“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
- Scenarios quiz
- 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
- Web Part caching
- object cache
- edge caching
- BLOB cache
- in-memory cache
- virtual memory
- Office viewing service cache
- page-output cache
- fragment caching
- disk-based caching
- ICP
- CARP
- cacheability headers
- post-cache substitution
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 primary interest to administrators and what I will be focusing on
  • Object caching
  • BLOB caching
  • Page output caching
  • Office web applications cache

• Mentioned but not covered in any depth
  • Development-related caching (Web Part cache, ASP.NET cache, IVaryByCustomHandler implementation, post-cache substitution, and fragment caching)
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
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
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
BLOB caching

- `<BlobCache>` element in MOSS 2007
  ```xml
  <BlobCache location="C:\blobCache" path="\.(gif|jpg|png|css|js)" maxSize="10" enabled="false" />
  ```

- `<BlobCache>` element in SharePoint 2010
  ```xml
  <BlobCache location="C:\BlobCache\14" path="\.(gif|jpg|jpeg|jpe|jif|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

- **max-age in action – initial request**
  - 125 HTTP requests
BLOB caching

- **max-age** in action – subsequent request
- 11 HTTP requests
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 (per-server) or full-farm 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
    • Primarily managed through a system of profiles
    • 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

• 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 page changes on each request
  • If and 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

Like a big lookup table

1. Page request comes in
2. Key is built based on request
3. Lookup is performed
4. If key is found in cache
   • Page is returned from cache
5. If key isn’t found in cache
   1. Page is rendered
   2. Rendered page is inserted with key
   3. Page is returned
Page output caching

Basics for enabling

Step 1: Create profiles
Page output caching

Basics for enabling

Step 1: Create profiles
Step 2: Select profiles
Page output caching

Basics for enabling

Step 1: Create profiles
Step 2: Select profiles
Step 3: Vary by subsite
Page output caching

Basics for enabling

Step 1: Create profiles
Step 2: Select profiles
Step 3: Vary by subsite
Step 4: Vary by layout
Page output caching

Basics for enabling

Step 1: Create profiles
Step 2: Select profiles
Step 3: Vary by subsite
Step 4: Vary by layout
Step 5: Enable cache
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
  - Contains 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
Scenarios: Quiz Time!
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, compaction process leads to thrashing
• SharePoint’s ability to serve pages falls through the floor

WHAT TO WATCH
• Publishing Cache Hit Ratio performance counter
• Total Number Of Cache Compactions performance 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”

“Configure cache settings for a Web application (SharePoint Server 2010)”

“Disk-Based Caching for Binary Large Objects”

“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”

“MOSS Object Cache Memory Tuning is not an Intuitive Process”

“cache Element for caching (ASP.NET Settings Schema)”
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The SharePoint 2007 Disaster Recovery Guide
http://tinyurl.com/SPDRBook

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