Open Source

in the Corporate World

J2EE Development with Free and Open Source Tools

Aaron Mulder

CHARIOT SOLUTIONS

Why do you care?

Keep up with open source and free tools that can make you a more productive J2EE developer

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Agenda

- Review free and open-source J2EE development tools
- We'll go into more depth for some tools than others, but try to show by example (with screen shots and a bit of source code)
- Don't worry, these slides will be online, with the product URLs

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The Old Standbys

- Databases
  - PostgreSQL, MySQL, SAP-DB, Firebird, Hypersonic, McKoi
- App Servers
  - J2EE: JBoss, JOnAS, Geronimo (soon)
  - Web: Tomcat, Jetty
- IDEs, Bug Trackers
  - Eclipse, NetBeans, jEdit
  - Bugzilla, Scarab, JIRA*
- Builds & Continuous Integration
  - Ant, Maven, Anthill, CruiseControl

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Server Products

Part I

CHARIOT SOLUTIONS

Portals

- Cocoon Portal
- Jetspeed
- Liferay
- eXo

- Cocoon Portal has great XML/XSLT support, upcoming CMS add-on, “alpha” JSR-168
- Jetspeed v1 works well today, but JSR-168 support is in the upcoming v2
- Liferay is a portal offering JSR-168 support today
- eXo is a server platform offering JSR-168 and WSRP support among other services

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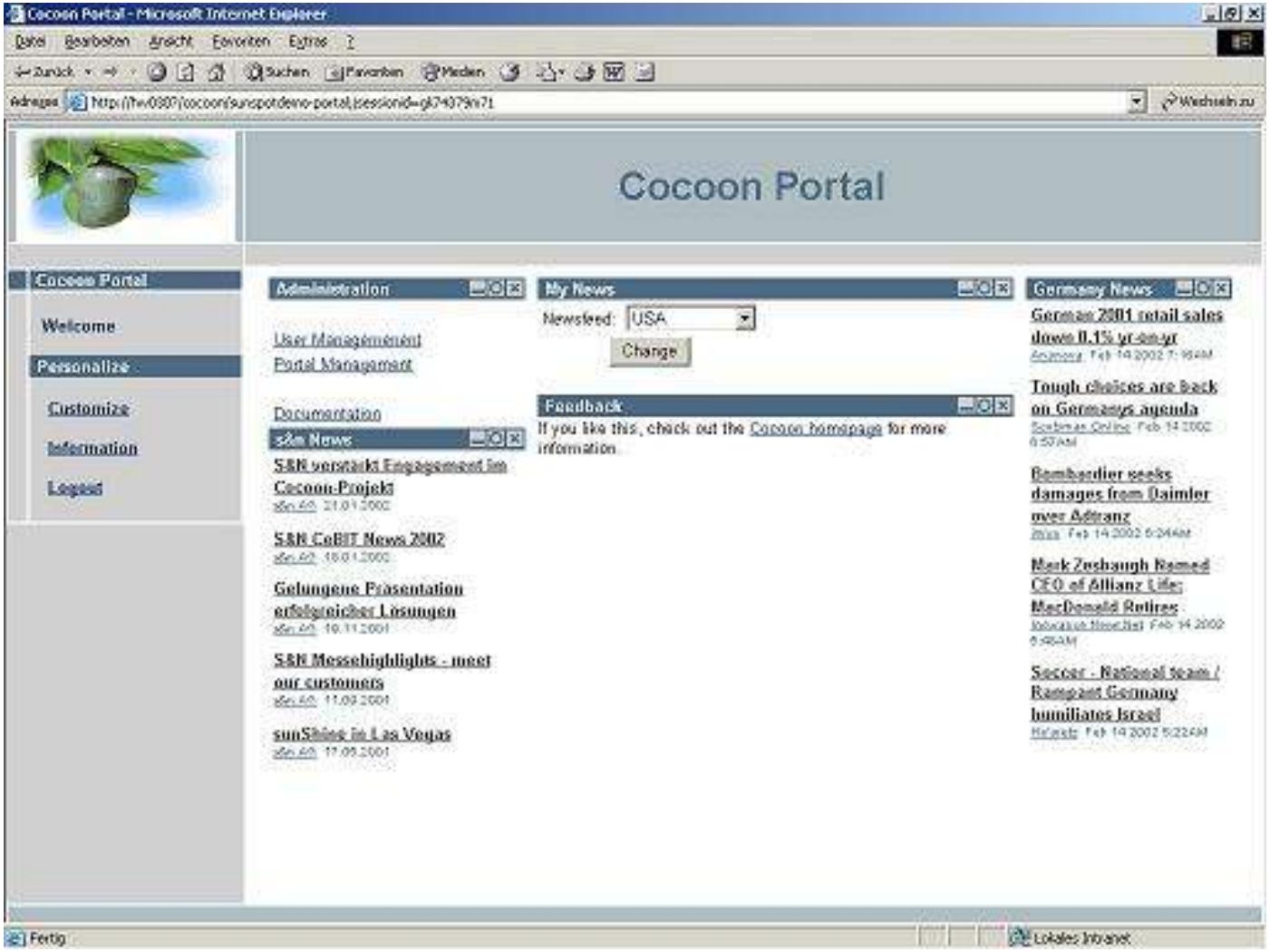
Cocoon Portal Screenshot



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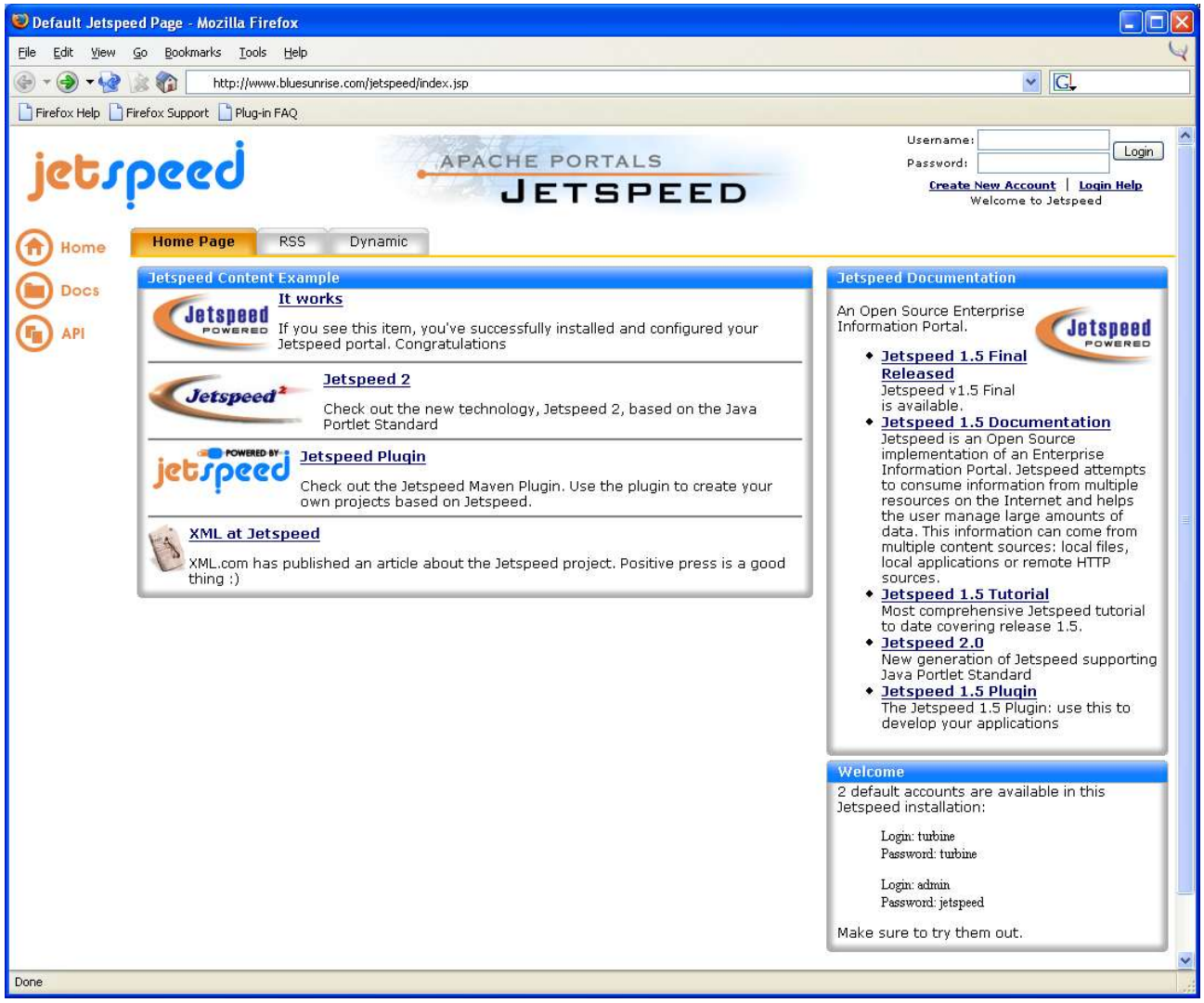
Jetspeed Screenshot



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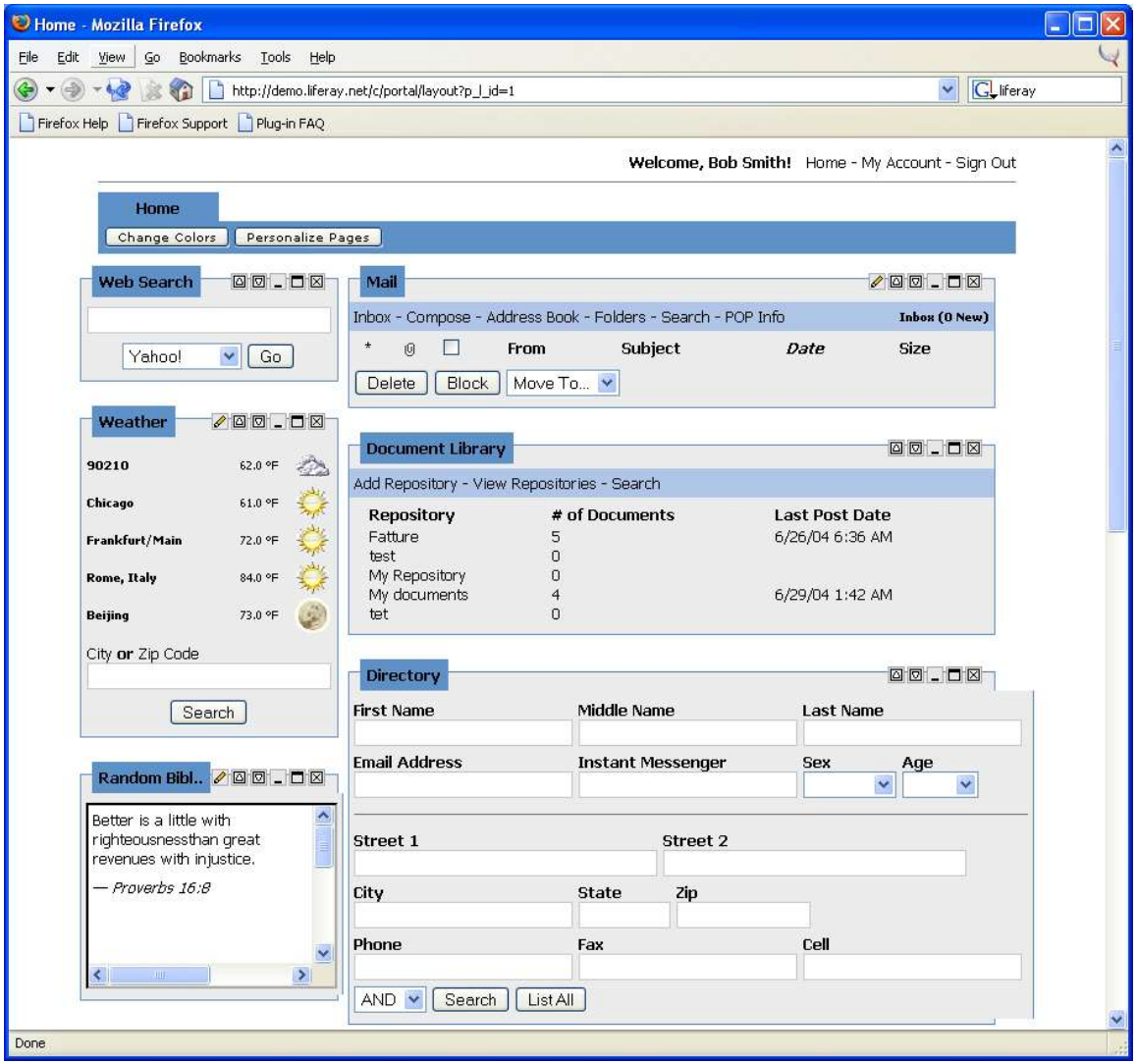
Liferay Screenshot



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Rules Engines

- Drools
- OFBiz Rules
- JESS*
- InfoSapient

- Can be used to control web flow in addition to the standard back-end calculations
- Can update rules without changing code
- Not as mature rule authoring and deployment tools as commercial options (e.g. JRules)
- Each tool uses a different rules language
  - JSR-94 covers rules engines

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Drools Rule Sample

```
<rule name="Free Fish Food Sample">
 <parameter identifier="cart">
  <java:class>org.drools.ShoppingCart</java:class>
 </parameter>
 <parameter identifier="item">
  <java:class>org.drools.CartItem</java:class>
 </parameter>
 <java:condition>
   cart.getItems( "Fish Food" ).size() == 0
 </java:condition>
 <java:condition>
   item.getType().equals( "Fish" )
 </java:condition>
 <java:consequence>
   cart.addItem(new CartItem("Fish Food Sample"));
   modifyObject( cart );
 </java:consequence>
</rule>
```


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Business Systems

- OFBiz
- Compiere

- OFBiz (Open For Business) includes a number of Java/J2EE business functions and developer tools in one package. It's built on a number of other open-source libraries.
- Compiere is a J2EE ERP/CRM package, covering the usual marketing/sales, finance, accounting, distribution, inventory, HR… plus sales force automation

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OFBiz Features

Business Features

- eCommerce
- Person/Group
- Marketing
- Catalog
- Facility
- Order
- Accounting
- Work Effort

Technical Features

- Web Cache
- Entities
- XML Data
- Scheduler
- Workflow
- Rules
- Flat Files
- Server Statistics

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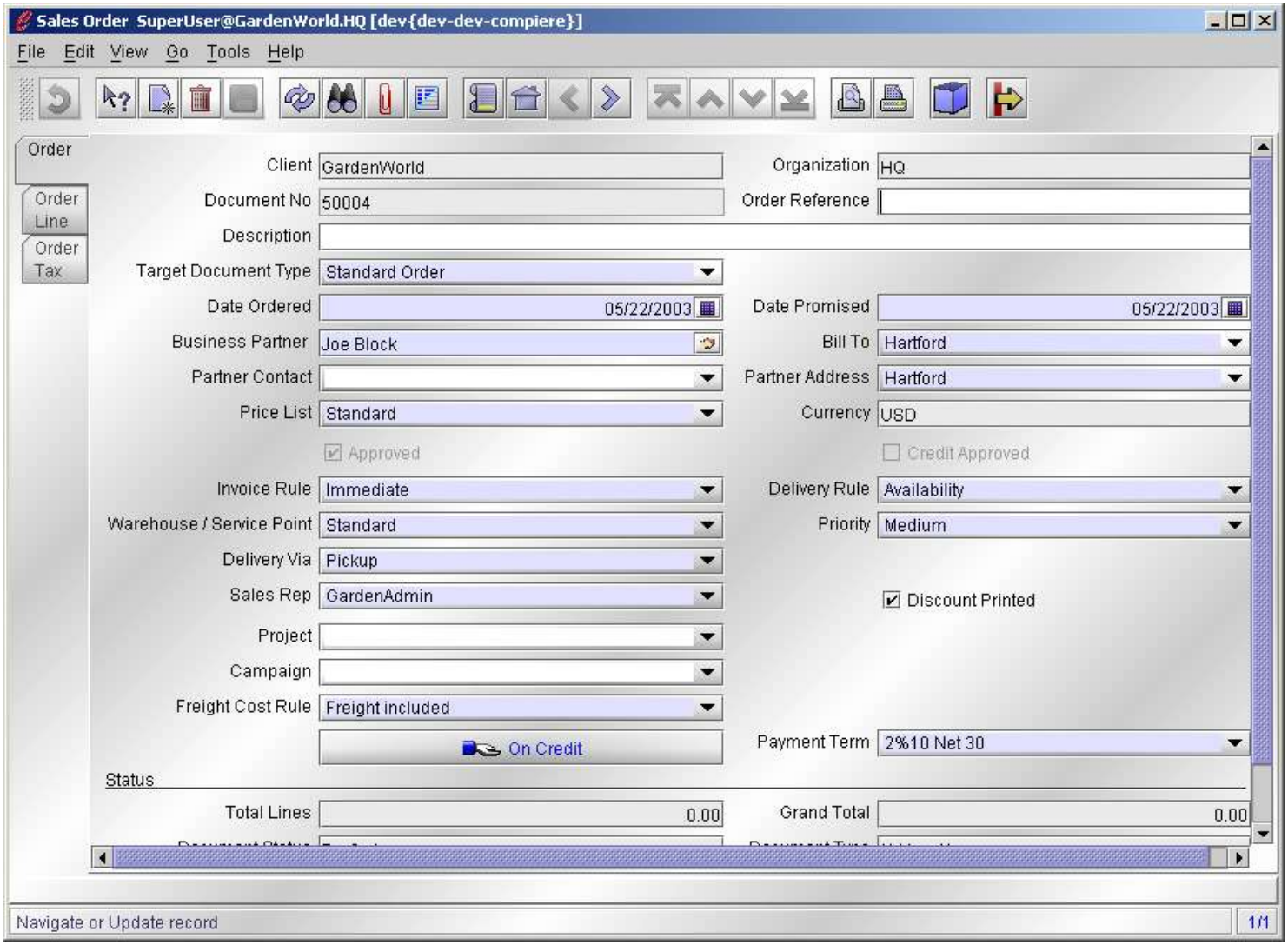
Compiere Screenshot



