

LSI's VMware vCenter Plug-In: A Study in the Use of Open Source Software

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The goal for the presentation is to share our experience with open source in the hope that it will provide insight and guidance.

Bio – Brian Mason

- ❑ Staff Software Engineer at LSI
- ❑ Master in Computer Science
- ❑ 20+ years development experience
- ❑ Most of the past 11 developing Management and Control Software for hardware devices.

Bio – Erik Johannes

- ❑ Staff Software Engineer at LSI
- ❑ Master of Computer Science
- ❑ 25 years industry experience
- ❑ Variety industries including Storage, Telecommunications, and ATE.

- ❑ **Brief Background**
 - ❑ What our group does
 - ❑ Architectural Overview of LSI vCenter plug-in
- ❑ Options and Consideration
 - ❑ Why Open Source?
 - ❑ Evaluation Criteria
- ❑ Experience with Specific packages
 - ❑ Runtime Open Source Libs
 - ❑ Development Tools

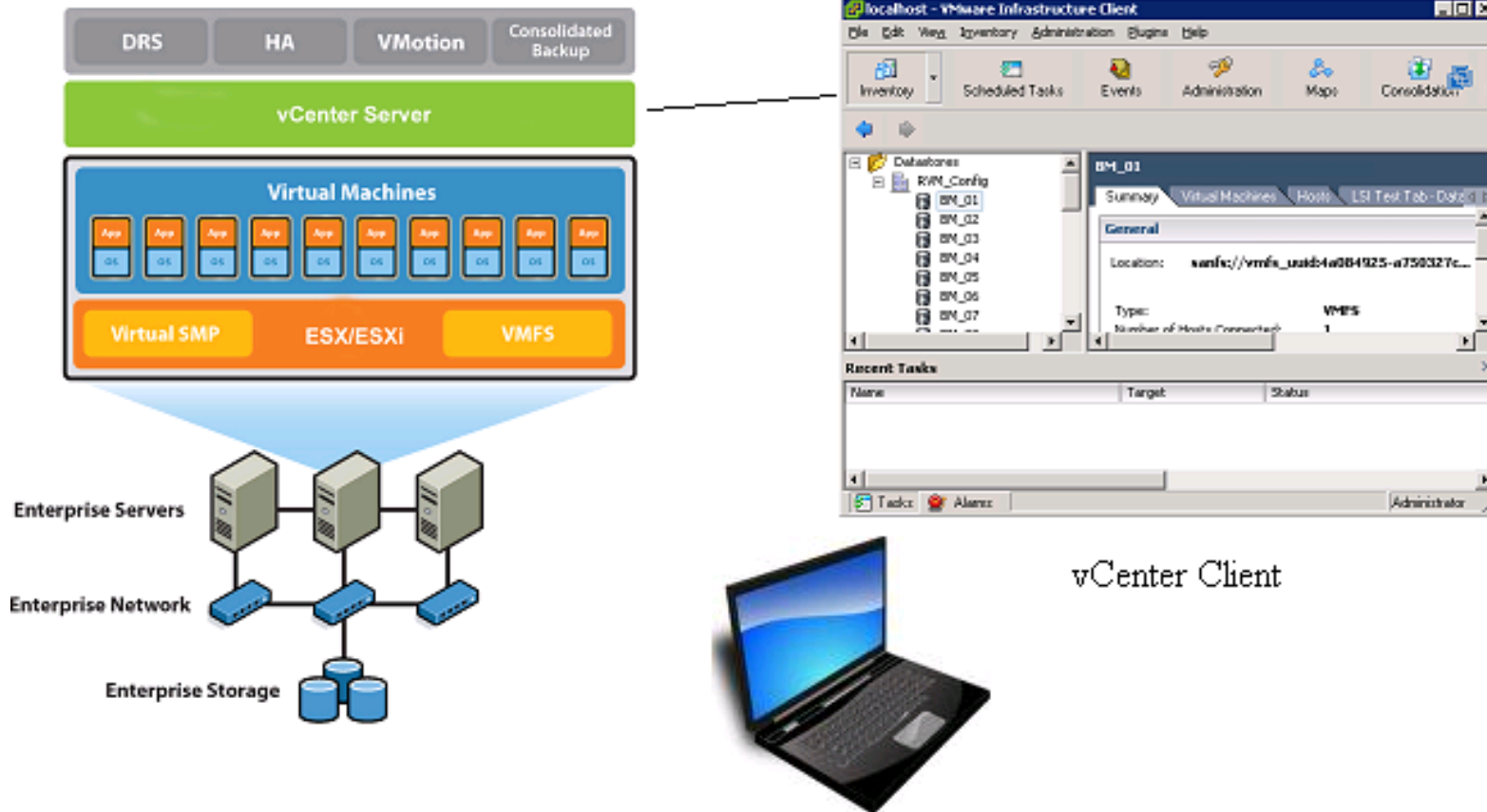
- ❑ The Engenio Storage Group develops storage products:
 - ❑ Host Bus Adapters and Internal RAID controllers
 - ❑ NAS Gateways
 - ❑ External RAID systems
- ❑ Many of our products are sold through OEM partnerships.

