Scalable Development Environment
Cisco Approach.

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Agenda

- Cisco’s ClearCase infrastructure
- How we standardize ClearCase
- Our MultiSite Implementation
- ClearCase Admin Tools
- ClearCase Development Tools
Our Responsibilities

- Develop and deploy admin and development tools.
- 24x7 direct support to clients around the globe
  - Multiplatform – Unix, Windows, Linux
- Manage and support ClearCase on servers worldwide
  - Deployment
  - License management
- Develop and implement standard configurations
  - Admin/User Documentation
- Planning for growth and scaling
  - Average of ~7 acquisitions per year
- Monitor reliability and performance
# Our Infrastructure

<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering Sites</td>
<td>20</td>
</tr>
</tbody>
</table>
| ClearCase Licenses              | 3,858 deployed  
|                                 | 3,963 purchased |
| Users (last 90 days)            | 8,870  |
| VOB Servers                     | 120    |
| View Servers                    | 418    |
| License/Registry Servers        | 77     |
| Clients                         | 6,589  |
| VOBs                            | 1,733  |
| Replicas                        | 5,558  |
| Used VOB Storage                | 22,752 GB |
| Views                           | 81,311 |
| Active Views                    | 39,475 |
| Used View Storage               | 53,490 GB |

![Graph showing number of servers over time](chart1.png)

![Graph showing number of clients over time](chart2.png)

Last Updated: 5/1/06
Support Ratio

Multiple companies were polled to determine the average support ratio for a large scale ClearCase infrastructure. The lowest ratio was 1:50, the highest was 1:275, resulting in an average of 1:152. **Cisco’s support ratio is 1:682.**

*Release support, build management, and custom tools were not considered.*
Our Cell Architecture

- **VOB Server A**
  - SAN VOB storage
  - VOB server processes
  - DB Servers

- **VOB Server B**
  - SAN VOB storage
  - VOB server processes
  - DB Servers

- **VOB Server C**
  - SAN VOB storage
  - VOB server processes
  - DB Servers

- **License/Registry Server A**
  - License server
  - Registry server
  - Local region
  - Clients are view servers & desktops

- **Desktop A**
  - NAS view storage
  - View server processes
  - Normally 1 CC user

- **Desktop B**
  - NAS view storage
  - View server processes
  - Normally 1 CC user

- **View Server A**
  - View storage
  - View server processes
  - Lots of memory & cpus
  - Multiple, parallel builds

- **License and Registry services**
- **VOB services**
How we standardize ClearCase

At Cisco, a strong partnership between the system administrators and the ClearCase group allows us to globally standardize our environment.

- Consistent hardware, operating systems, and system patches.
- ClearCase is installed **locally** on all servers & clients.
  - All servers run the same ClearCase version.
  - Servers and clients have a standard list of components installed.
- Custom user account for CC Admin tasks.
- Consistent configuration of the registry across all servers.
- Installation of a custom set of monitoring tools (ccadm) on all servers & clients. Jobs invoked by the ClearCase scheduler.
- All processes and procedures are documented.
VOB Server Standardization

We have two configurations for VOB servers. The Sun V1280 is used for sites that will either have a large number of VOBs or VOBs that are very active. The Sun V480 is used for smaller sites. All VOB servers run Solaris 8.

- VOB server access is restricted to administrators.
- VOB server WAN/LAN connections are FiberGig and CopperGig gigabitEthernet.
- Custom lockmgr parameters
  - The number of simultaneous open files (-f) must be greater than 7 times the number of local VOBs.
- VOB storage filesystems are backed up twice per week.
- Separate storage on a filer is created for cleartext cache.
  - Less I/O strain on the VOB server. Faster cache access.
- Custom shipping bays for MultiSite on dedicated disks.
VOB Standardization

Consistency is important when supporting a large number of VOBs. We try to make all VOBs look the same.

- **VOB names**
  - Pattern is /vob/<project>

- **Replica names**
  - Pattern is <site>-<role>
    - <site>-master, <site>-backup, <site>-1 … <site>-N, <site>-test

- All replicas are self-mastering and identity preserving.

- All VOBs have at most 1 master replica, at least 1 backup replica, and any number of other production replicas.