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Content Management

- Lenya
- Plone
- Slide
- Bricolage

- Plone is a content management system built on Zope, including inline structured text
- Leyna is a CMS add-on for Cocoon, and includes browser-based form and WYSIWYG editors
- Both include workflow, content versioning, text search, layout customization
- Bricolage is a higher-end alternative

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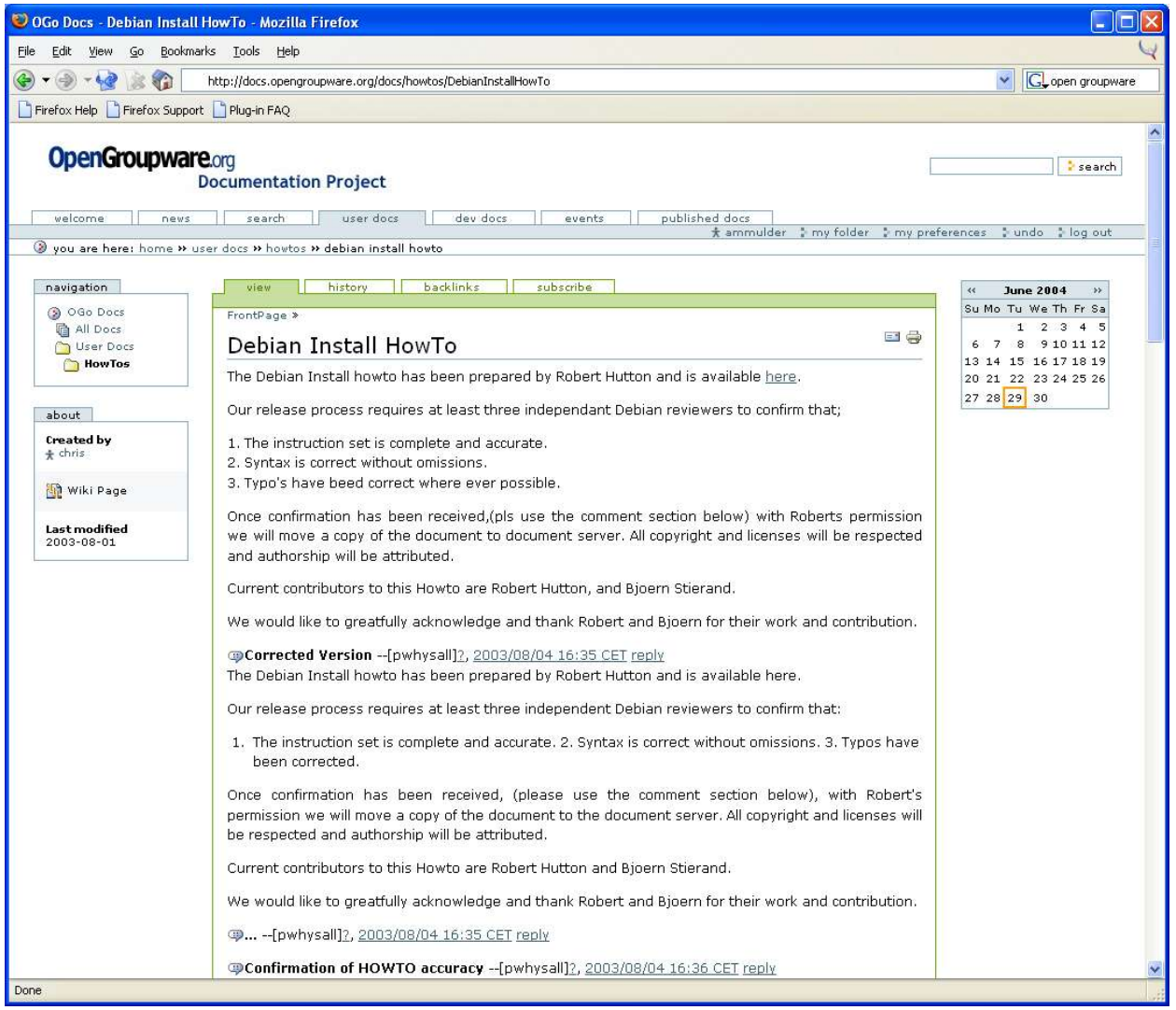
Plone Screenshot



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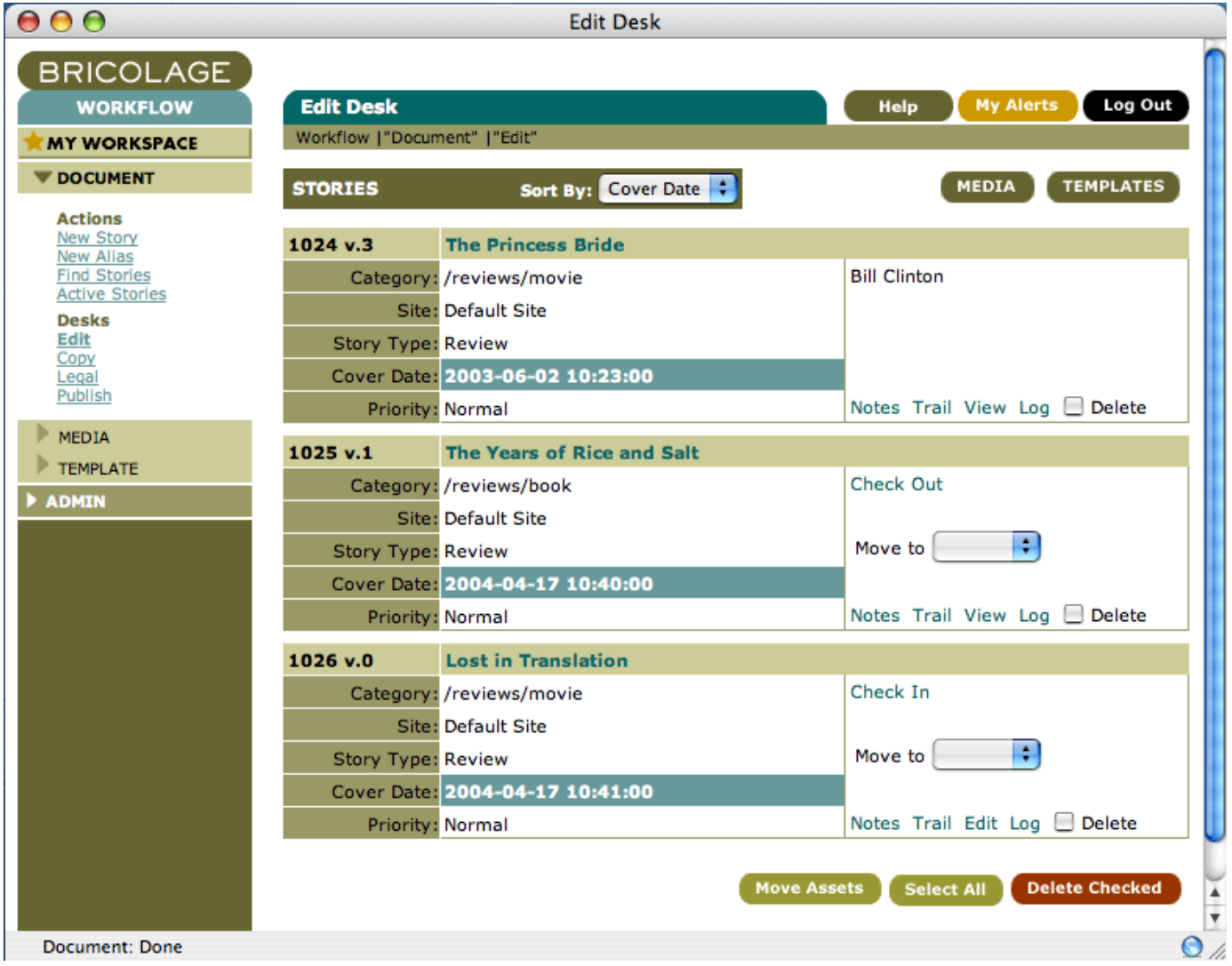
Bricolage Screenshot



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Development Tools

Part II

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Collaboration

- Wiki (MoinMoin)
- OpenGroupware.org
- IM (Jabber)
- WebMail (SquirrelMail)

- Great for distributed teams, and people working offsite behind restrictive firewalls
- All tools can be operated securely (over SSL, etc.)
- Can often use ssh / PuTTY to port forward from remote locations
- Wikis are a very user-friendly interface for creating and editing searchable content

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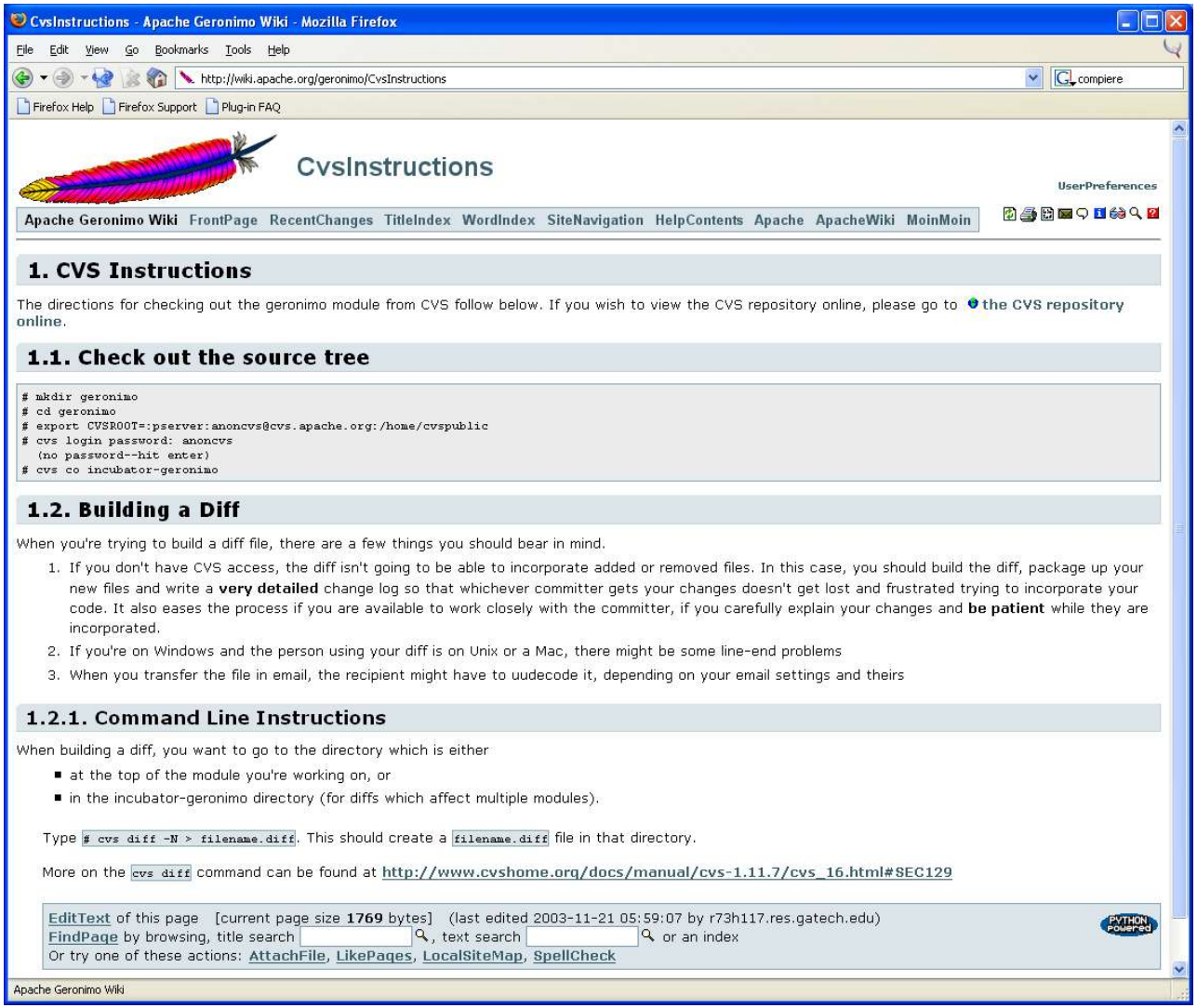
Wiki in View Mode



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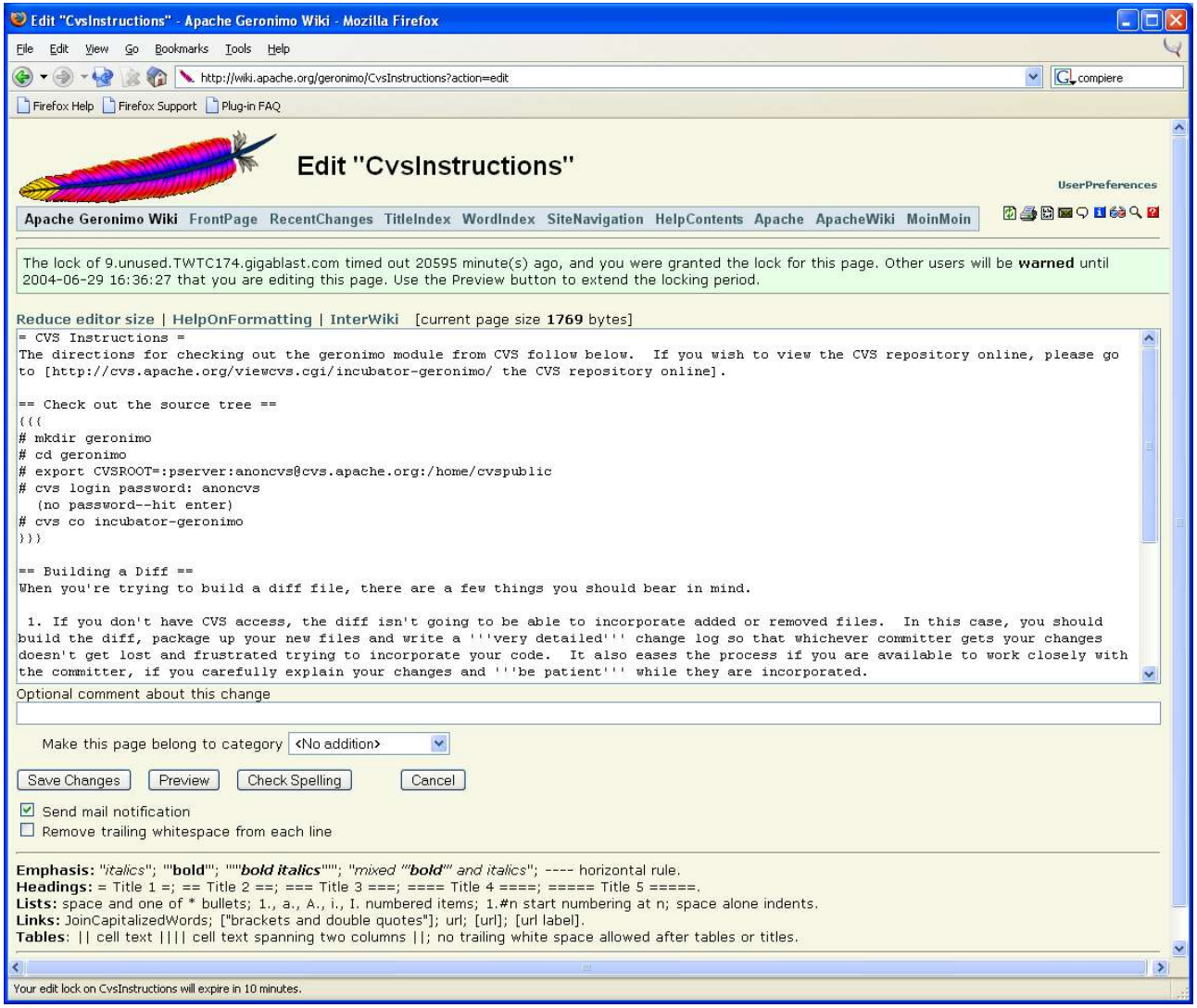
Wiki in Edit Mode