- ❑ The goal is to integrate with End User Applications
 - ❑ Management of our Storage Arrays.
 - ❑ Improve the efficient use of our Storage Arrays.
 - ❑ Provide a single pane of glass familiar to user.
- ❑ Integration examples are
 - ❑ Oracle's Enterprise Manager.
 - ❑ Microsoft's System Center Operations Manager.
 - ❑ VMware's vCenter virtualization manager.

Management TLA Soup Defined

- ❑ Hyper Text Transport Protocol (HTTP/HTTPS)
- ❑ eXtensible Markup Language (XML)
- ❑ Distributed Management Task Force (DMTF)
- ❑ Common Information Model (CIM)
- ❑ Web-Based Enterprise Management (WBEM)
- ❑ Storage Management Initiative Specification (SMI-S)
- ❑ CIM Object Manager (CIMOM)
- ❑ Virtual Machine (VM)
- ❑ Virtual Infrastructure or VMWare Infrastructure (VI)

VMWare vCenter/vSphere



- ❑ The plugin is registered with the server
- ❑ Registration indicates where in the client to display plugin and the URL for the plugin
- ❑ Client display integration points include:
 - ❑ Additional Tab added to object's display
 - ❑ Object's right click menu items
 - ❑ An icon added to the home page
 - ❑ The entire display
- ❑ Recommend following VMWare UI guidelines

The vSphere Client

The screenshot displays the vSphere Client interface with the LSI Storage vCenter2 Plug-in configuration for a storage array. The main window shows the 'Capacity' section for the array 'XBB-7-7091-77-78'. A pie chart illustrates the storage usage: Unconfigured (4.97 TB), Free (6.33 TB), Used (2.24 TB), and Hot Spare (0 Bytes).

