A CIFS Geek in Exile

- or -

What I Did on My Holiday

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Founder and CTO

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Introductions
Me

Your Friendly Neighborhood CIFS Geek

- CIFS Author
- jCIFS project co-founder
- Samba Team member since 97/98
- Incurable Idealist
- Etc., etc., ad nauseam

A ruminant mammal (Geekus geekus) with long legs, humped shoulders, and broadly palmated antlers.
Me

Your Friendly Neighborhood CIFS Geek

Tainted!

- Lead author of the Microsoft [MS-CIFS] and [MS-SMB] specifications.
- Access to MS Internal Information.
- Mustn't touch anyone else's CIFS implementation for one year.

That year is OVER!

A ruminant mammal (Geekus geekus) with long legs, humped shoulders, and broadly palmated antlers.
What I Did on my Holiday
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This is my report on what I did on my CIFS holiday.

I worked on implementing other Windows protocols:

- **BITS Protocol**
  Created STiB: a BITS client toolkit.

- **MS BranchCache™**
  Started implementing PeerDist (BranchCache™).
“BITS is Earth’s most widely used file transfer service, with more than 600 million unique users across the planet.”

– Vipul Bansal, Microsoft WMI Blog, Jan 2009.
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BITS: Background “Intelligent” Transfer Service

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Note Well: nobody cares.
BITS: Background “Intelligent” Transfer Service

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What does that mean anyway?

- It does not say “protocol”, it says “file transfer service”.
- BITS is the Windows system service used by Windows Update to download patches.
- Most users don't even know it's there.
BITS: Background “Intelligent” Transfer Service

BITS Features

- Built into Windows
- Restartable Transfers
  - ...but only linearly; does not “patch”.
- Both Download and Upload
  - ...and “Upload Reply”.
- Job priority levels
- Senses network traffic to manage impact
BITS: Background “Intelligent” Transfer Service

BITS Download Jobs

The overwhelming majority of BITS jobs are probably Windows Update downloads.

BITS Downloads use HTTP/HTTPS.

Sort of like uucp?
wget + batch + nice + diffserv?

The “special sauce” is the use of network traffic monitoring to limit BITS data transfer rates.
BITS: Background “Intelligent” Transfer Service

BITS Upload Jobs

- Much less common.
- Proprietary extensions to HTTP/HTTPS.
- Only between Windows BITS clients and Windows HTTP[S] servers.
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- Proprietary extensions to HTTP/HTTPS.
- Only between Windows BITS clients and Windows HTTP[S] servers – Until now!
BITs: Background “Intelligent” Transfer Service

BITs means:
- Slow Transfer in Background?
- Silly Technology is Boring?
- Sipping Tea in Belgium?
- BITs spelled sdrawkcab with a small ‘i’?

BITs: It Is what It Is.
- ...a toolkit for testing BITs Uploads.
- ...example code for others to read / use.

A CGI script could be written to accept BITs Uploads.
BITS: Background “Intelligent” Transfer Service

BITS Upload Extensions:
- HTTP Extension Method: BITS_POST
- BITS Packet Types
  - Ping
  - Create-Session
  - Fragment
  - Cancel-Session
  - Close-Session
  - Ack

BITS Documentation:
- MSDN: BITS Upload Protocol
- WSPP: [MC-BUP]
BITS: Background “Intelligent” Transfer Service

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Do we care?

YAWP (Yet Another Windows Protocol)

- BITS Upload is supported in IIS,
- and in Microsoft's “lightweight” HTTP server.
- It's convenient when working with Windows,
- Not nearly as powerful as, eg., rsync.
- Not as secure as sftp, scp, or sshfs.
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MS-BITS, however, also supports BranchCache™, which suggests some very useful testing scenarios.

› GET support added to STiB,
› PeerDist included in the header,
› It works!
BITS: Background “Intelligent” Transfer Service

http://www.ubiqx.org/proj/STiB/

STiB is at version 0.2

It contains stibtest, which can:

- Send files using MS-BUP protocol,
- Get files using HTTP1.1,
- Get a subrange of a requested file,
- Specify “peerdist” encoding when requesting all or part of a file.

Please download and test it.
Send patches.
Pay Attention!

This is where it gets interesting.
What the heck is Prequel?
Prequel: A project to build an Open Source Implementation of Microsoft's BranchCache™.

So what the heck is BranchCache™?
Prequel: A project to build an Open Source Implementation of Microsoft's BranchCache™.

BranchCache™ is a distributed content caching system
- supported in W2K8r2 servers,
- and Windows7 clients.

Cheap, effective WAN acceleration for SMB2, HTTP, and BITS.
Prequel

BranchCache Architecture
A quick overview

Content Servers
- Have content to share with multiple clients.

Clients (peers)
- Request & receive content from content servers.

The Cache
- A copy of the original content, divided into segments and blocks; accessed via hash tags.

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Content Servers:

- Web Servers (HTTP, BITS)
- File Servers (SMB2)

The client must know to ask for content tags instead of actual content.

- If the tags are already calculated, they are returned by the BranchCache™-enabled server.
- Otherwise the content is returned, and the server (W2K8r2) calculates the tags for next time.
This is IE 8 indicating support for BranchCache™ by listing “peerdist” as an acceptable encoding.

Accept-Encoding: gzip, deflate, peerdist
Client-side PeerDist Caching

There are two modes of operation:

- Distributed Mode
- Hosted Mode
Distributed Mode
Distributed Mode

- Each client keeps a local cache.
- A client requests PeerDist tags from the server, then broadcasts to find the cached content.
- If the content is not cached,
  - The client requests the content from the content server,
  - The client stores both content and tags in its own cache.

Reminiscent of the CIFS Browse Service.
Prequel

Hosted Mode

Content Server

WAN Link/VPN

Cache
Hosted Mode

A client request tags from the content server.

The client then asks the local cache server for the content.

If the content is not cached, the client requests content from the content server.

The client sends both content and tags to the cache server.

Content can now be retrieved from the cache server using only tags.

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Content Tags

Blocks
- Are a unit of download  
  (from either the content server or cache server)
- Are 64K  
  (or less, for the last block in a file only)

The block tag is an SHA\{\text{256}}\{\text{384}}\{\text{512}} hash of the block.

Segments
- Are a unit of discovery
- One segment is \text{32M} \equiv 512 \text{ blocks}  
  (or less, if the last block is short)

Segments are identified by a hash of the block hashes.
Prequel

Prequel Goals

I. Content Server
   - CGI script for Apache that generates correct tags.
   - Server-side code to provide a starting point for Samba implementation.

II. Peer Cache
   - Implement a stand-alone peer caching client.
   - Maybe a FUSE file system on top.

III. Cache Server
   - Implement a Hosted Cache server.
Prequel does not have a release number yet.

pq_cgi – CGI program to generate PeerDist Content Information.

* Tested with Apache.

pdDump – Pretty-print Content Information.

*_key_dx – Extract W2K8r2 Server Passphrase and Server Secret

http://www.ubiqx.org/proj/Prequel/
Prequel Daemon
Conceptual Overview

Source Files

Cache Files
Demo?
Other Stuff
The End