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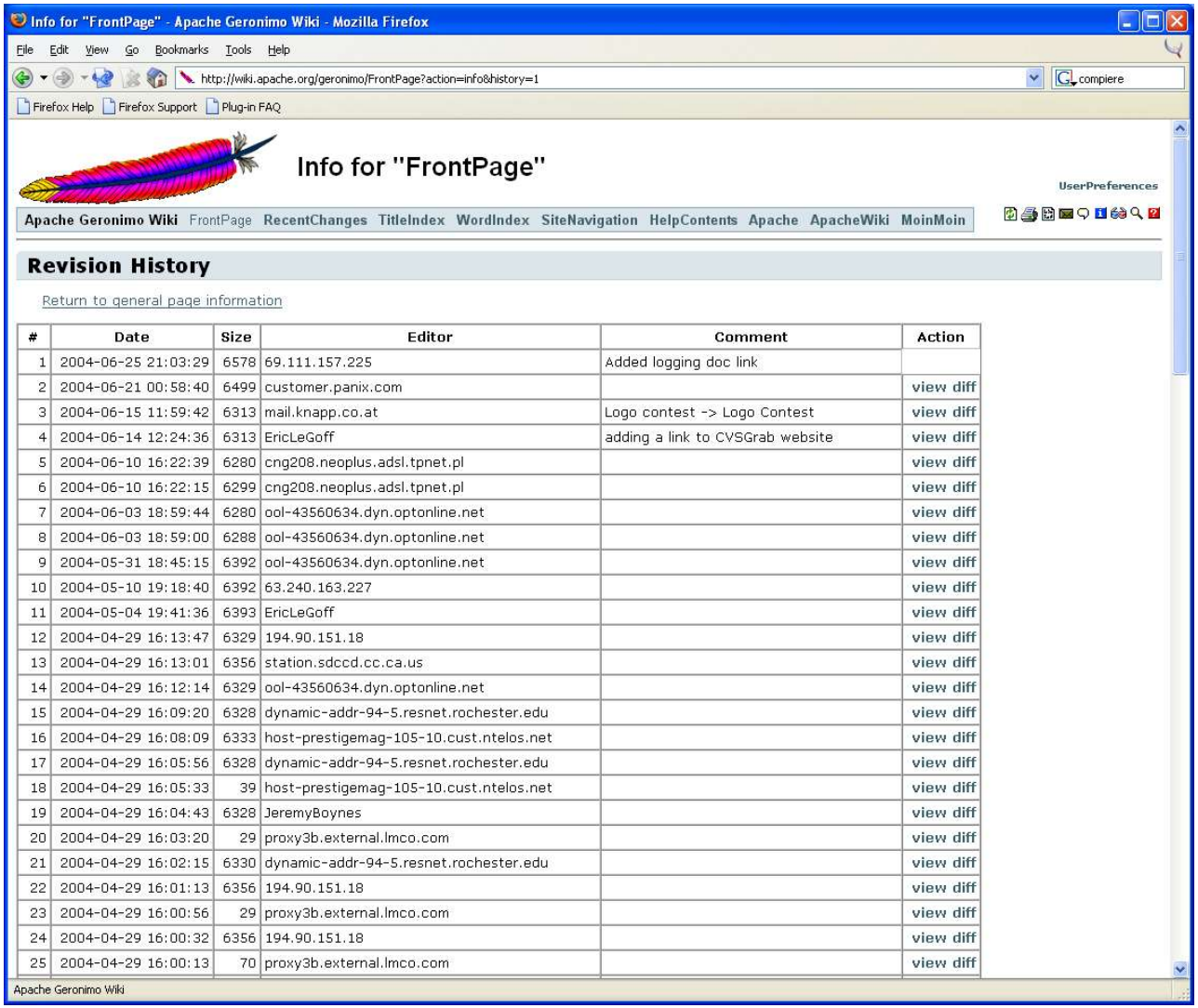
Wiki Revision History



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2	2004-06-21 00:58:40	6499	customer.panix.com		view diff
3	2004-06-15 11:59:42	6313	mail.knapp.co.at	Logo contest -> Logo Contest	view diff
4	2004-06-14 12:24:36	6313	EricLeGoff	adding a link to CVSGrab website	view diff
5	2004-06-10 16:22:39	6280	cng208.neoplus.adsl.tpnet.pl		view diff
6	2004-06-10 16:22:15	6299	cng208.neoplus.adsl.tpnet.pl		view diff
7	2004-06-03 18:59:44	6280	ool-43560634.dyn.optonline.net		view diff
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9	2004-05-31 18:45:15	6392	ool-43560634.dyn.optonline.net		view diff
10	2004-05-10 19:18:40	6392	63.240.163.227		view diff
11	2004-05-04 19:41:36	6393	EricLeGoff		view diff
12	2004-04-29 16:13:47	6329	194.90.151.18		view diff
13	2004-04-29 16:13:01	6356	station.sdccd.cc.ca.us		view diff
14	2004-04-29 16:12:14	6329	ool-43560634.dyn.optonline.net		view diff
15	2004-04-29 16:09:20	6328	dynamic-addr-94-5.resnet.rochester.edu		view diff
16	2004-04-29 16:08:09	6333	host-prestigemag-105-10.cust.ntelos.net		view diff
17	2004-04-29 16:05:56	6328	dynamic-addr-94-5.resnet.rochester.edu		view diff
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19	2004-04-29 16:04:43	6328	JeremyBoynes		view diff
20	2004-04-29 16:03:20	29	proxy3b.external.lmco.com		view diff
21	2004-04-29 16:02:15	6330	dynamic-addr-94-5.resnet.rochester.edu		view diff
22	2004-04-29 16:01:13	6356	194.90.151.18		view diff
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25	2004-04-29 16:00:13	70	proxy3b.external.lmco.com		view diff

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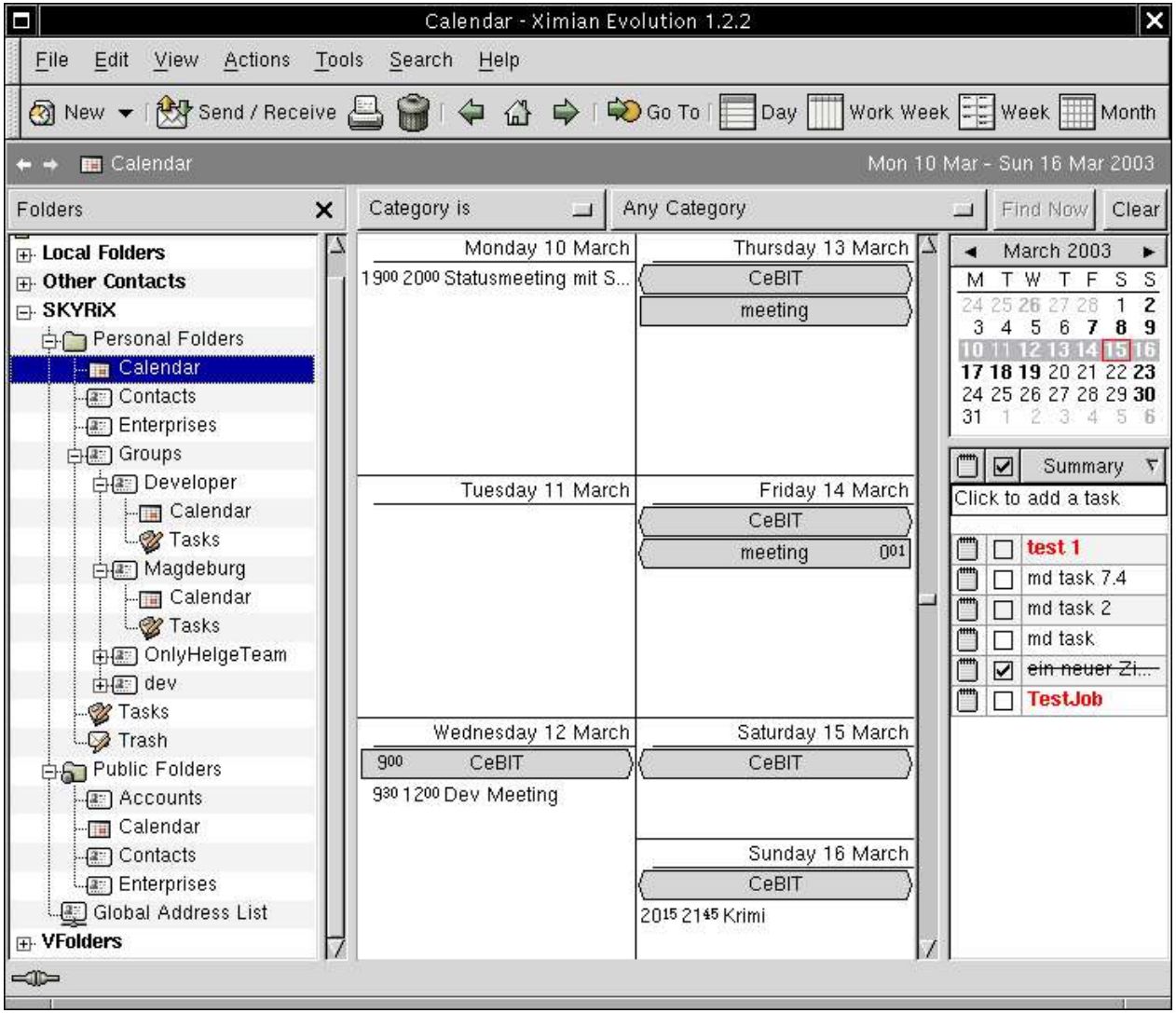
Evolution/OpenGroupware



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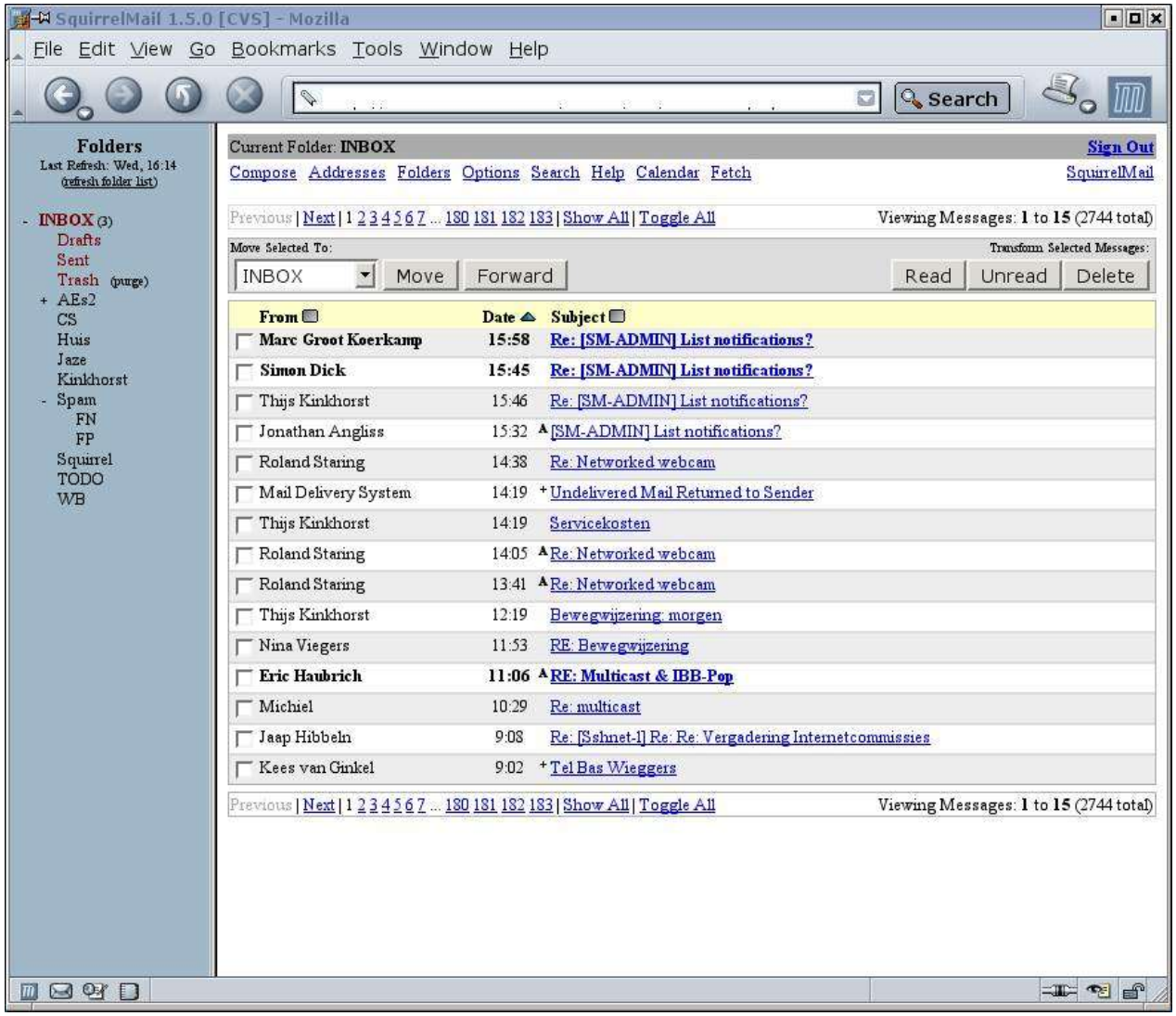
SquirrelMail



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Web Troubleshooting

- Web Developer Extension for Mozilla

- Toolbar that lets you (among other things!)
  - disable cookies, animations, Java, JavaScript, style sheets, referrer…
  - View/edit CSS or styles on a particular element
  - View/edit form details & widgets
  - View images details, hide images, missing alt
  - Display tab index, ID, topographic info, cookies
  - Outline blocks, tables, frames
  - Validate CSS/HTML/links

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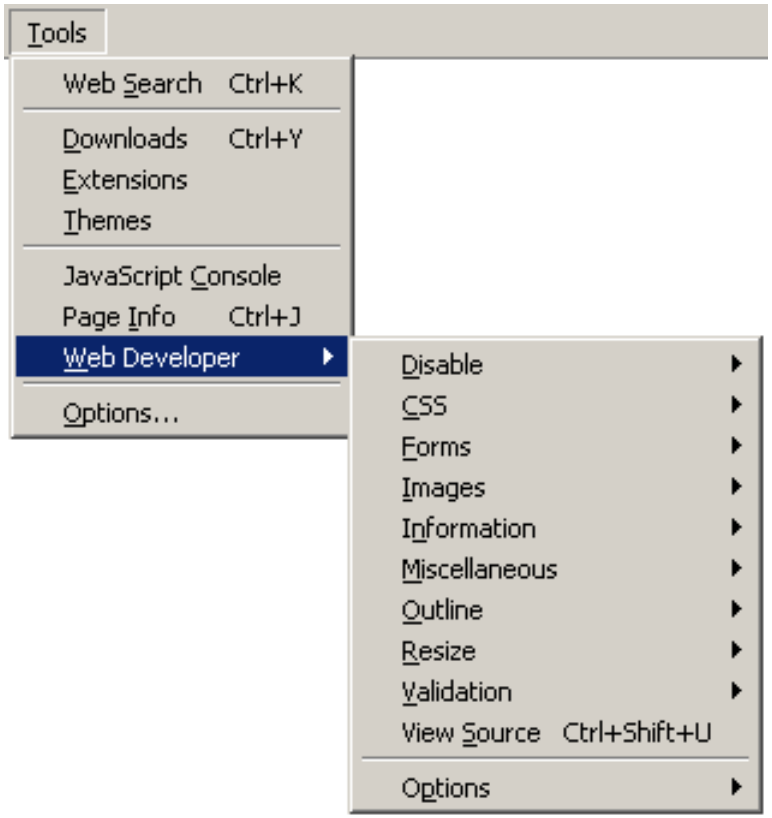
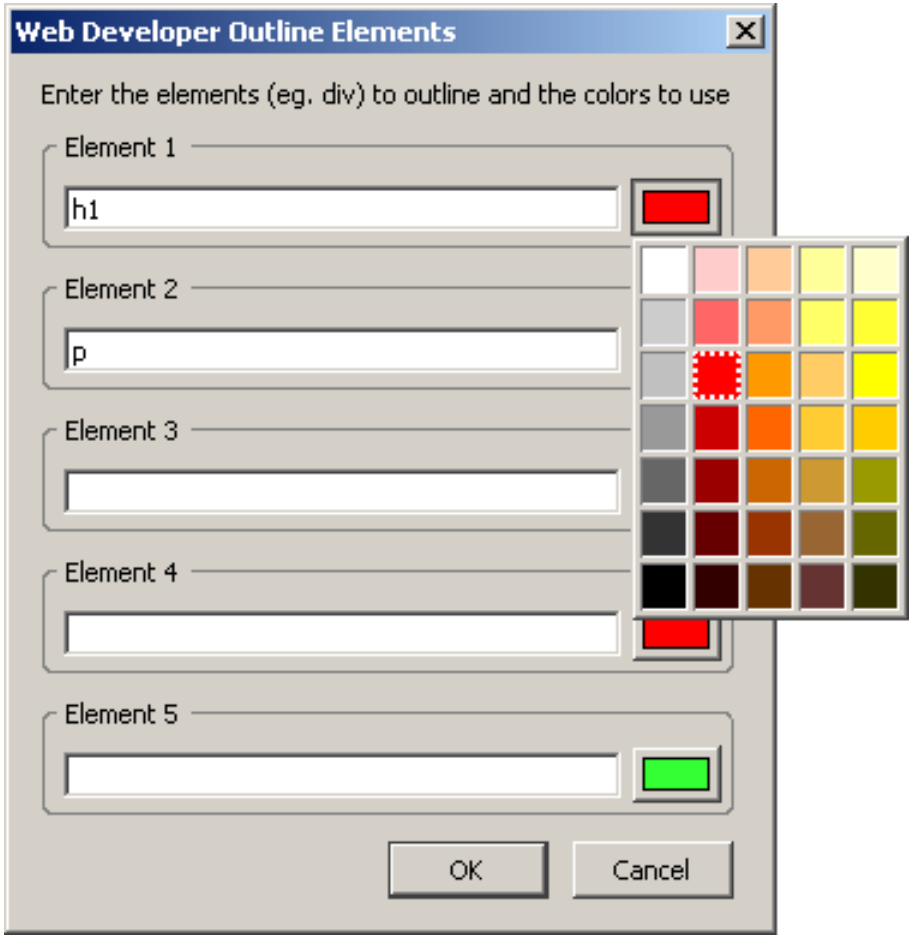
WebDev Screenshots





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Documentation

- DocBook
- Structured Text

- Can write elaborate content using simple markup, and then use a tool to format it into output formats including RTF, PDF, HTML, JavaHelp, etc.
- Document “source” is plain text and can be version controlled
- Documentation builds can be integrated with source code control or application builds

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DocBook Source

TextPad - [C:\dev\lishp\qa\testplan.sgml *]

File Edit Search View Tools Macros Configure Window Help

testplan.sgml *

ANSI Characters

```
189 ½
190 ¾
191 ¿
192 À
193 Á
194 Â
195 Ã
196 Ä
197 Å
198 Æ
199 Ç
200 È
201 É
202 Ê
203 Ë
204 Ì
```

```
<chapter id="testplan">
    <title>Test Plan</title>

    <sect1 id="testing-types">
        <title>Types of Testing</title>

        <para>
            Testing of the &project; project will be conducted using both manual and
            automated test scripts focused on the following 7 areas.
        </para>

        <sect2 id="testplan-functional">
            <title>Functional Testing</title>
            <para>
                Extensive manual and automated testing to ensure that the product meets
                all of the functional requirements defined by the detailed use cases.
                Functional testing will produce most errors in the testing process.
                Failure types include:
                    <orderedlist>
                        <listitem>
                            <para>Business rule not followed (e.g. duplicate name
                                should be rejected</para>
                        </listitem>
                        <listitem>
                            <para>Unexpected error -- a stacktrace of any kind is shown
                                to the user</para>
                        </listitem>
                        <listitem>
                            <para>Functionality not complete.  A use case specifies more
                                functioanlity than the application appears to provide.
                                k</para>
                        </listitem>
                    </orderedlist>
            </para>
        </sect2>

        <sect2 id="testplan-integration">
            <title>Integration Testing</title>
            <para>
```