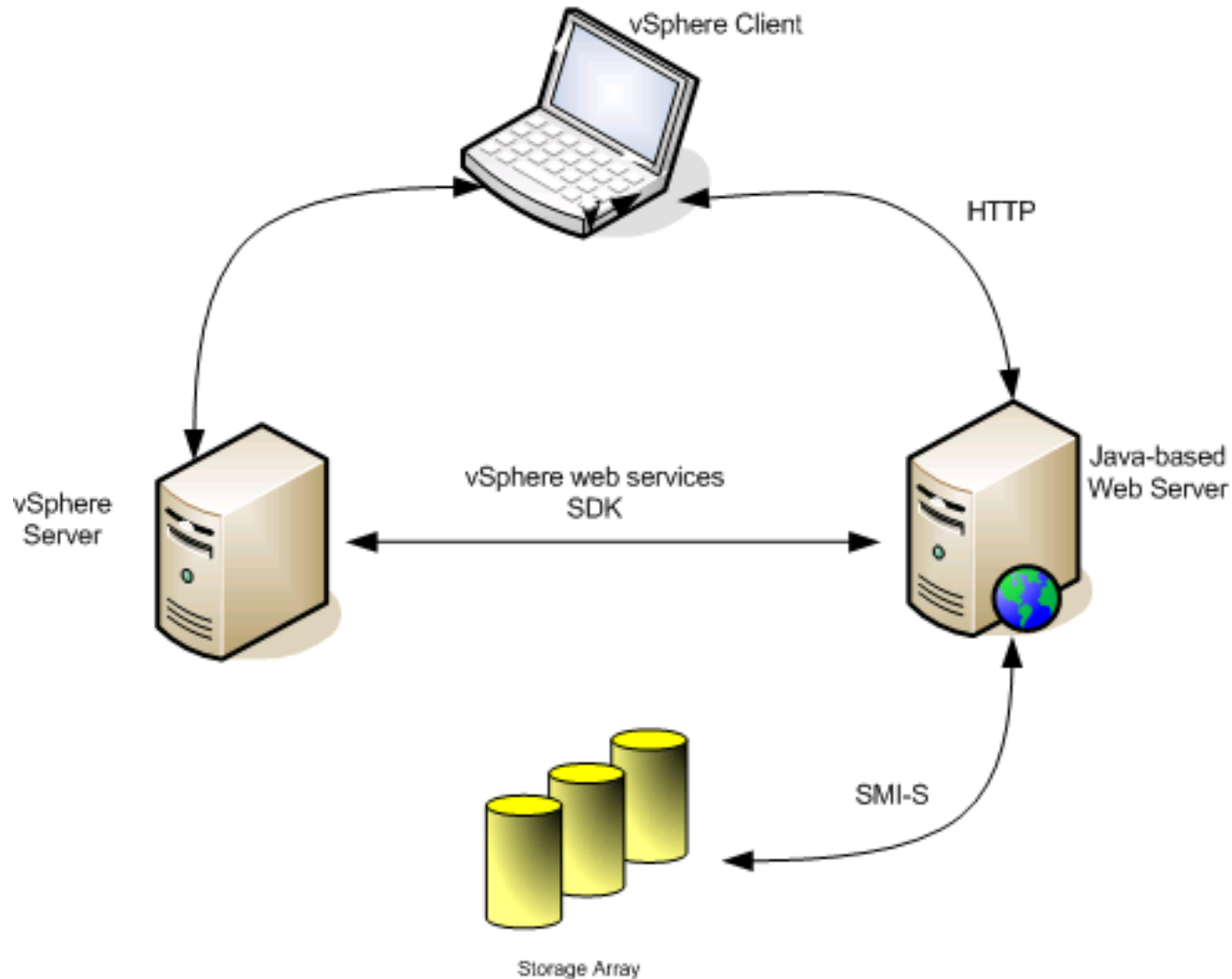
The 'Capacity' section includes the following details:

- Name: XBB-7-7091-77-78
- Status: optimal
- Controllers: 2
- Failed Controllers: 0
- Trays: 6
- Drives: 78
- Drive Type: Fibre, SATA
- Hot Spares: 0
- In Use: 0
- Stand by: 0

The 'Commands' section includes links for 'Edit Array Properties' and 'View Event Log'. Below the main window, a table lists storage resources:

Storage1 (1)	Extent	Extent Type	Lun Number	Status	ESX Host	Sto
	VMHBA0:1:0	SCSI	0	✓	147.145.50.223	--
	600A0B800047398A00008A234BD8179F	Fibre	1	✓	ESX_223_A	XBB-7-7
	600A0B800047398A00008A254BD81927	Fibre	0	✓	ESX_223_A	XBB-7-7
	60080E50001B524C0000011F4C3BF1E7	Fibre	5	✓	ESX_223_A	Snowma
	60080E50001B52720000012E4C3BF253	Fibre	4	⚠	ESX_223_A	Snowma
	60080E50001B524C000001234C3BF291	Fibre	3	✓	ESX_223_A	Snowma
	60080E50001B5272000001304C3BF2A7	Fibre	2	⚠	ESX_223_A	Snowma
	60080E50001B5272000001214C3BF243	Fibre	1	⚠	ESX_223_A	Snowma
	VMHBA2:3:0	Fibre	0	✓	147.145.50.223	--
	VMHBA2:3:1	Fibre	1	✓	147.145.50.223	--
	600A0B80004739CC0000937C4C3F313F	iSCSI	2	✓	ESX_223_B	XBB-7-7
	600A0B800047398A000090F4C3F30DA	iSCSI	1	✓	ESX_223_B	XBB-7-7
	600A0B80004739CC0000937A4C3F3116	iSCSI	0	✓	ESX_223_B	XBB-7-7
	60080E50001B5272000001324C3BF2F3	Fibre	0	✓	ESX_223_A	Snowma
	VMHBA0:0:0	SCSI	0	✓	147.145.50.223	--
	VMHBA35:4:1	iSCSI	1	✓	147.145.50.223	--
	VMHBA35:4:0	iSCSI	0	✓	147.145.50.223	--