- Ops only kept for 180 days.
  - Helps us manage the size of a VOB’s database and VOB storage filesystem.
Safety Triggers

IBM recommends that all VOBs have a set of safety triggers to prevent users from invoking dangerous commands. Our safety triggers were developed internally and are designed to:

- Restrict users from invoking rmelem, rmver, rmttype, and rmstream.
- Prevent the creation of duplicate elements (a.k.a. evil twins).
- Remove the 0th element version on empty branches.
- Add group write permissions to directories.
- Prevent developers from creating their own triggers.
- “Are you sure?” prompt to users when running rmlabel, rmbranch, rmattr, and mv.

Safety triggers are consistent across all VOB replicas. No site specific triggers are supported by the ClearCase team.
MultiSite, Multi-National
Getting the most out of MultiSite

We use a custom set of wrapper tools on top of MultiSite to manage VOB syncs.

- All VOBs are updated every 30 minutes through a scheduler job.
- Sync packets follow a standard naming convention.
  - sync^<LocalHost>^<LocalReplica>^<pid>^<Vob>^Date
- The hub for most VOBs is the master replica.
  - xxx-master sends to all spokes (xxx-1, xxx-2) and xxx-backup
  - xxx-backup sends to xxx-master
  - All spokes (xxx-1, xxx-2) send to xxx-master
- Sync targets are automatically chosen using the above algorithm.
- The status of all VOB syncs is send to our central logging server.
- Errors are reported to our Admin Console.
Getting the most of out MultiSite

- The number of parallel MultiSite processes is automatically determined by looking at the host’s configuration and the number of local VOBs.
- Turning off syncs to any VOB, host, or site is as easy as adding a line to a configuration file (graphically via the Host Portal).
  - Very useful during server or site downtimes.
  - Obviously very dangerous too. Only CC Admins can turn off syncs.
- Some common MultiSite errors are automatically fixed by our syncing scripts.
  - Pesky NOBODY ops from Windows clients
  - VOBs missing a group (all of our replicas are identity preserving)
  - Cannot get version statistics (usually a permission problem)
  - VOB locks (syncs restarted automatically)
MultiSite Hub Architecture

- **San Jose Server (Hub)**
  - **rtp-backup** to **NC Backup Server**
  - **sj-master**
  - **India Server**
    - **cbin-1**
  - **Texas Server**
    - **rcdn-1**
  - **NC Server**
    - **rtp-1**

- **Other Replicas**
A Closer Look at our Largest Product

We implemented 3 hubs for our largest product due to the massive amounts of weekly operations.

This product is actually contained in a group of 10 VOBs. Symlinks are used extensively so it looks, acts, and feels like one VOB.

- VOB accessed by over 4,000 users.
- MultiSited to 57 replicas and 18 worldwide sites every 30 minutes.
- Total VOB size is 148 GB.
- Average of 150,000 operations per week.
- Creating a new set of replicas takes about 1 week.
Cisco ClearCase Admin Tools

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ClearCase Admin Tools

We developed a set of tools to monitor the health of ClearCase and track usage. The tools protect data integrity by constantly monitoring the environment and automatically fixing issues before users are impacted.

- We call them the ccadm tools.
- Developed internally by the ClearCase team.
- Installed on every server and most clients.
- Used to monitor the health of ClearCase, inventory, capacity planning, and trending analysis.
- All jobs run through the CC scheduler.
- All web reports updated dynamically.
- All warnings reported to our Admin Console and an email alias.
## ClearCase Admin Console

### Useful Quick Links
- SCM:CI
  - SCM Admin Docs
  - ClearCase User FAQ's
  - CCADM Knowledge Base
  - CCADM Host Portal
  - ClearCase Vendor Docs
  - Warning Suppressor
  - CCADM Trace Map Pages
  - Frontline Coverage
  - Hotline Phone Forwarding
  - Temporary Licenses
  - ClearCase Servers
  - Infrastructure Report
- IBM/Rational
  - ClearCase Technote
  - Supported Releases
  - Open a case with IBM
- ECS
  - CM Notices
  - ECS Boardcast
- GTSC/Support
  - Alliance Case Updates
  - Software.