31 35

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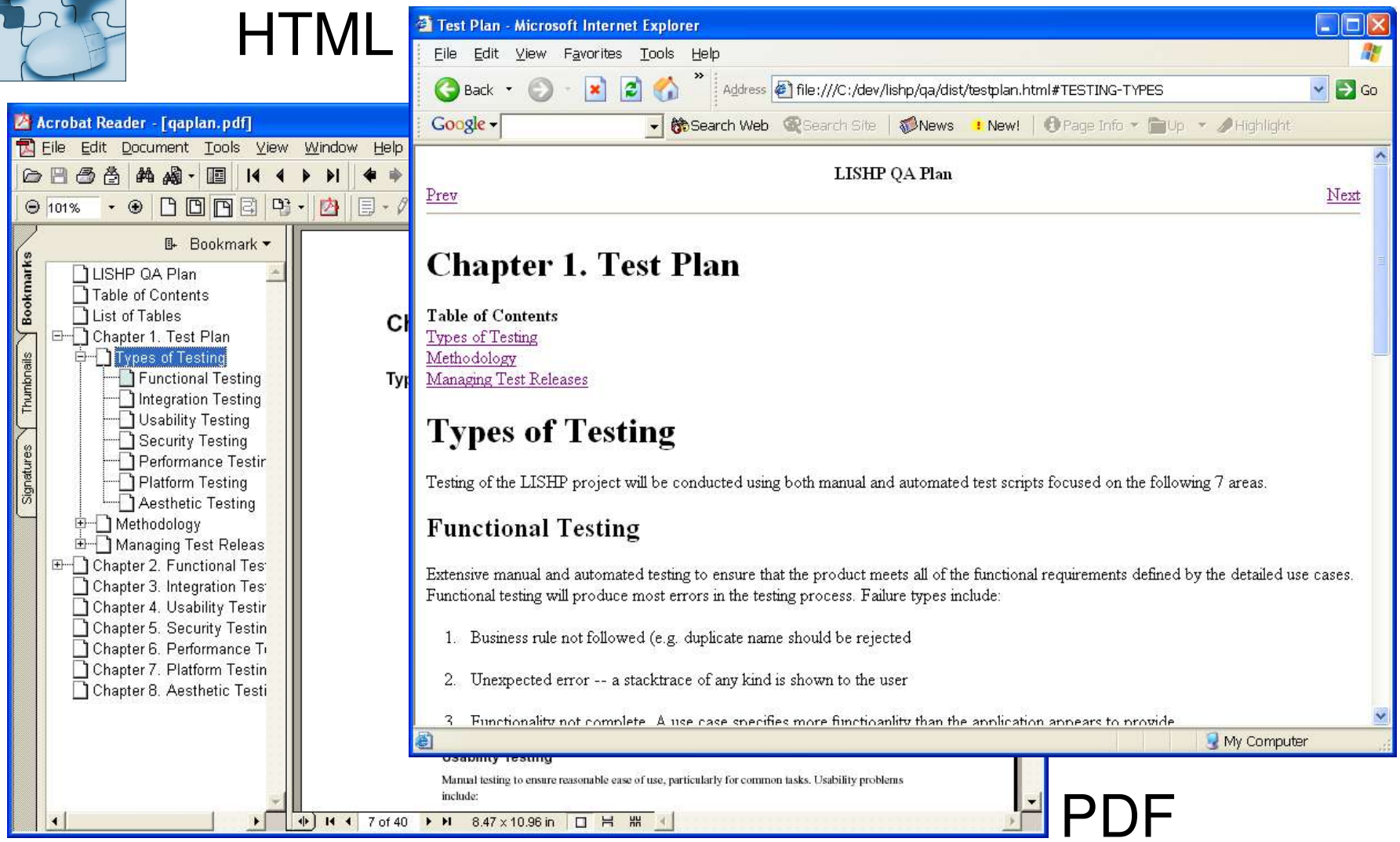
DocBook Output

HTML



PDF

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Database Browsers

- DBVisualizer
- TORA
- TOAD
- SQuirreL

- Don’t leave home without one!
- Works with any JDBC-compliant database
- Can browse the database, update on the fly, handle SQL commands and/or scripts, provide GUIs for filtering, insert/update, etc.
- Oracle-specific tools have features such as query analysis

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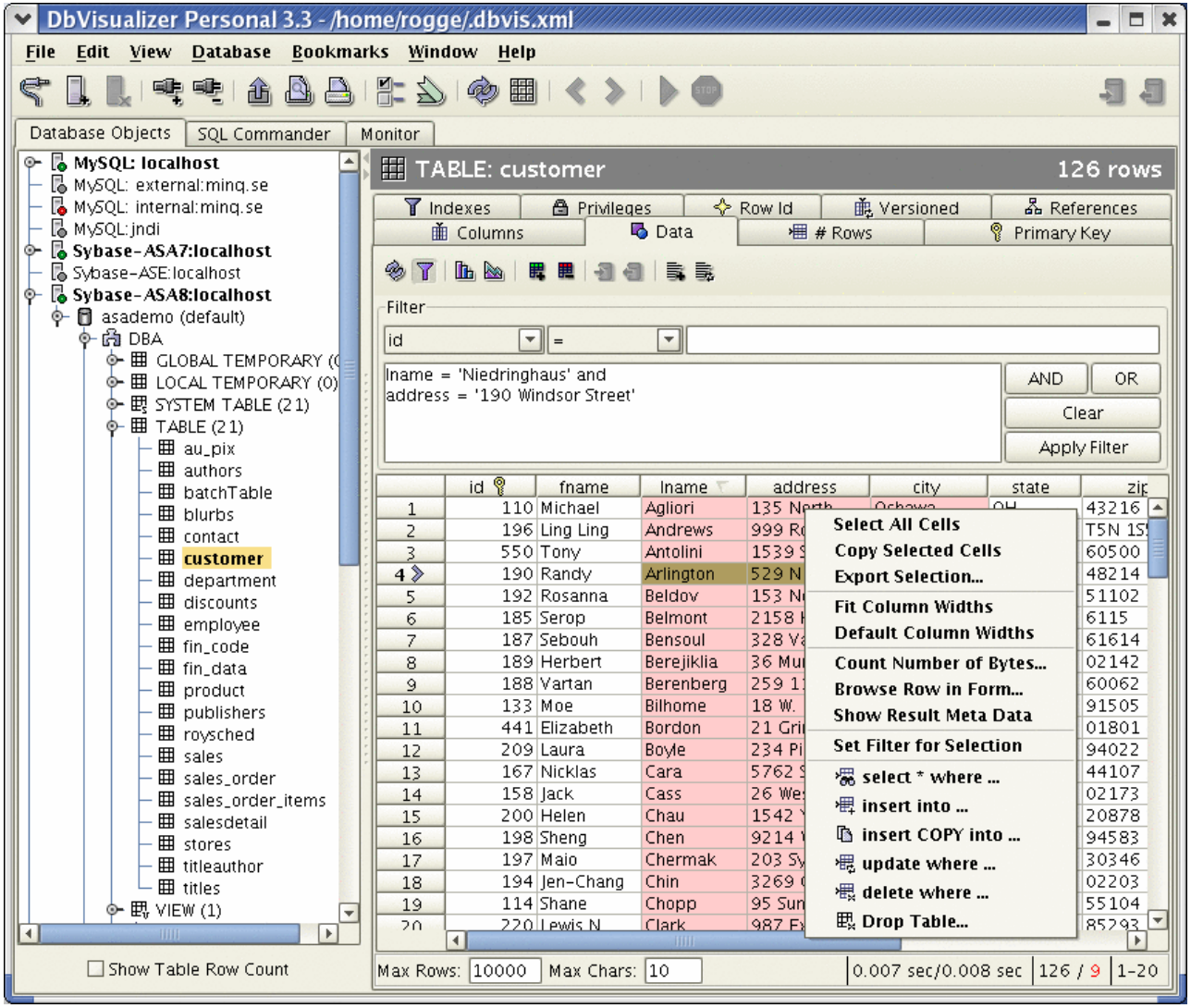
DBVisualizer Screenshot



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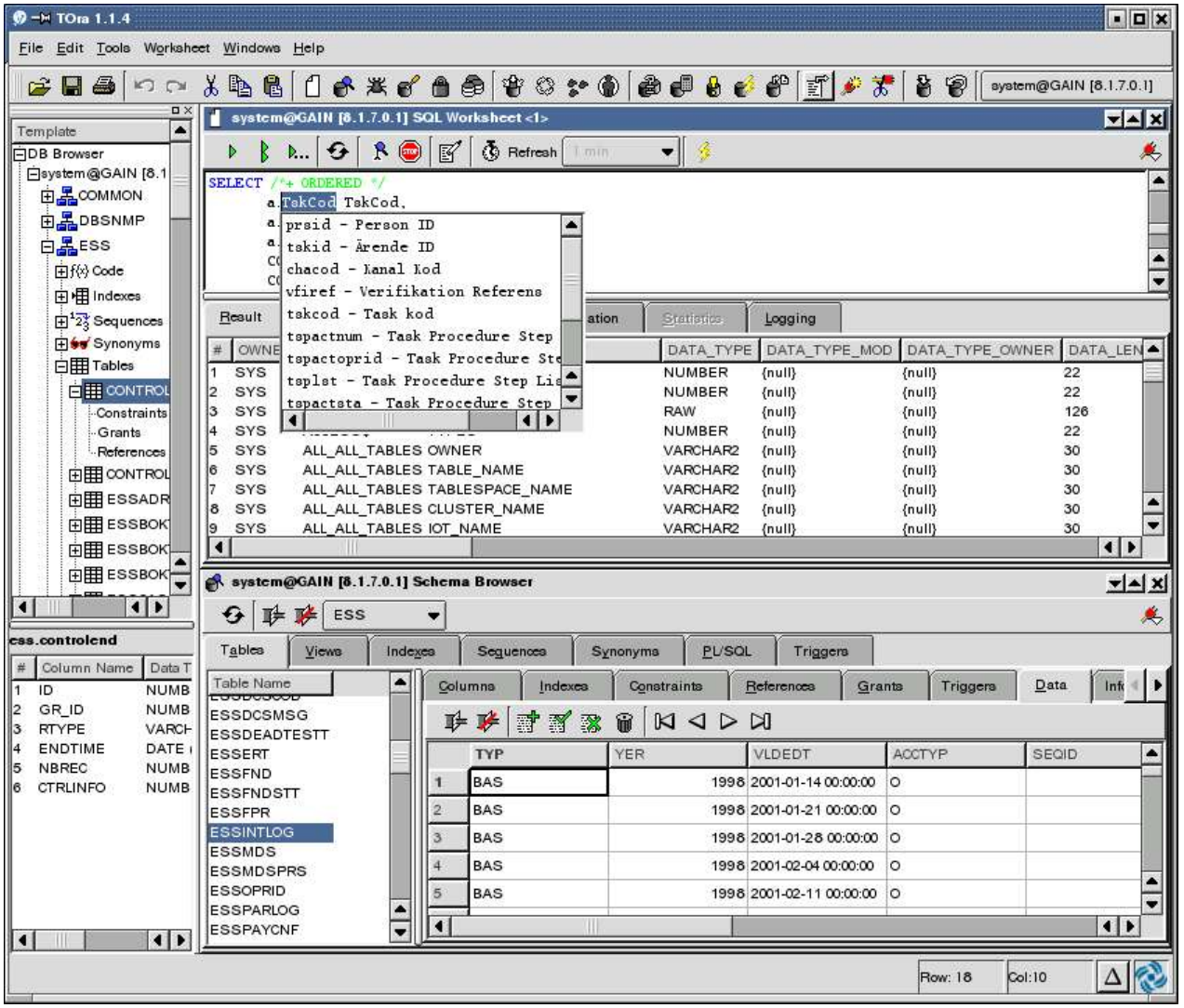
TORA Screenshot



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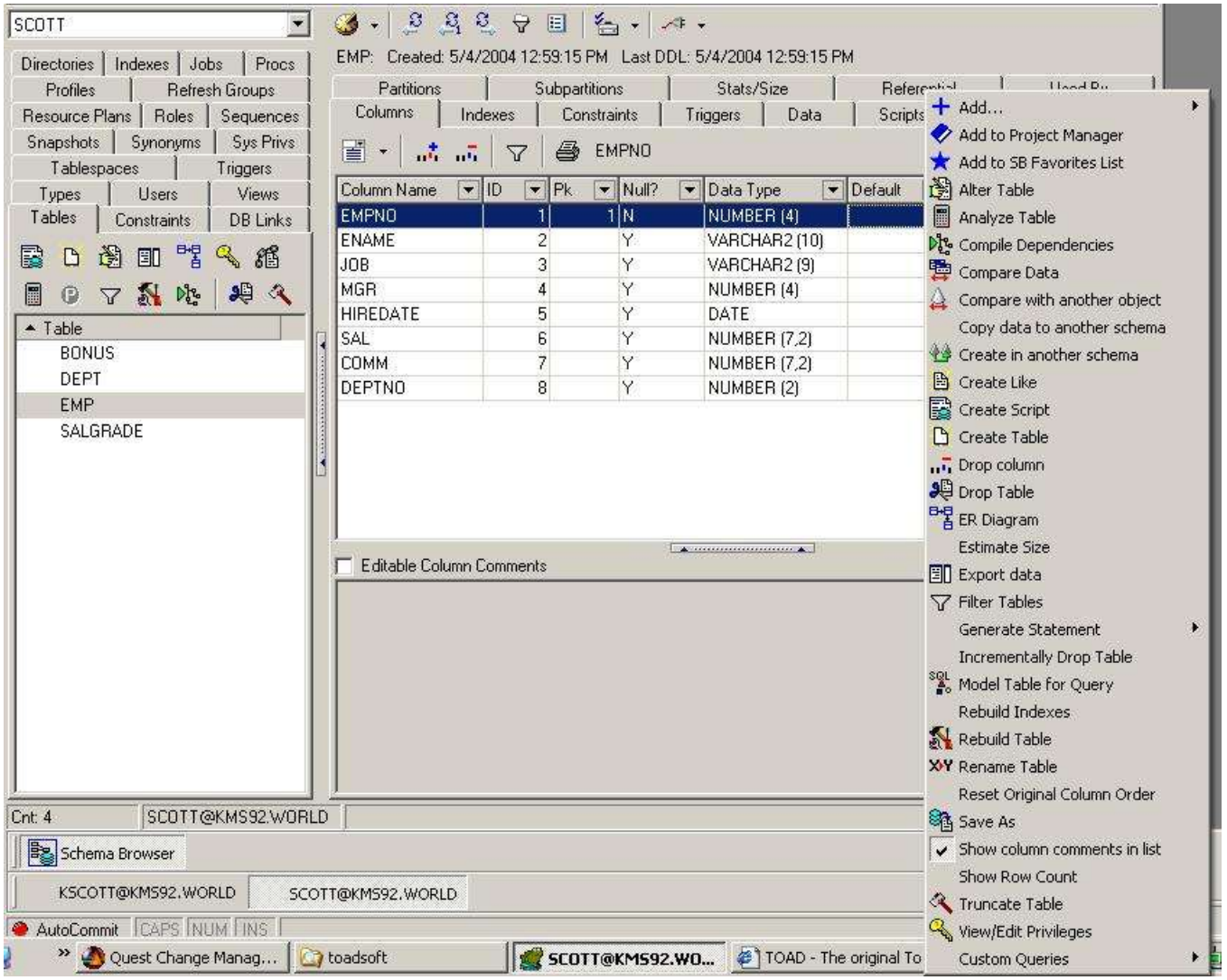
TOAD Screenshot