LSI's vCenter plug-in Architecture



- ❑ **Brief Background**
 - ❑ What our group does
 - ❑ Architectural overview of LSI vCenter plug-in
- ❑ **Options and Considerations**
 - ❑ Why open source?
 - ❑ Evaluation criteria
- ❑ Experience with specific packages
 - ❑ Runtime open source libs
 - ❑ Development tools

Why We Use Open Source

- ❑ Free as in Speech
 - ❑ Fast Bug fix turn around
 - ❑ Freedom to fix it ourselves
 - ❑ Nothing is hidden
 - ❑ Many testers
- ❑ Free as in Beer
 - ❑ Nothing is free, but often cheaper
 - ❑ Cost in Evaluation and Internal Support
- ❑ Often Best in Class

- Does it meet our needs?
- Can I compile it?
- Is it an Active Community?**
 - Frequent / Current Releases
 - Active Wiki or mail group
- Is it standards based?

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 - ❑ Development Tools

Runtime Open Source Libs

- Java
- Jetty
- SBLIM
- GWT And GWT Incubator

- ❑ The whole plug-in is written in Java
- ❑ The system is packaged as a Web Application
- ❑ Can be deployed on JEE Application Container
 - ❑ We shipped Jetty
- ❑ Used Java 6
- ❑ Used JMX for monitoring
- ❑ JSR 48 Compliant CIM Client (More later)

