "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/

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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

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The SharePoint 2007 Disaster Recovery Guide
http://tinyurl.com/SPDRBook

The SharePoint 2010 Disaster Recovery Guide
http://tinyurl.com/SPDRBook2010