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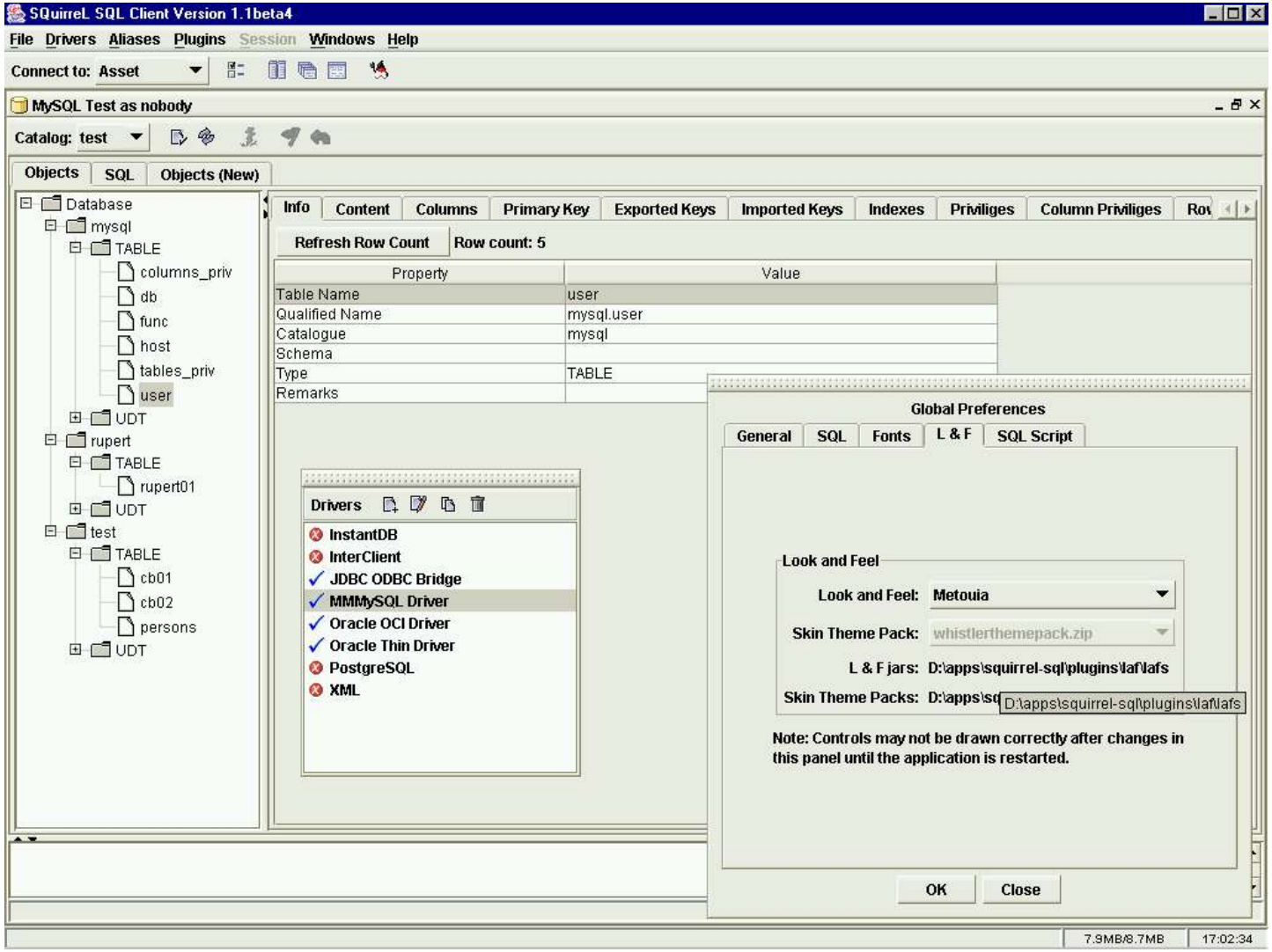
SQuirreL Screenshot



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LDAP Browse

- LDAP Browser
- Luma
- JXplorer

- Graphical view of an LDAP server
- View attributes for an entry, query all the entries in a context, see what's visible depending on who connects, etc.
- Great for troubleshooting connectivity problems when using an LDAP server (or Active Directory) for J2EE authentication

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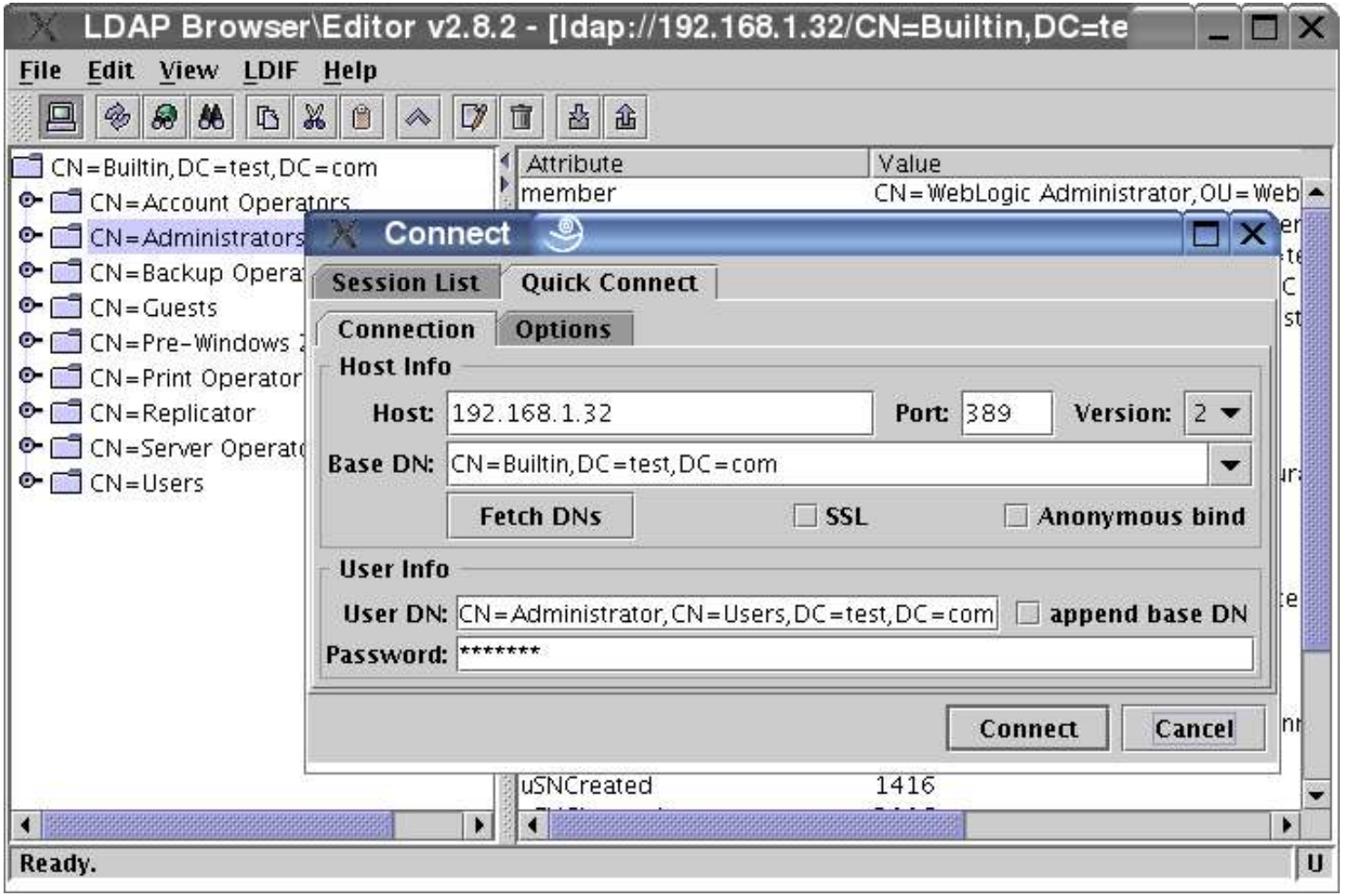
LDAP Browser/Editor



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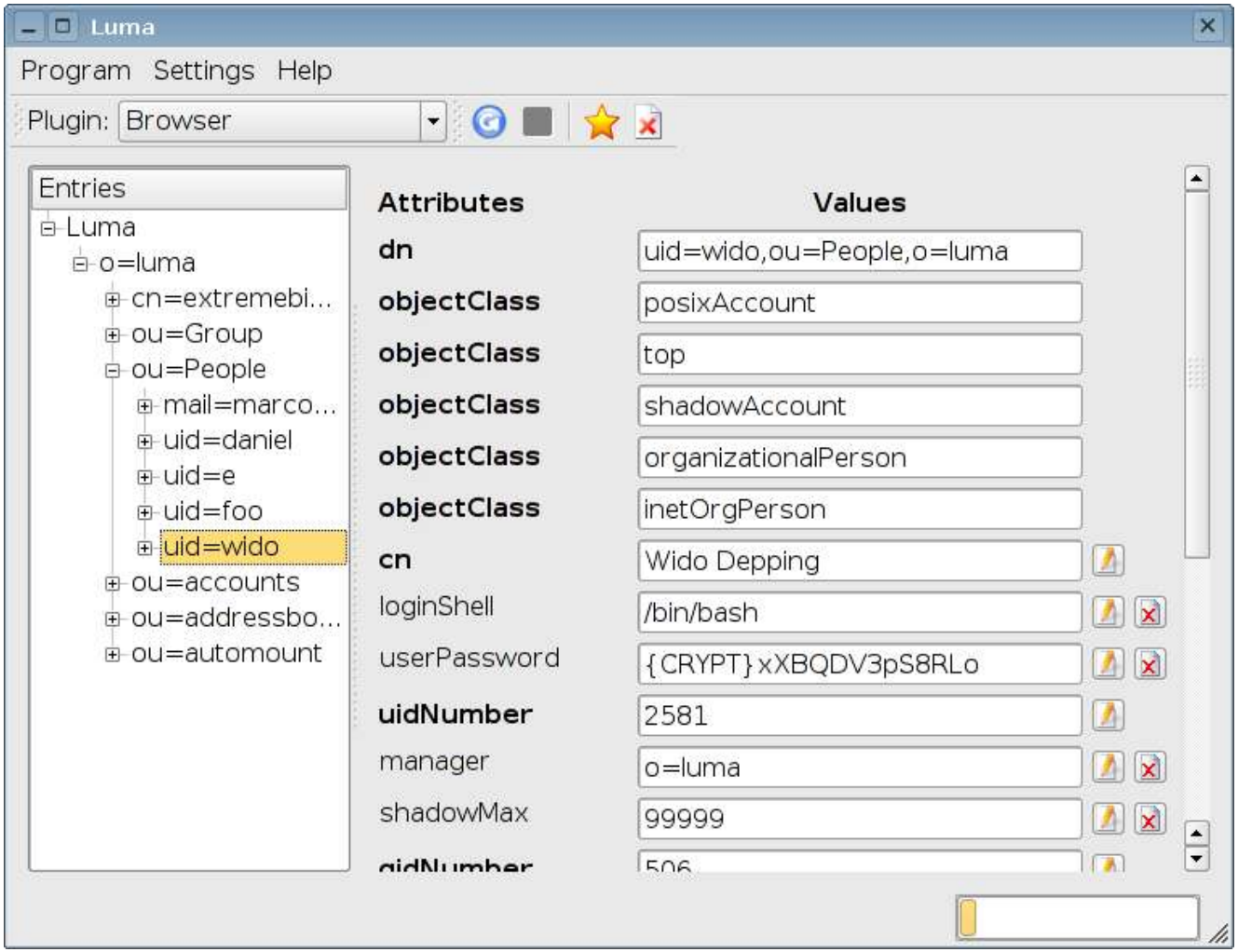
Luma Screenshot



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Testing

- JWebUnit
- MAXQ
- JMeter
- TestMaker

- Covers load testing & web functional testing
- Can build scripts using a web proxy (additional customization usually required)
- Not as good test authoring, graphing, integration with OS/DB monitors, or process integration
- Excellent first step for quality/performance feedback during development cycle

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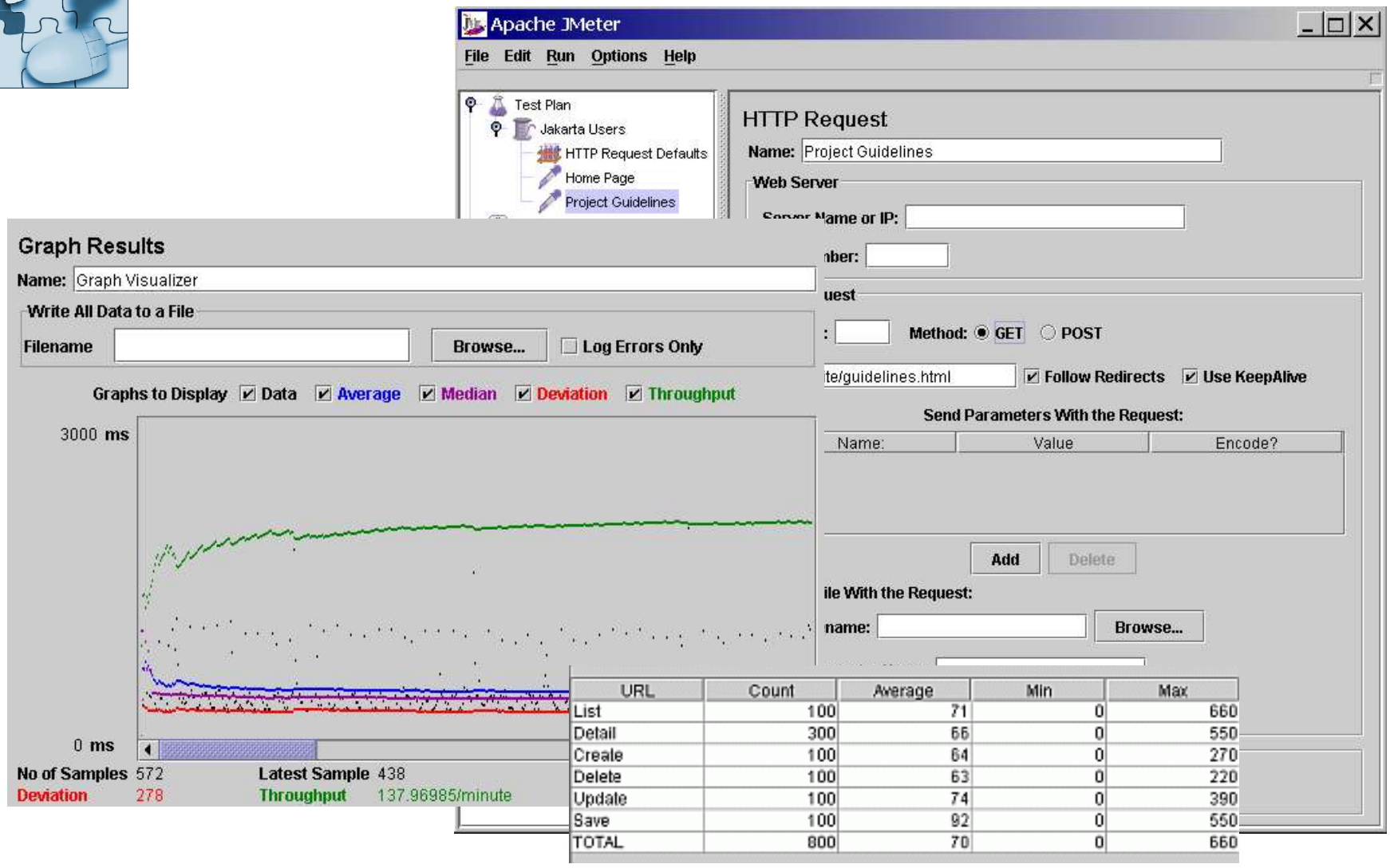
JMeter Screenshots



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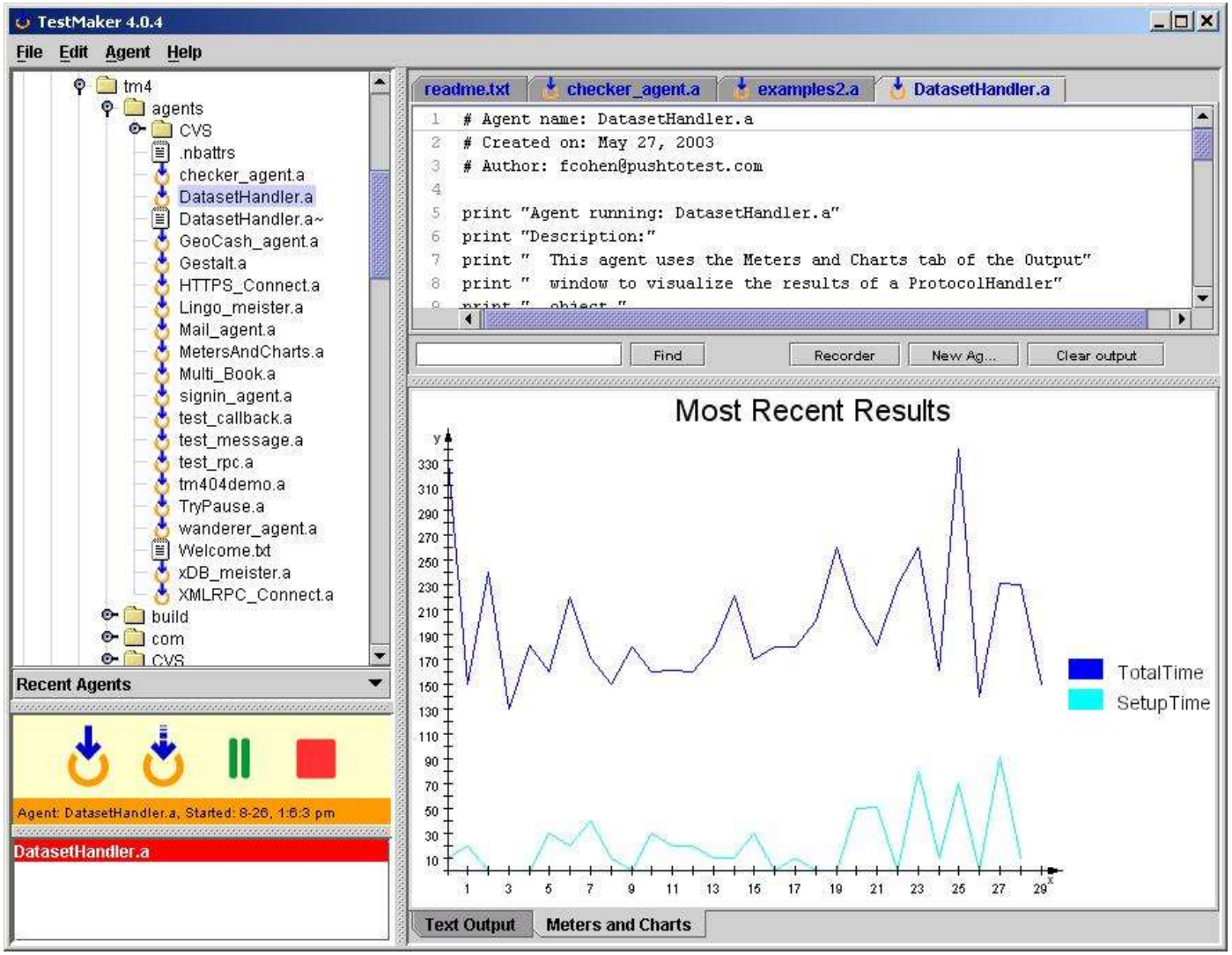
TestMaker Screenshot



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Source Control

- CVS
- ViewCVS
- Subversion

- Subversion is now used in production; it fixes some egregious problems with CVS (non-standard port, moving files, version controlling directories…)
- ViewCVS is a great web interface for CVS and Subversion
- Various scripts can be used i.e. to e-mail diffs, build documentation, or invoke bug tracking