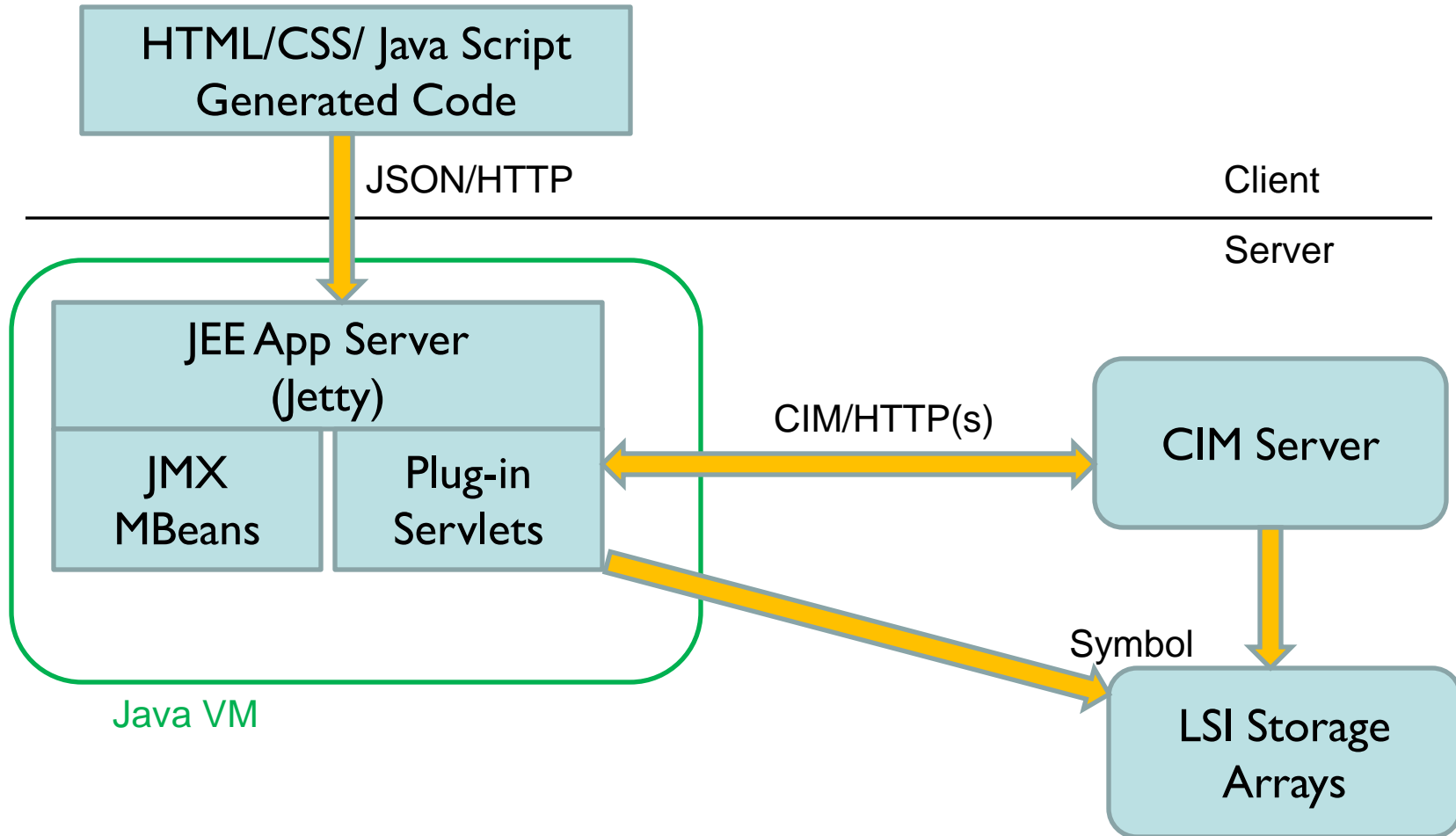
Java Development Advantages

- ❑ Familiar syntax makes for an easy transition.
- ❑ Object oriented.
- ❑ Lowers concerns about resource leaks.
- ❑ **Massive** library support
- ❑ Rich IDE Support
- ❑ Built in remote debugging and profiling
- ❑ Compiles very fast

Java Deployment Advantages

- ❑ Extremely stable
 - ❑ Has redefined P1 bugs
- ❑ Runs on all platforms we need
 - ❑ (AIX, HPUX, Solaris Windows, Linux, Mac)
- ❑ Single compile target for all platforms
- ❑ No DLL Issues
- ❑ Built in monitor via JMX
- ❑ Fast performance

Details System Architecture



Runtime Open Source Libs

- Java
- Jetty
- SBLIM
- GWT And GWT Incubator

- ❑ Open Source “light weight” Web Server
- ❑ Java Web Application Container
 - ❑ Static HTML
 - ❑ Servlets / JSP
 - ❑ SSL
 - ❑ Many more ...
- ❑ Pluggable Architecture
- ❑ Used as our App Server