### User Submitted Problems/Comments

<table>
<thead>
<tr>
<th>Host(s)</th>
<th>Site</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>host5, host6</td>
<td></td>
<td>Host(s) is Restricted VOB servers. Added on 05/12/2006 11:47 by John Doe. Host5 and host6 are restricted VOB servers administered and supported by the Foo Bar team. Contact John Doe for any issues. Estimated Fix Date/Time: N/A. Update Problem: Remove Problem.</td>
</tr>
</tbody>
</table>

### Priority 1 Problems

<table>
<thead>
<tr>
<th>Host</th>
<th>Site</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>host1</td>
<td></td>
<td>Host(s) is Missing MultiSite syncs. Missing sync for project1, barb-1 ... sj-master. Recommend Solution: Suppress Problem. View Comments: jones2 was on 04/03/2006 15:30. John Doe is working on this. He will add the sync lines to the crontab. Update Comments.</td>
</tr>
<tr>
<td>host2</td>
<td></td>
<td>Host(s) is Missing MultiSite syncs.</td>
</tr>
<tr>
<td>host3</td>
<td></td>
<td>ClearCase license expirations.</td>
</tr>
</tbody>
</table>

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Add A Problem to the Board.
ClearCase Admin Tools

Listed below is an overview of the data we collect and the responsibilities of our admin tools.

- ClearCase & Host configuration, status, and license strings
- ClearCase and host performance statistics
- ClearCase view, VOB, and server usage statistics
- Identify and fix common view and VOB misconfigurations
- Identify inactive views and VOBs
- Backup the ClearCase registry
- Kill runaway view_server processes
- Scrub the lost+found directory of all VOBs.
- Remove references to views that no longer exist.
Host Portal

This is the Host Portal’s home page. From here, ClearCase admins have access to any and all data we collect for a ClearCase host. The filters help limit the search criteria.

<table>
<thead>
<tr>
<th>Filter</th>
<th>Hostname</th>
<th>Host OS</th>
<th>Host Theater</th>
<th>Country</th>
<th>Class</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>SCM Core Infrastructure Servers</th>
</tr>
</thead>
<tbody>
<tr>
<td>hostname</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>host1</td>
</tr>
<tr>
<td>host2</td>
</tr>
<tr>
<td>host3</td>
</tr>
<tr>
<td>host4</td>
</tr>
<tr>
<td>host5</td>
</tr>
</tbody>
</table>
We track disk usage for the:

- Entire VOB
- VOB database
- VOB source pools
- VOB cache
- VOB derived objects
Performance data we track include:

- `ct lsview`
- `ct lsvob`
- `cd <view>/<vob>; ls`
- `ct desc vob:<vob>`
- Process Counts
- CPU Load Average
- CPU Utilization
- Physical Memory
- Swap Memory
- Ping Times
Host Portal – Server Dependencies

Understanding a server’s dependents helps us:

- **Notify** the correct client base during a downtime
- **Predict** the severity of an outage (how many clients or servers will be affected)
- **Identify** cross WAN VOB/view mounts like the one below
Cisco ClearCase Development Tools

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Why tools ?

- Work smarter – Not harder!
- Thousands of CC users
- Workflow automation – Change tracking
- Geographically distributed development sites
- Various Technology Groups - Numerous release streams
- Streams management
- Quality control
- Build and release management
How tools are architected?

- Activity based workspace
- Automatic Configuration Specification management
- Branch mastership
- Integration with bug tracking system, MIS, Multisite.
- Component based development
- Quality controls
- Scalability and performance
How do we develop tools?

- Object Oriented Perl
- Oracle Database
- Clearcase metadata and triggers
What do we do with tools?

- **Activity based workspace**
  - Create activity specific view
  - Automatic config spec generation
  - Update the workspace with latest changes
  - Pre-checkin quality criteria
  - Seamless delivery of changes to development stream
  - Reuse of workspace
Component based development

- Independent repository per component
- Independent component development stream
- Bug fixes to component repositories
- Batching of bug fixes to different development streams
Branch management

- Finer control on the changes being accepted.
- Sub branches to develop new feature sets
- Branching strategy to manage various product development
- Sharing of code base within various products.
- Propagating changes between related branches.
- Lifecycle of a development branch
What works best for us?

- Scalability
- Propagating feature sets
- Failure handling – High availability
- Error handling
- Virtual labeling – reduced multisite operations
Our concerns

- Performance – Interfacing with various other software tools
- Tools are growing and becoming complex
Questions
Thank You

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