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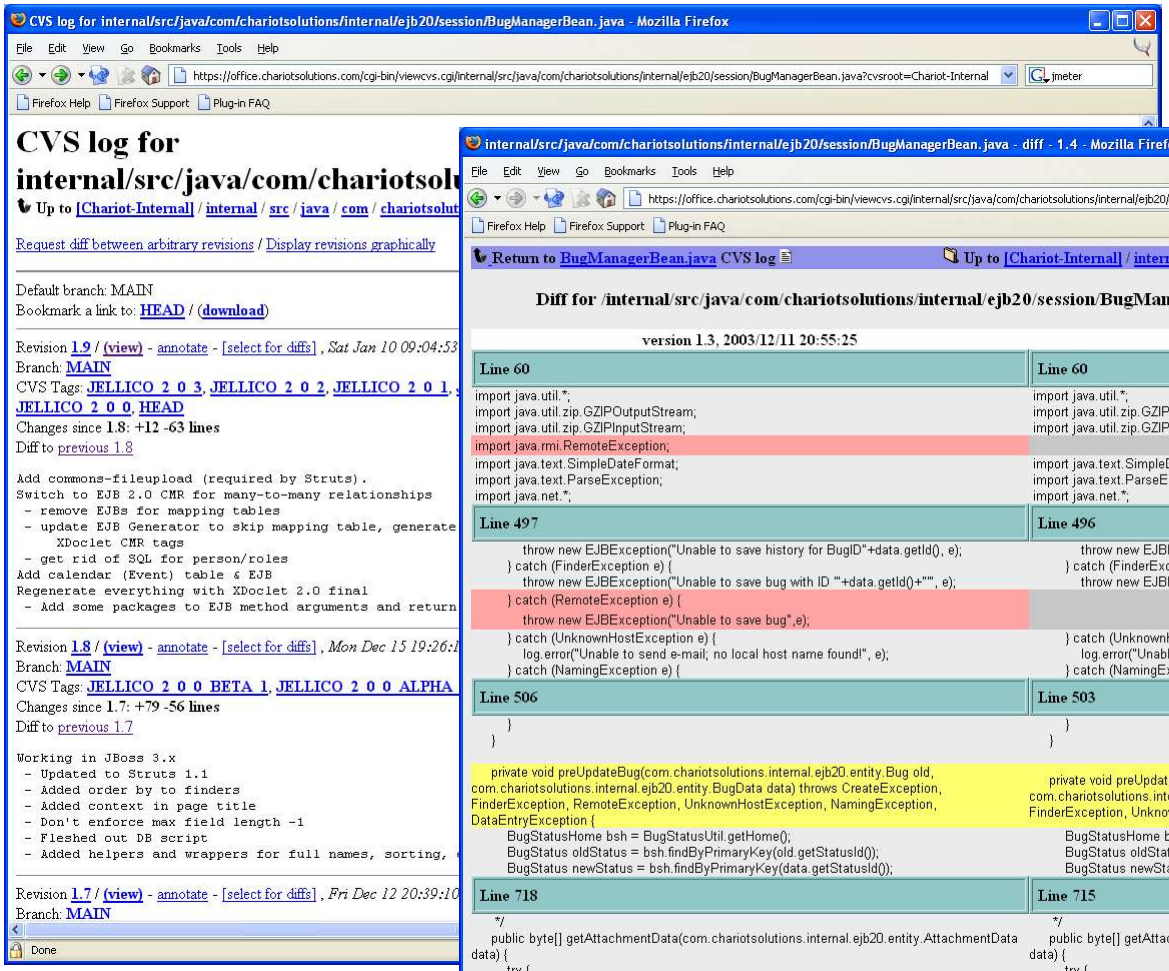
ViewCVS Screenshots



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Profiling

- Eclipse Profiler
- JMemProf
- Cougaar Profiler
- JTreeProfiler

- Most tools use standard JVMPI interface to access JVM profiling information
- New tools can use bytecode instrumentation (altering specific classes as needed) for better performance than standard JVMPI monitoring
- These tools offer similar statistics and analysis to what commercial tools offer

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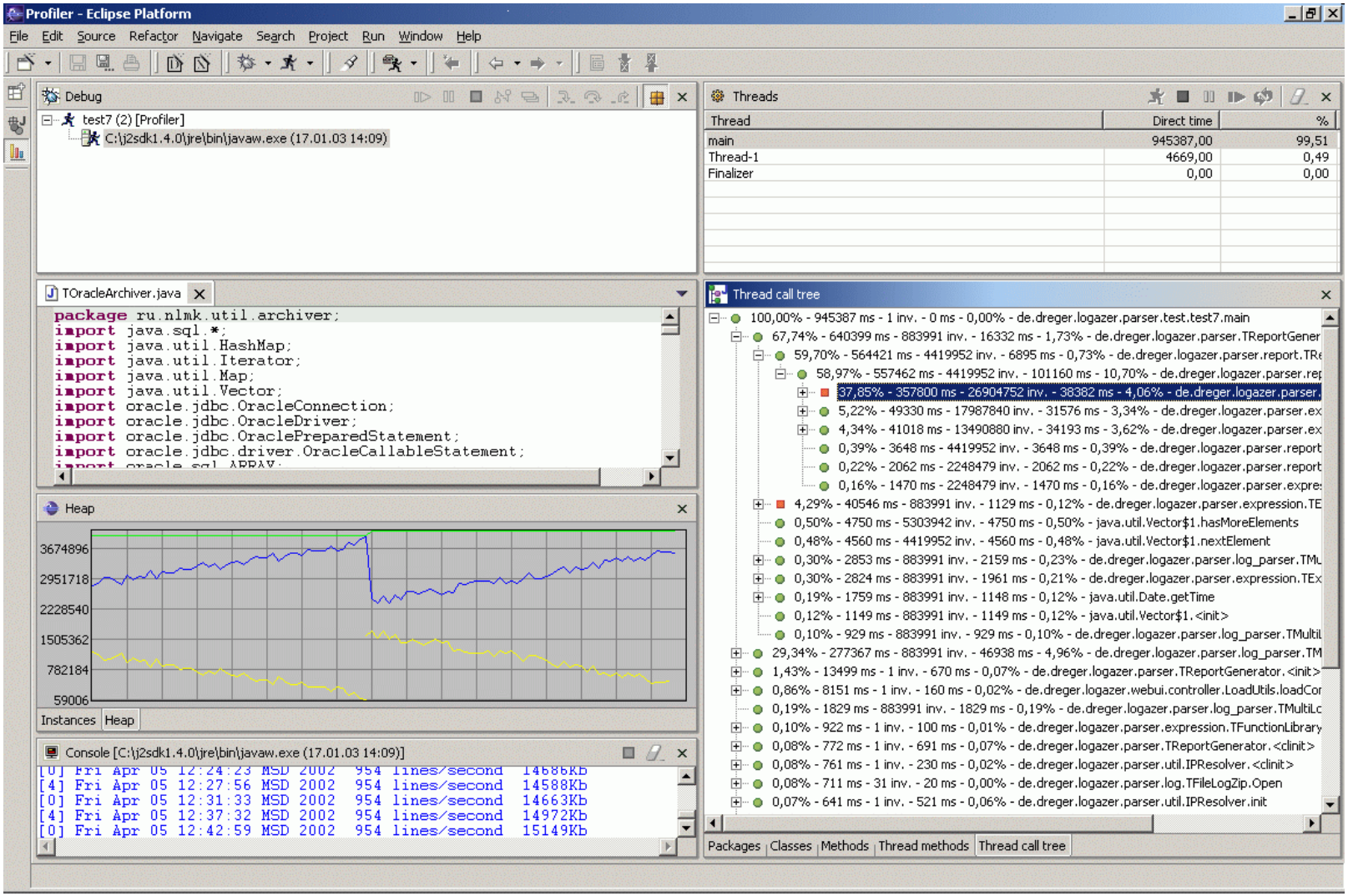
Ecplise Profiler



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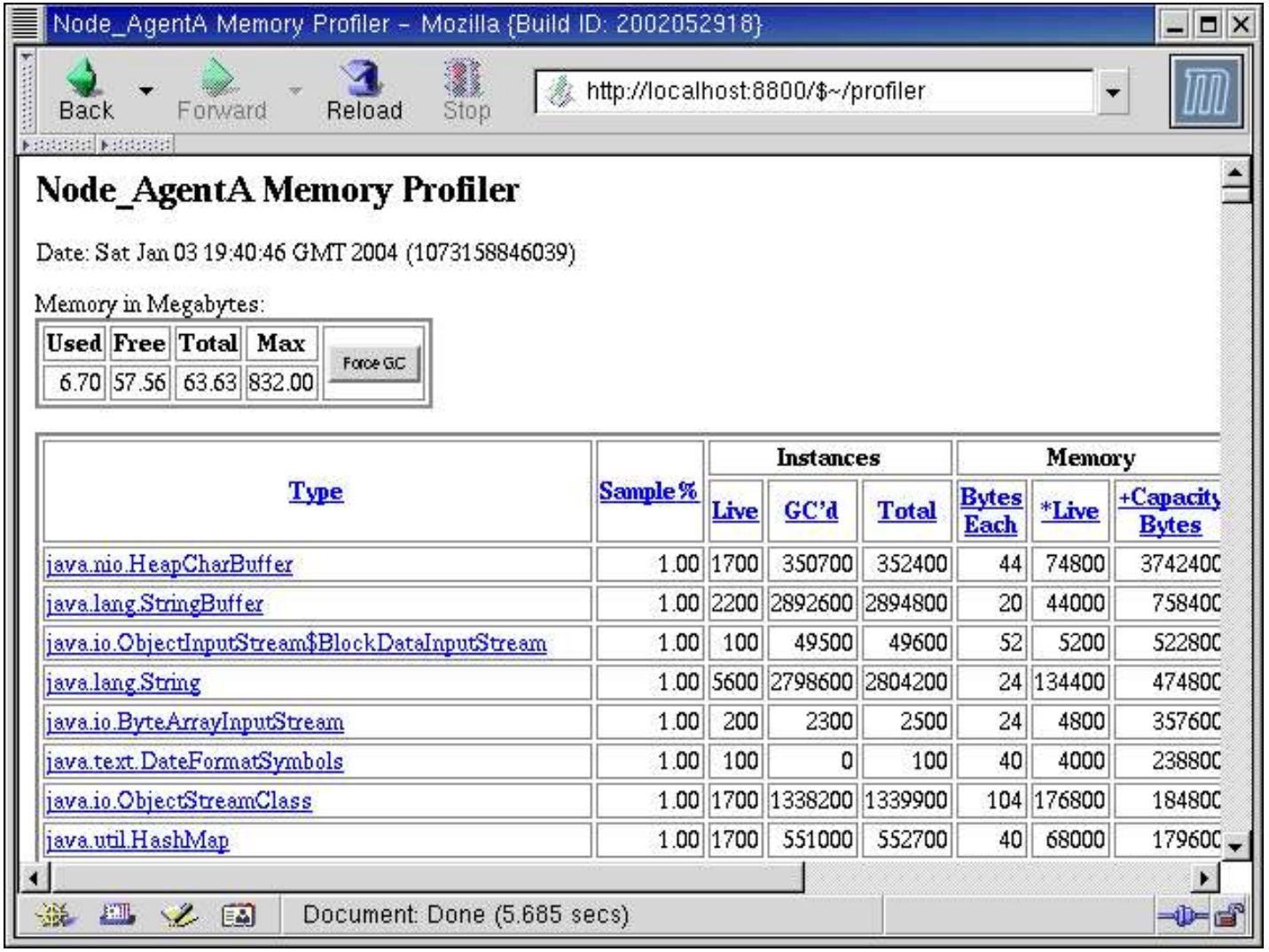
Cougaar Profiler Results



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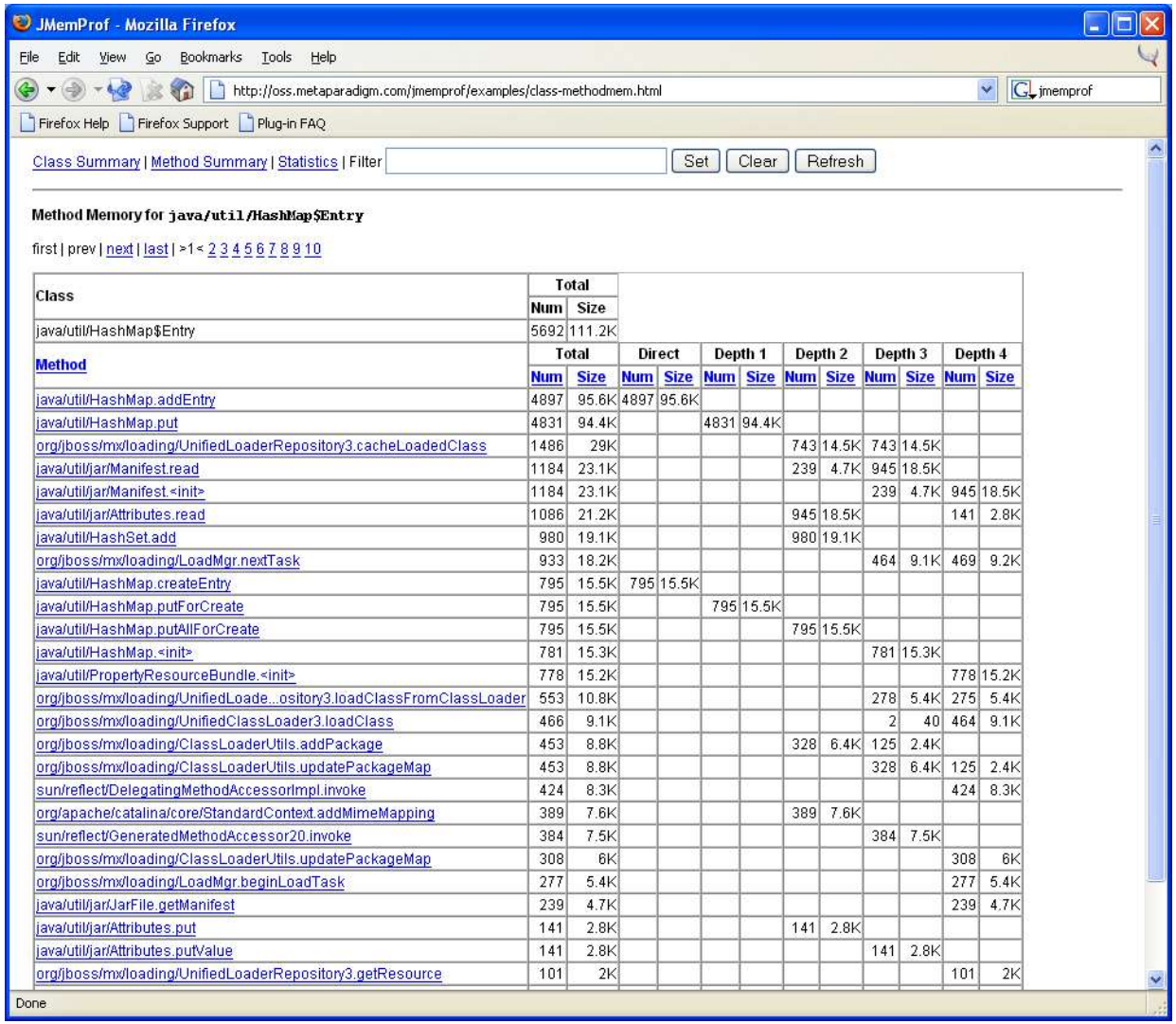
JMemProf Results



Class	Total	
	Num	Size
java/util/HashMap$Entry	5692	111.2K

Method	Total		Direct		Depth 1		Depth 2		Depth 3		Depth 4	
	Num	Size	Num	Size	Num	Size	Num	Size	Num	Size	Num	Size
java/util/HashMap.addEntry	4897	95.6K	4897	95.6K								
java/util/HashMap.put	4831	94.4K			4831	94.4K						
org/jboss/mx/loading/UnifiedLoaderRepository3.cacheLoadedClass	1486	29K					743	14.5K	743	14.5K		
java/util/jar/Manifest.read	1184	23.1K					239	4.7K	945	18.5K		
java/util/jar/Manifest.<init>	1184	23.1K							239	4.7K	945	18.5K
java/util/jar/Attributes.read	1086	21.2K					945	18.5K			141	2.8K
java/util/HashSet.add	980	19.1K					980	19.1K				
org/jboss/mx/loading/LoadMgr.nextTask	933	18.2K							464	9.1K	469	9.2K
java/util/HashMap.createEntry	795	15.5K	795	15.5K								
java/util/HashMap.putForCreate	795	15.5K			795	15.5K						
java/util/HashMap.putAllForCreate	795	15.5K					795	15.5K				
java/util/HashMap.<init>	781	15.3K							781	15.3K		
java/util/PropertyResourceBundle.<init>	778	15.2K									778	15.2K
org/jboss/mx/loading/UnifiedLoade...ository3.loadClassFromClassLoader	553	10.8K							278	5.4K	275	5.4K
org/jboss/mx/loading/UnifiedClassLoader3.loadClass	466	9.1K							2	40	464	9.1K
org/jboss/mx/loading/ClassLoaderUtils.addPackage	453	8.8K					328	6.4K	125	2.4K		
org/jboss/mx/loading/ClassLoaderUtils.updatePackageMap	453	8.8K							328	6.4K	125	2.4K
sun/reflect/DelegatingMethodAccessorImpl.invoke	424	8.3K									424	8.3K
org/apache/catalina/core/StandardContext.addMimeMapping	389	7.6K					389	7.6K				
sun/reflect/GeneratedMethodAccessor20.invoke	384	7.5K							384	7.5K		
org/jboss/mx/loading/ClassLoaderUtils.updatePackageMap	308	6K									308	6K
org/jboss/mx/loading/LoadMgr.beginLoadTask	277	5.4K									277	5.4K
java/util/jar/JarFile.getManifest	239	4.7K									239	4.7K
java/util/jar/Attributes.put	141	2.8K					141	2.8K				
java/util/jar/Attributes.putValue	141	2.8K							141	2.8K		
org/jboss/mx/loading/UnifiedLoaderRepository3.getResource	101	2K									101	2K