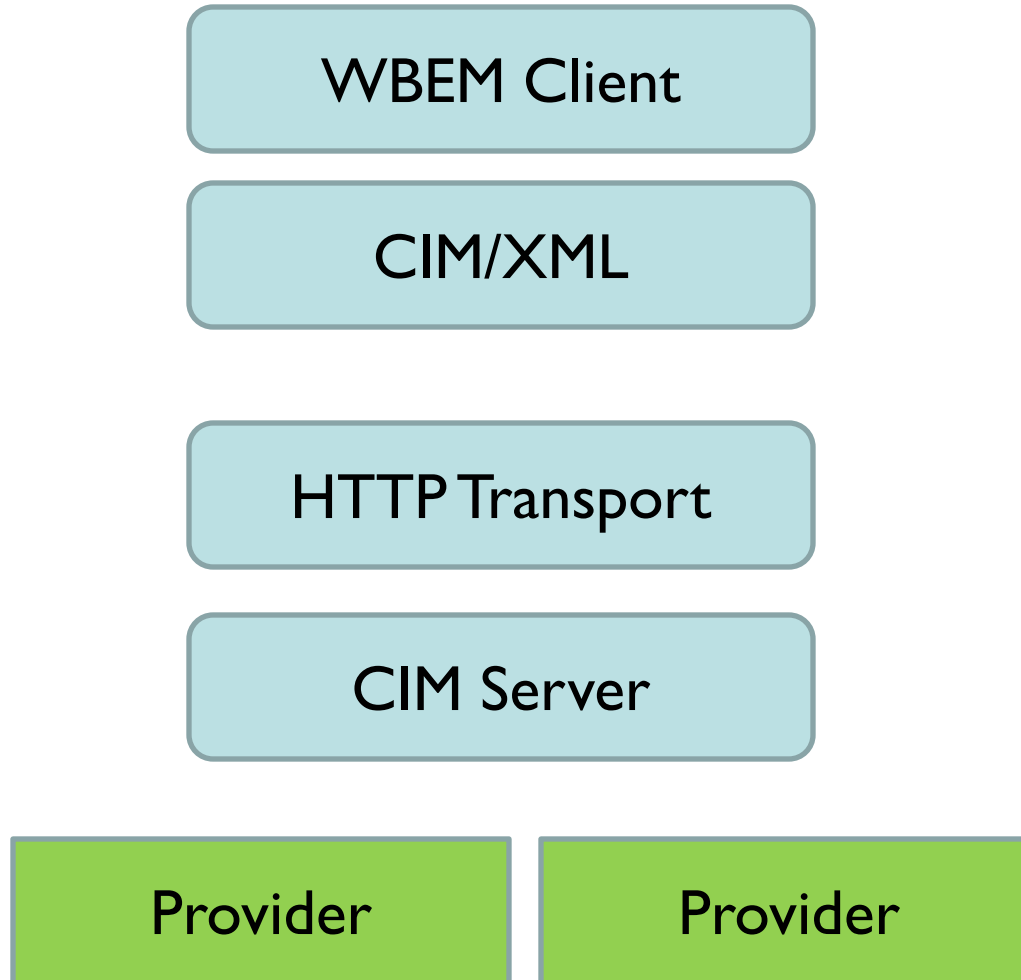
Tomcat Alternative

	Jetty (6.1.x)	Tomcat (6.x)
Memory Footprint (With our WAR)	28MB	38MB
Modular	Yes	No
Servlet/JSP Support	2.5/2.1	2.5/2.1
Embeddable	Yes	No

Runtime Open Source Libs

- Java
- Jetty
- **SBLIM**
- GWT And GWT Incubator

WBEM Stack



- ❑ Used as CIM client
- ❑ Has a 1.x And 2.x version streams
- ❑ 2.x (2.1.5 current)
 - ❑ Requires Java 5 or higher(Generics)
 - ❑ Implements JSR 48
- ❑ **1.x and 2.x NOT COMPATIBLE**
 - ❑ Source package change for JSR 48
 - ❑ No known upgrade path

- ❑ Presents a CIM logical abstraction
 - ❑ CIM Instance
 - ❑ CIM Classes
 - ❑ Typed Key / Value Properties
 - ❑ Associations
- ❑ **No XML Processing!!**
- ❑ Supports indications

- Navigation
 - Enumerate Classes
 - Enumerate Instances
 - Enumerate Association Classes
 - Follow Associations
- Filtering
 - Filter Properties
 - Filter Instances returned by Associations

SBLIM Sample

```
WBEMClient client=getClient();
CIMProperty prop;
CloseableIterator<CIMInstance> poolIt;
poolIt=client.associatorInstances(storageSystem,
    "CIM_HostedStoragePool", "CIM_StoragePool",
    "GroupComponent", null, false, null);
while (poolIt.hasNext()){
    CIMInstance poolInst = poolIt.next();
    prop=poolInst.getProperty("ElementName");
    String name=prop.getValue().toString();
    System.out.println(name);
}
poolIt.close();
```

Runtime Open Source Libs

- Java
- Jetty
- SBLIM
- **GWT and GWT Incubator**

- ❑ Google Web Toolkit
- ❑ Used for Developing Rich Internet Applications
- ❑ A set of tools and libraries
- ❑ Compiles Java to Java Script
 - ❑ Supports a sub section of Java Language and Packages
 - ❑ Allows for “Native” Java Script
- ❑ Rich Debugging Both Client and Server Side

- ❑ GWT Abstracts JavaScript Details
 - ❑ Allows Programmer to work in Java
 - ❑ Avoids cross browser JavaScript Issues
- ❑ **Does not protect against CSS Issues**

GWT Client Code Example

```
public void onModuleLoad() {  
    Label label = new Label("Hello, GWT!!!");  
    Button button = new Button("Click me!");  
    button.addClickHandler(new ClickHandler() {  
        public void onClick(ClickEvent event) {  
            label.setVisible(!label.isVisible());  
        }  
    });  
  
    RootPanel.get().add(button);  
    RootPanel.get().add(label);  
}
```

- ❑ The client side communicates with the server side
- ❑ Uses RPC to communicate with server over HTTP
- ❑ Easy to pass Java objects back and forth
- ❑ Has both Synchronous and Asynchronous
- ❑ Project Used Asynchronous
 - ❑ Nonblocking, call returns immediately
 - ❑ Callback is called with server response

GWT Asynch Comm Example

- Define the Interface

```
public interface MyService extends RemoteService {  
    public String myMethod(String s);  
}
```

- Server implements the Interface

```
public class MyServiceImpl extends RemoteServiceServlet  
implements MyService  
{  
    public String myMethod(String s) {  
        // Do something interesting with 's' on the server.  
        return s;  
    }  
}
```

- Asynchronous interface is used to make call

```
interface MyServiceAsync {  
    public void myMethod(String s,  
                          AsyncCallback<String> callback);  
}
```

- AsyncCallback<T> Interface

- onSuccess(T result)

- onFailure(Throwable caught)

The GWT Client call

```
MyServiceAsync myService = (MyServiceAsync)
    GWT.create(MyService.class);
AsyncCallback callback = new AsyncCallback() {
    public void onSuccess(String result) {
        // do some UI stuff to show success
    }
    public void onFailure(Throwable caught) {
        // do some UI stuff to show failure
    }
};
myService.myMethod("Hello There", callback);
```

- ❑ CSS Issues
- ❑ 2.x has Widgets for both Quirks and Standard Mode
 - ❑ Widgets cannot be used together
 - ❑ No compile time check, just runtime weirdness
- ❑ Avoid modifying displayed tables
 - ❑ Very slow modifying displayed elements
 - ❑ Create New Elements and Replace
 - ❑ Much Worse in IE than others

- ❑ GWT has limited set of controls
- ❑ Incubator helps to fill out some of the gaps
- ❑ Use With Caution! Its not all cooked
- ❑ Includes
 - ❑ Tables, Panels, Status
 - ❑ Validation Library
 - ❑ Logging Library
 - ❑ Graphics Library
- ❑ We have used Tables and Logging

GWT Incubator Example

□ GWT Incubator Paging Scroll Table

- View only critical events
 View details

Retrieve the most recent events:

Index	Sequence	Date/Time	Priority	Component Type	Component Location	Description
0	25609	9/18/10 2:39:11 PM		Volume	Volume Excursion_datastore1_173-174	Media scan (scrub) resumed
1	25608	9/18/10 2:39:10 PM		Volume	Volume Excursion_datastore1_173-174	Media scan (scrub) completed
2	25607	9/18/10 2:39:10 PM		Controller	Tray 85, Slot 2	Alternate controller checked in late
3	25606	9/18/10 2:38:07 PM		Controller	Tray 85, Slot 1	Start-of-day routine completed
4	25605	9/18/10 2:37:58 PM		Battery Pack	Tray 85, Controller 1, Slot 1	Controller cache battery is fully charged
5	25604	9/18/10 2:37:58 PM		Battery Pack	Tray 85, Controller 1, Slot 1	Battery replaced
6	25603	9/18/10 2:37:58 PM		Controller Firmware	None	Premium feature enabled
7	25602	9/18/10 2:37:58 PM		Controller Firmware	None	Premium feature enabled
8	25601	9/18/10 2:37:58 PM		Controller Firmware	None	Premium feature enabled
9	25600	9/18/10 2:37:58 PM		Controller Firmware	None	Premium feature enabled
10	25599	9/18/10 2:37:58 PM		Controller Firmware	None	Premium feature enabled
11	25598	9/18/10 2:37:55 PM		Controller	Tray 85, Slot 1	Management port link up
12	25597	9/18/10 2:37:54 PM		Controller	Tray 85, Slot 1	Controller reset
13	25596	9/18/10 2:37:38 PM		Channel	Host-side: controller in slot A, port 4	Fibre channel link up
14	25595	9/18/10 2:37:38 PM		Channel	Host-side: controller in slot A, port 3	Fibre channel link up
15	25594	9/18/10 2:37:37 PM		Controller SFP	Tray 100, Slot 0	Host side sfp optimal
16	25593	9/18/10 2:37:37 PM		Channel	Host-side: controller in slot A, port 4	Fibre channel link down