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Obfuscation

- ProGuard
- RetroGuard
- JODE
- JavaGuard

- Can be incorporated into a standard build process (typically via Ant with a config script)
- These tools change names and strip extra information to obfuscate classes
  - Also ends up compressing the JAR size
- ProGuard can “de-obfuscate” stack traces and handles Class.forName(“name”); JODE includes a decompiler

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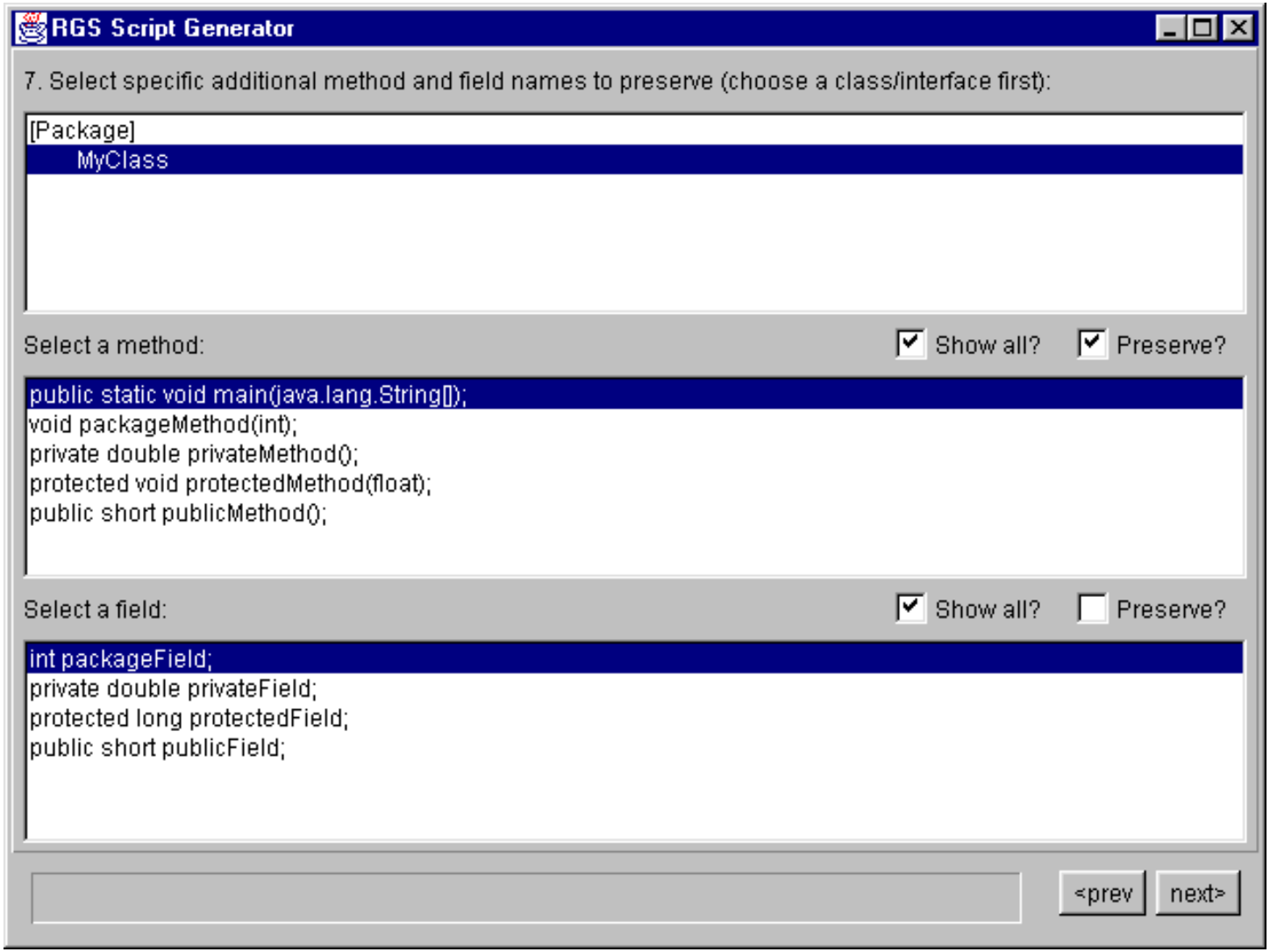
Sample Config GUI



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Installers

- IzPack
- Packlet
- VAInstall
- Lift Off Java Installer

- Wraps the install/uninstall process, including locating a JVM & possibly missing libraries
- Installer built based on a script, integrated with Ant, variable substitution, …
- Builds executable JAR or executable
- Some tools can set executable flags, change CRLF format, handle differential upgrades

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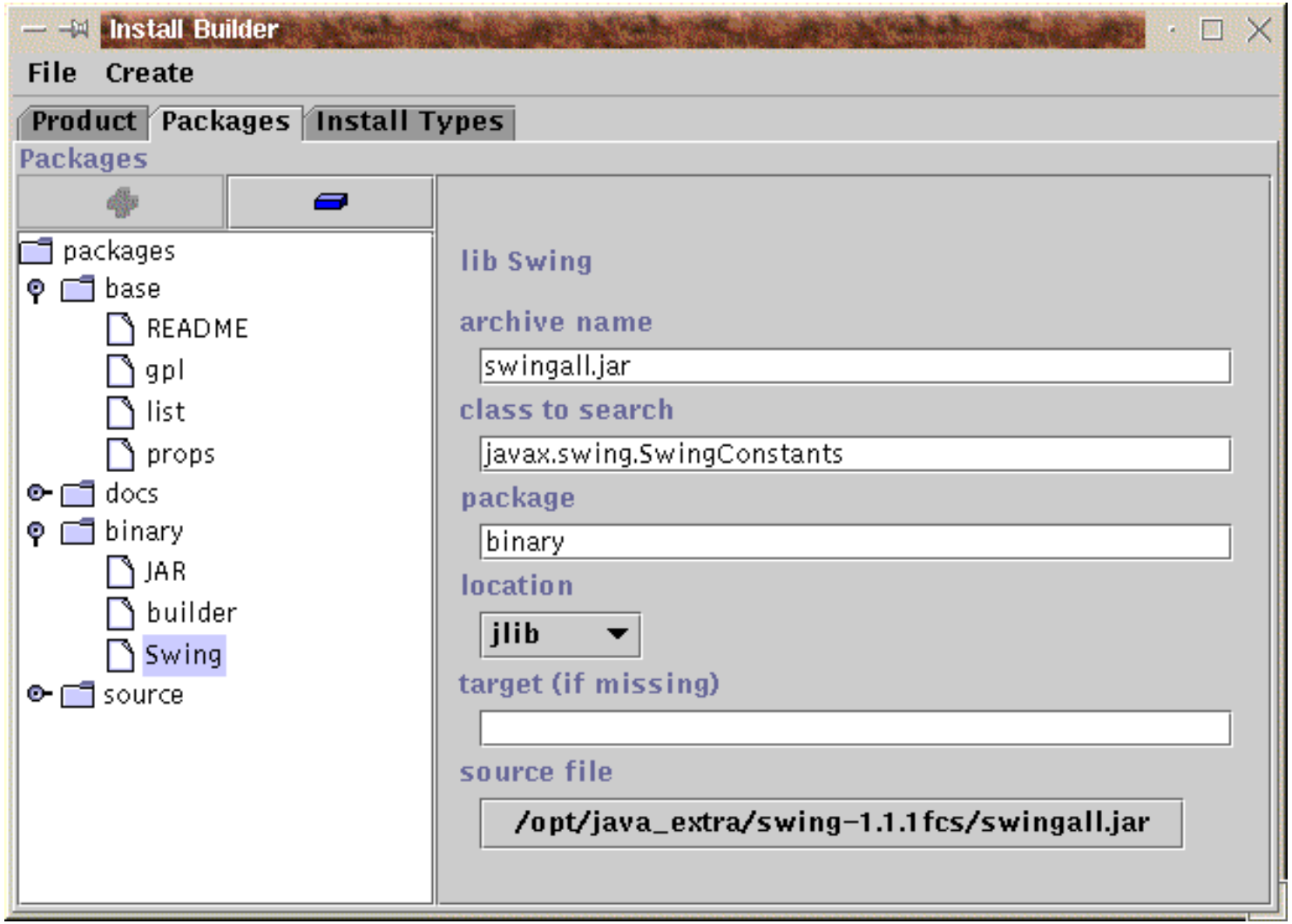
Lift Off Java Installer



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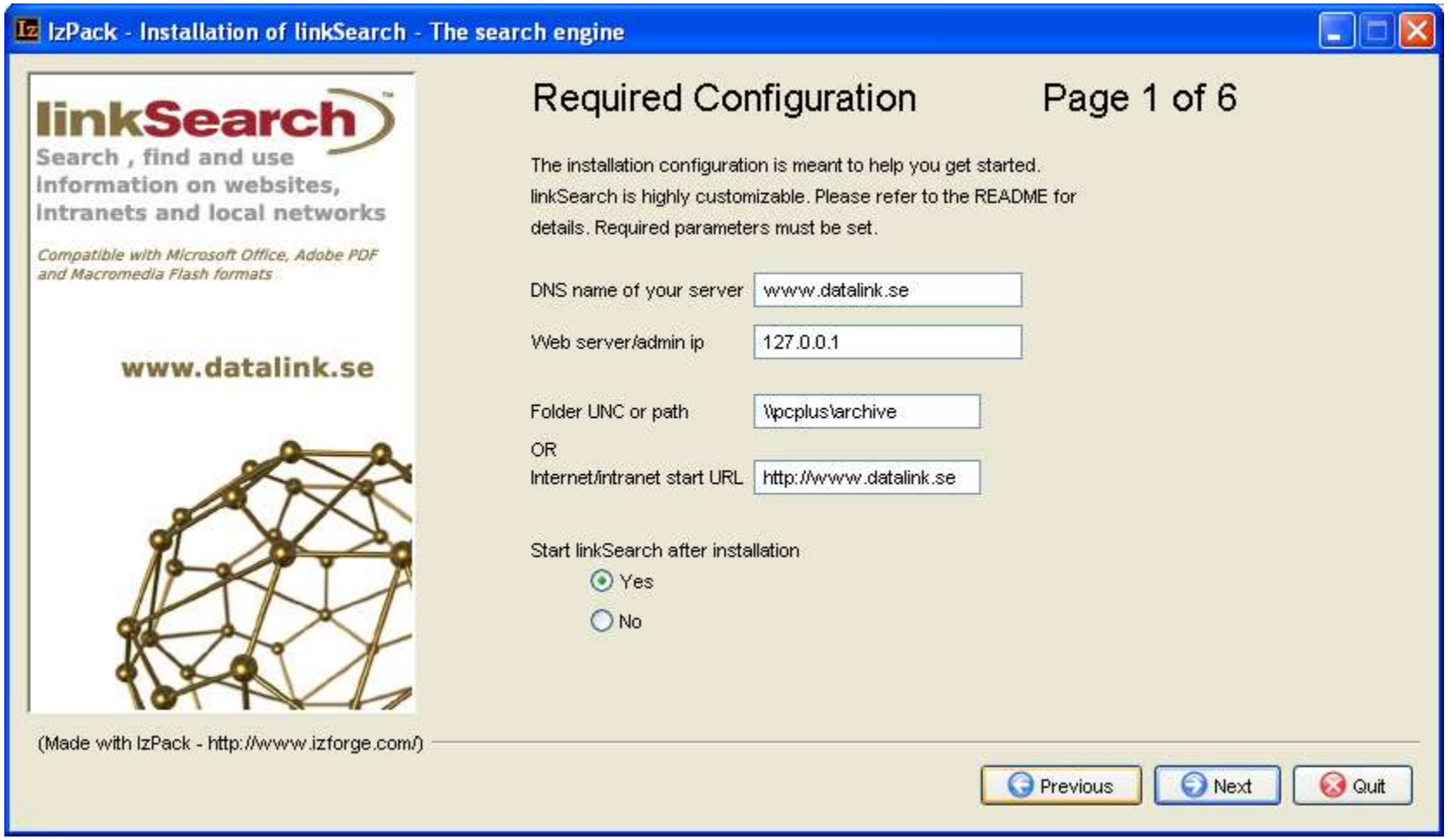
IzPack Screenshot



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Code Helpers

- JRefactory
- Hammurapi
- Numerous product-specific plugins

- JRefactory offers numerous handy formatting, refactoring, & quality checking features (cut & paste detection, standards compliance, metrics)
  - Includes plugins for jEdit, NetBeans, JBuilder, and plain Ant scripts, with more IDEs on the way
  - Also includes a standlone GUI if your IDE is not supported
- Hammurapi includes dozens of code inspectors and Ant integration

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Project Management

- OpenWorkbench

- The open source version of MS Project
- Scheduling, dependencies, scope changes, pretty pictures, it's all in there

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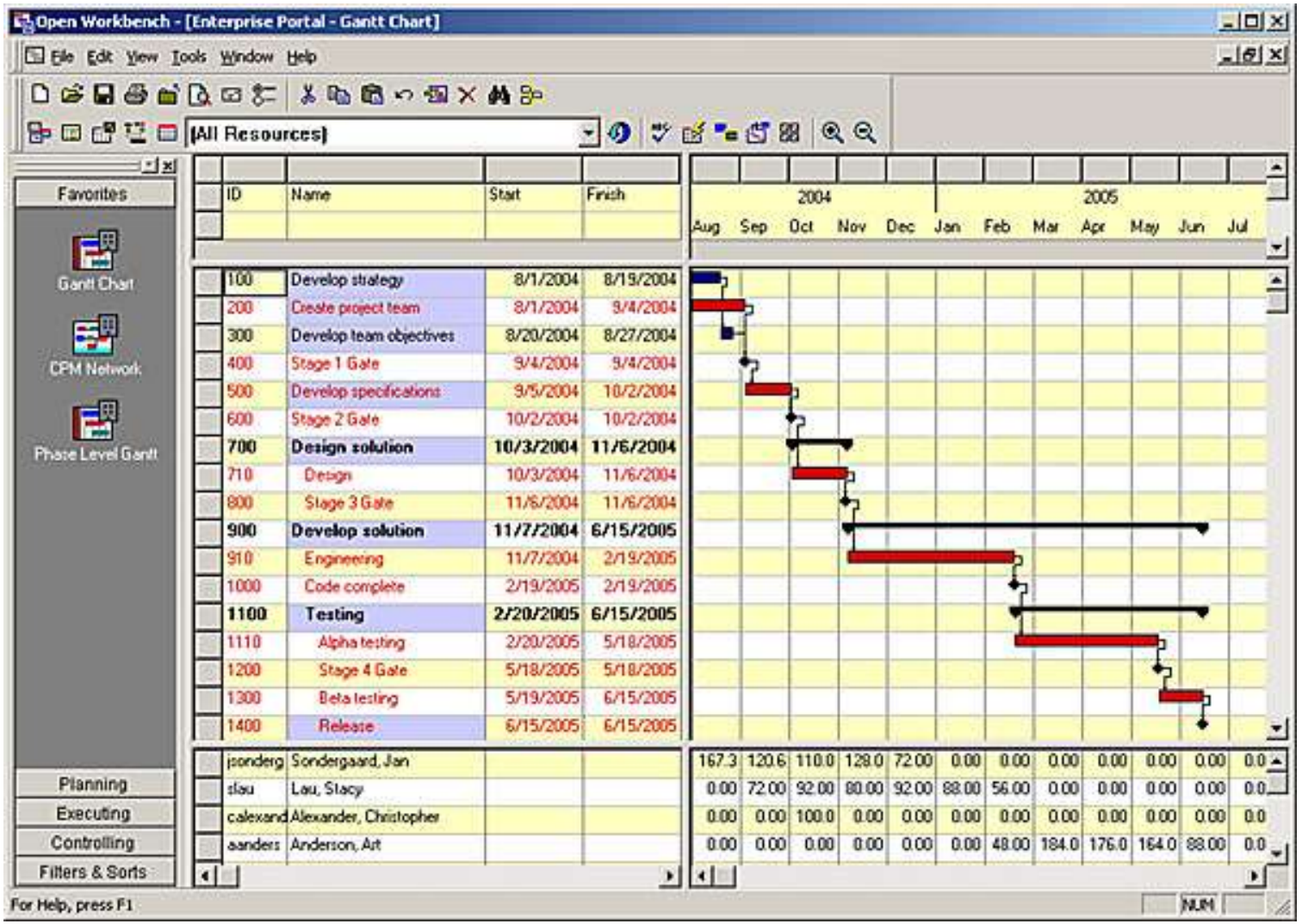
OpenWorkbench



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Libraries & APIs

Part III

CHARIOT SOLUTIONS

XML Binding

- Castor XML
- JiBX
- JAXB RI
- XMLBeans

- Maps XML data directly to Java objects; no manual parsing necessary
- Provides manipulation & validation of XML data in the object realm
- Different tools can generate Java code starting from XML, or create an XML format from Java code
- Can customize output formatting

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XML Binding Overview

```
<customer>
  <name>
    <first-name>Aaron</first-name>
    <last-name>Mulder</last-name>
  </name>
  <street>165 Indiana Ave</street>
  <city>Fort Washington</city>
  …
</customer>
```

- Complex type definitions are mapped to classes
- Child elements & attributes are mapped to fields
- May be able to adjust depth

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Persistence

- Castor JDO
- JORM
- Hibernate
- Apache OJB

- Handles mapping RDBMS data to Java objects and vice versa
- Java objects can be POJOs
- Can include transaction and caching support

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Hibernate/Spring Code

```
public class Product implements Serializable {
    private String name;
    private Collection productRates;
    // getters & setters
}

public class HibernateProductManager extends
                            HibernateDaoSupport {
    public ProductRate[] getProductRates(
                                    Integer productId) {
        Product p = (Product)
            getHibernateTemplate().get(
                            Product.class, productId);
        if(p == null) {…}
        return (ProductRate[])
           p.getProductRates().toArray(
              new ProductRate[0]);
    }
}
```


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Web Frameworks

- Struts
- WebWork
- Spring
- Tapestry

- Struts and WebWork handle page flow, validation, MVC structure, HTML form to Java object mapping, JSP taglibs, etc.
- Spring provides many of the same features, using an approach based on Inversion of Control (IoC), in addition to many utility APIs around JDBC, persistence, transactions, AOP, object/service management, and more.

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Hibernate & Spring, again

```
public class Product implements Serializable {
    private String name;
    private Collection productRates;
    // getters & setters
}

public class HibernateProductManager implements
        ProductManager extends HibernateDaoSupport {
    public ProductRate[] getProductRates(
                                Integer productId) {
        Product p = (Product)
            getHibernateTemplate().get(
                        Product.class, productId);
        if(p == null) {…}
        return (ProductRate[])
           p.getProductRates().toArray(
              new ProductRate[0]);
    }
}
```


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Spring Web (Java code)

```
public interface ProductManager {
    public ProductRate[] getProductRates(
                                        Integer product);
}
public class ViewProductRates extends
                                SimpleFormController {
    private ProductManager productManager;
    // getter & setter

    public ModelAndView onSubmit(Object command)
                                throws ServletException {
        ProductRatesForm form =(…)command;
        Integer productId = form.getProductId();
        ProductRate[] rates =
                    mgr.getProductRates(productId);
        return new ModelAndView("viewRates",
                                        "rates", rates);
    }
}
```


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Spring Web (JSP code)

```
<%@ taglib prefix="c"
           uri="http://java.sun.com/jstl/core" %>

<h1 align="center">Product Rates</h1>
<ul>
  <c:forEach items="${rates}" var="rate">
    <li>
      <c:out value="${rate.premium}" /> for
      <c:out value="${rate.coverage}" /> coverage
    </li>
  </c:forEach>
</ul>
```


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Spring Config File

```
<bean id="SessionFactory" ← Hibernate Construct
  class="…hibernate.LocalSessionFactoryBean">

<bean id="TransactionManager" ← Transactions
  class="…hibernate.HibernateTransactionManager">

<bean id="ProductManager" ← "Session Bean"
          class="demo.HibernateProductManager">
    <property name="sessionFactory">
        <ref bean="SessionFactory"/>
    </property>
</bean>

<bean id="ViewProductRates" ← Web Controller
          class="demo.ViewProductRates">
    <property name="productManager">
        <ref bean="ProductManager"/>
    </property>
</bean>
```


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Object-Level Security

- Acegi for Spring
- Seraph
- jSai
- Security Filter

- Provides server-independent authentication and authorization with caching
- Works in or out of a servlet container, but may not automatically pass credentials from web layer to EJB layer (depends on server plugin)
- Some of these can redirect to SSL based on security requirements, hash password, provide login/logout event hooks

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Search/Indexing

- Lucene
- Nutch
- JSpider
- Heritrix

- JSpider & Heritrix crawl web site(s)
  - Check for errors, validate links, create site map
  - Detect traps, useless data (calendar for 2020…)
- Lucene can index a set of content and do a mini-update for each bit as new content comes in, typically used to provide search features
- Nutch is an open-source search engine

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Text Processing

- iText
- POI
- FOP

- iText can programmatically create documents and then output them to formats including PDF
- FOP can process XML formatted objects and output formats including PDF
- POI can import and export files in Microsoft formats (Word, Excel, OLE compound docs)
- These are all low-level compared to report writers

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iText Code Sample

```
Document document = new Document();
PdfWriter writerA = PdfWriter.getInstance(document,
    new FileOutputStream("Chap0108a.pdf"));
writerA.setViewerPreferences(
    PdfWriter.PageLayoutTwoColumnLeft);
Watermark watermark = new Watermark(
    Image.getInstance("watermark.jpg"), 200, 420);
document.add(watermark);
HeaderFooter header = new HeaderFooter(
    new Phrase("This is a header"), false);
document.setHeader(header);
document.open();
document.setPageSize(PageSize.LETTER);
document.add(new Paragraph("Hello World"));
document.close();
```


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Reporting

- JasperReports
- JFreeReport
- DataVision
- JFreeChart

- High-level tools to design and output reports
- DataVision includes GUI editor, JFreeReport doesn't
- Jasper is powerful and featureful, but GUI editors are not always up to date
- Developers may end up maintaining report configuration files, printer configurations

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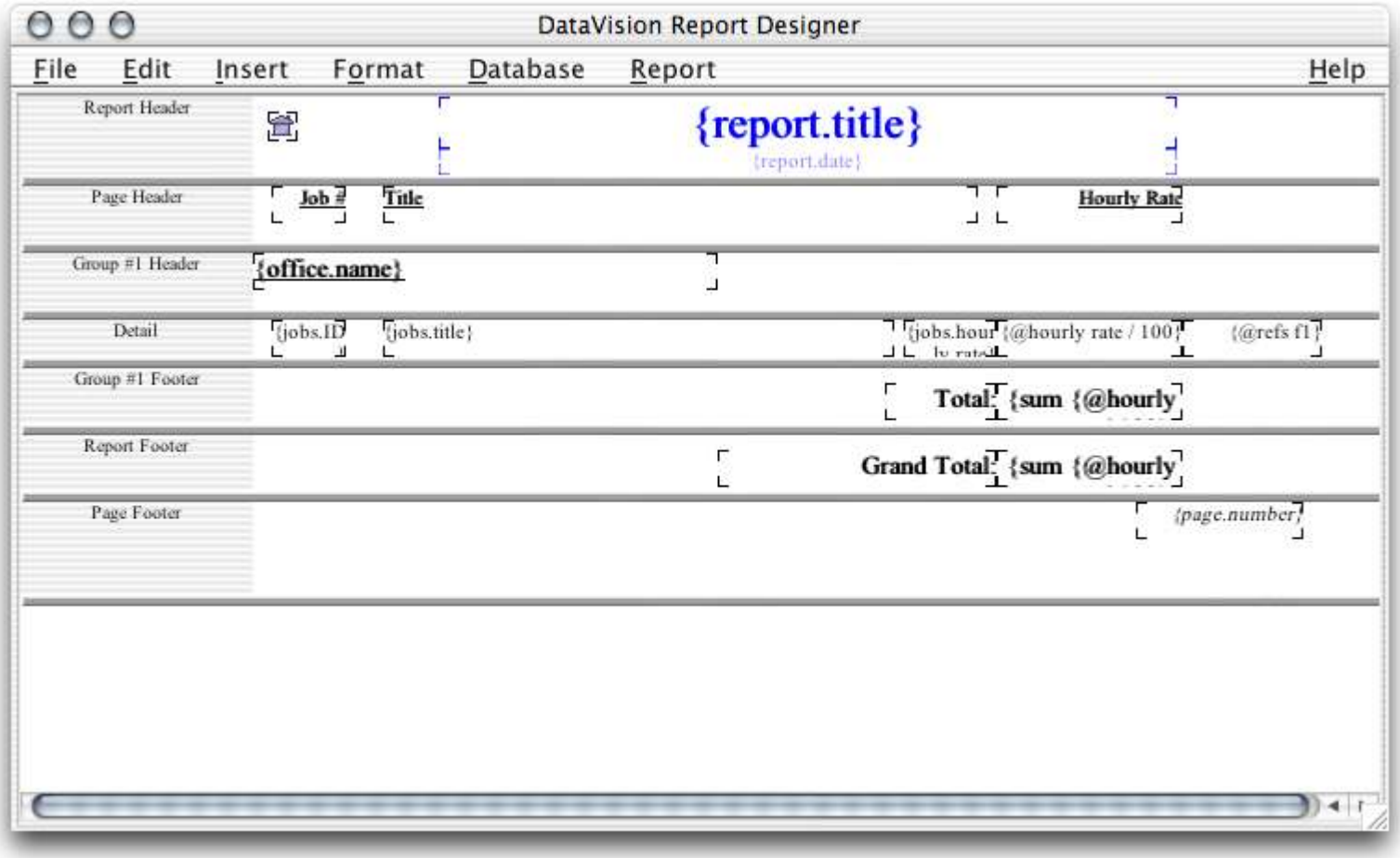
DataVision Designer



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JasperReport Definition

```
<jasperReport name="test" pageWidth="612"
        pageHeight="792" columnWidth="540"
        columnSpacing="15" leftMargin="36"
        rightMargin="36" topMargin="36"
        bottomMargin="36">
    <parameter name="month"
        class="java.lang.String" />
    <parameter name="debit_account"
        class="java.lang.String" />
    <parameter name="credit_account"
        class="java.lang.String" />
    <title>
        <band height="100">
            <textField>
                <reportElement x="200" y="6"
                    width="100" height="14"/>
                <textElement>
                    <font fontName="arial"
                    size="10" isBold="false"/>
```


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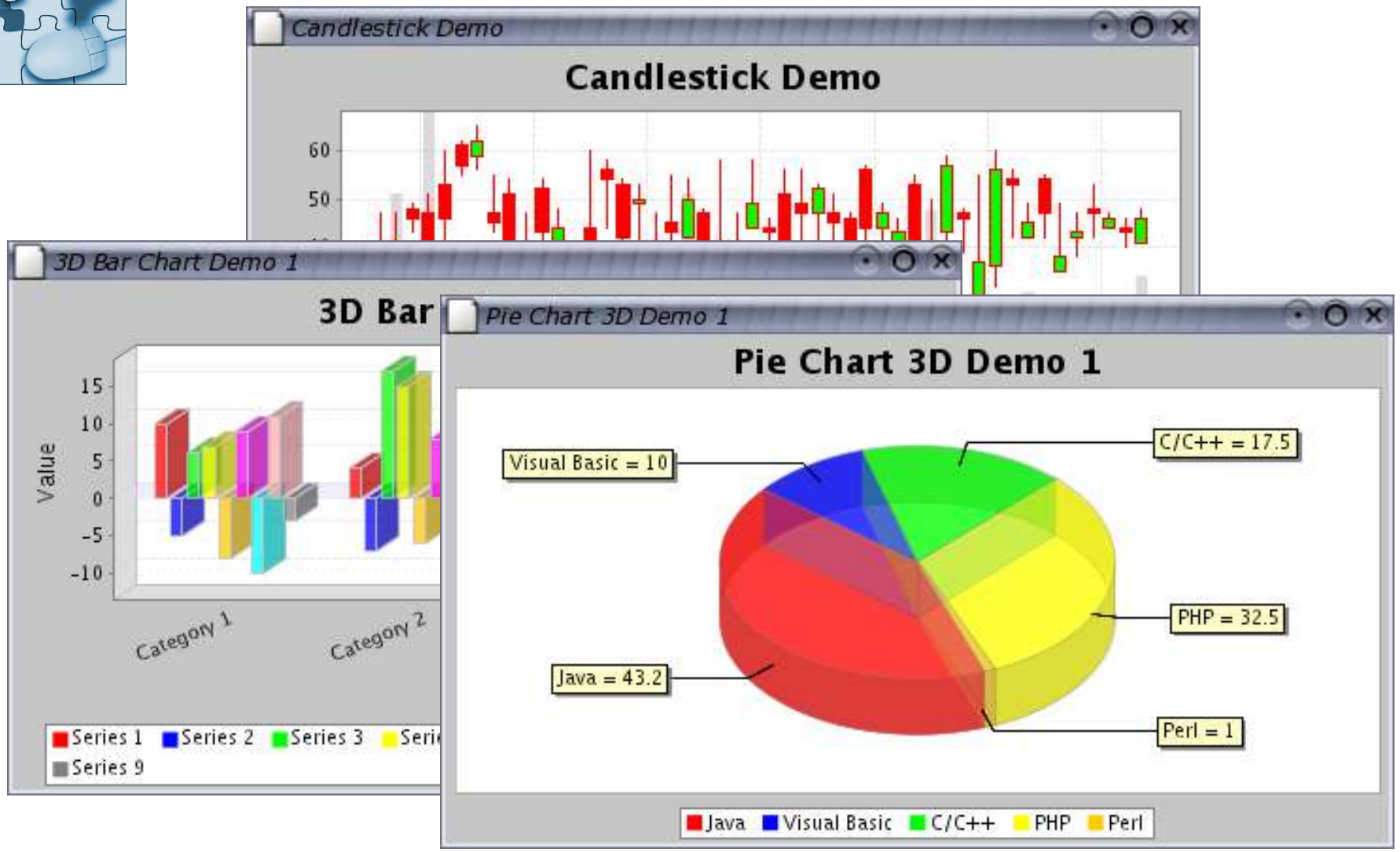
JFreeChart Samples



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Scheduling

- Quartz
- J2EE Timer
- JCronTab
- (AutoSys/Cron)

- The J2EE timer service is quite limited; it can schedule N seconds in the future
- JCronTab is a Java implementation of the UNIX cron service; it's reasonably lightweight
- Quartz is very feature-rich, but requires more setup and maintenance (typically database tables, etc.). Quartz integration starting to appear as a feature in other products.

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Others to Investigate

- OScache
- Laszlo and IDE for Eclipse
- Direct Web Remoting
- Sulu
- XUI
- MyFaces
- Beehive
- JCrawler
- JobServer
- TestNG

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URLs

PostgreSQL
postgresql.org

MySQL
mysql.org

SAP-DB
sapdb.org

Firebird
firebird.sourceforge.net

Hypersonic
hsqldb.sourceforge.net

McKoi
mckoi.com

JBoss
jboss.org

JOnAS
jonas.objectweb.org

Geronimo
geronimo.apache.org

Tomcat
jakarta.apache.org/tomcat

Jetty
jetty.mortbay.org

Eclipse
eclipse.org

NetBeans
netbeans.org

jEdit
jedit.org

Bugzilla
bugzilla.org

Scarab
scarab.tigris.org

JIRA
atlassian.com/software/jira

Ant
ant.apache.org

Maven
maven.apache.org

Anthill
urbancode.com/projects/anthill

CruiseControl
cruisecontrol.sourceforge.net

Cocoon Portal
cocoon.apache.org

Jetspeed/Pluto
portals.apache.org

Liferay
liferay.com

eXo
exo.sourceforge.net

Drools
drools.org

OFBiz
ofbiz.org

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URLs

JESS
herzberg.ca.sandia.gov/jess

InfoSapient
info-sapient.sourceforge.net

Compiere
compiere.org

Lenya
cocoon.apache.org/lenya

Plone
plone.org

Slide
jakarta.apache.org/slide/

Bricolage
bricolage.cc

MoinMoin
moin.sf.net

OpenGroupware
opengroupware.org

Jabber
jabber.org

SquirrelMail
squirrelmail.org

Web Developer Extension
chrispederick.com

DocBook
docbook.org

StructuredText
zope.org

DBVisualizer
minq.se/products/dbvis

TORA
globecom.net/tora

TOAD
toadsoft.com

SQuirreL
squirrel-sql.sourceforge.net

LDAP Browser/Editor
iit.edu/~gawojar/ldap

Luma
luma.sourceforge.net

JXplorer
pegacat.com/jxplorer

JWebUnit
jwebunit.sourceforge.net

MAXQ
maxq.tigris.org

JMeter
jakarta.apache.org/jmeter

TestMaker
pushtotest.com/Downloads/features.html

CVS
cvshome.org

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URLs

JMemProf
oss.metaparadigm.com/jmemprof

ViewCVS
viewcvs.sourceforge.net

Subversion
subversion.tigris.org

Eclipse Profiler
eclipsecolorer.sourceforge.net/index_profiler.html

JMemProf
oss.metaparadigm.com/jmemprof

Cougaar Profiler
profiler.cougaar.org

JTreeProfiler
jcoverage.sourceforge.net

ProGuard
proguard.sourceforge.net

RetroGuard
retrologic.com/retroguard-main.html

JODE
jode.sourceforge.net

JavaGuard
sourceforge.net/projects/javaguard

IzPack
izforge.com/izpack

Packlet
packlet.sourceforge.net

VAInstall
vainstall.sourceforge.net

Lift Off Java Installer
liftoff.sourceforge.net

JRefactory
jrefactory.sourceforge.net

Hammurapi
hammurapi.org

OpenWorkbench
openworkbench.org

Castor
castor.org

JAXB RI
jaxb.dev.java.net

JiBX
jibx.org

XMLBeans
xml.apache.org/xmlbeans

JORM
jorm.objectweb.org

Hibernate
hibernate.org

Apache OJB
db.apache.org/ojb

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URLs

Struts
jakarta.apache.org/struts

WebWork
opensymphony.com/webwork

Spring
springframework.org

Tapestry
jakarta.apache.org/tapestry

Acegi
acegisecurity.sourceforge.net

Seraph
opensource.atlassian.com/seraph

jSai
oss.ipov.org/jsai

Security Filter
securityfilter.sourceforge.net

Lucene
jakarta.apache.org/lucene

Nutch
nutch.org

JSpider
j-spider.sourceforge.net

Heritrix
crawler.archive.org

iText
lowagie.com/iText

FOP
xml.apache.org/fop

POI
jakarta.apache.org/poi

JasperReports
jasperreports.sourceforge.net

DataVision
datavision.sourceforge.net

JFreeReport / JFreeChart
jfree.org

Quartz
opensymphony.com/quartz

JCronTab
jcrontab.sourceforge.net

OScache
opensymphony.com/oscache

Laszlo
openlaszlo.org

Direct Web Remoting
dwr.dev.java.net

Sulu
sulu.sourceforge.net

XUI
xui.sourceforge.net

MyFaces
myfaces.apache.org

Beehive
incubator.apache.org/beehive

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URLs

JCrawler
jcrawler.sourceforge.net

JobServer
grandlogic.com/content/html_docs/
products-jobserver.shtml

TestNG
www.beust.com/testng

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