Loaded 2000 out of 8192 of 4

- ❑ IDE
 - ❑ Eclipse
 - ❑ Netbeans
 - ❑ Both have GWT & SVN plug-ins
 - ❑ Why Use Both?
- ❑ Build and Integration
 - ❑ ANT
 - ❑ Junit
 - ❑ Hudson

- ❑ ANT replacement for make
 - ❑ More Powerful
 - ❑ Extensible
- ❑ JUnit is Unit Test Framework
- ❑ Both deserve a separate presentation

- ❑ Continuous Build Server
- ❑ Monitors VCS for changes
 - ❑ Checks out code
 - ❑ Builds code/run tests
 - ❑ Publishes results
- ❑ plug-in Architecture
 - ❑ Works with many VCS
 - ❑ Integrates with many build systems
- ❑ Is Java, but builds anything. (We do Java and C++)

Hudson Dashboard

Dashboard [Hudson] - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Dashboard [Hudson]

Hudson

search ?

ENABLE AUTO REFRESH

add descriptive

[New Job](#)

[Manage Hudson](#)

[People](#)

[Build History](#)

Build Queue

No builds in the queue.

Build Executor Status

#	Status
1	Idle
2	Idle

All +	S	W	Job ↓	Last Success	Last Failure	Last Duration
			DCSF MMC	1 day 22 hr (#247)	N/A	15 sec
			fcmagent	6 mo 4 days (#306)	N/A	3 min 45 sec
			fcminstaller	7 mo 3 days (#12)	7 mo 3 days (#8)	1 min 6 sec
			fcmsim	7 mo 3 days (#26)	N/A	0.7 sec
			KeyGenerator	3 mo 25 days (#102)	3 mo 25 days (#100)	5.9 sec
			LsiMirroredVolume	1 day 21 hr (#131)	N/A	54 sec
			sanmodel	5 mo 28 days (#15)	N/A	35 sec
			vcenter2	2 days 3 hr (#468)	N/A	5 min 54 sec

Find: LSI Next Previous Highlight all Match case

Hudson Project Screen

The screenshot shows the Hudson web interface for the project 'vcenter2'. The main heading is 'Project vcenter2'. A 'Code Coverage Trend' graph displays the percentage of code coverage for 'block', 'class', 'line', and 'method' categories across builds #469 to #488. The 'class' category consistently shows the highest coverage, around 50-60%. The 'method' category shows the lowest coverage, fluctuating between 25% and 35%. The 'block' and 'line' categories show very low coverage, near 0%. Below the graph is a 'Build History' table listing recent builds with their IDs and timestamps. The interface also includes a sidebar with navigation links like 'Back to Dashboard', 'Status', 'Changes', 'Workspace', 'Build Now', 'Delete Project', 'Configure', 'Coverage Trend', and 'Subversion Polling Log'. A search bar at the bottom allows for finding text in the workspace, with options for 'Next', 'Previous', 'Highlight all', and 'Match case'.

Build	block (%)	class (%)	line (%)	method (%)
#469	0	60	0	35
#480	0	60	0	35
#481	0	50	0	25
#482	0	55	0	30
#483	0	55	0	28
#484	0	55	0	28
#485	0	55	0	28
#486	0	55	0	28
#487	0	60	0	35
#488	0	60	0	35

Build ID	Timestamp
#468	Aug 20, 2010 11:50:26 AM
#467	Aug 20, 2010 11:40:26 AM
#466	Aug 20, 2010 11:30:26 AM
#465	Aug 20, 2010 11:04:05 AM
#464	Aug 20, 2010 10:20:26 AM

Would we use it Again?

Tool	Use it again
Java	Yes
ANT	Yes
Junit	Yes
SBLIM	Yes
GWT	Maybe
Jetty	Yes
Hudson	Yes

QA

Reference Links

- ❑ <http://sourceforge.net/apps/mediawiki/sblim/index.php?title=CimClient>
- ❑ <http://code.google.com/webtoolkit/>
- ❑ <http://code.google.com/p/google-web-toolkit-incubator/>
- ❑ <http://hudson-ci.org/>