Eclipse Test and Performance Tools Platform (TPTP)
Unit 1 – Introductions
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Audience

Please introduce yourself

- Name
- Knowledge/Experience on Eclipse-TPTP Profiling Tool
- What do you hope to get from the workshop?
Agenda

- Unit 1 - Introductions
- Unit 2 - Technology Overview
- Unit 3 - Profiling and Logging Perspective
- Unit 4 - Launch
- Unit 5 - Attach
- Unit 6 - Profiling options
- Unit 7 - Profiling Views
- Unit 8 - Preferences
- Unit 9 - Extension Points
- Unit 10 - Conclusion
Eclipse Test and Performance Tools Platform (TPTP)
Unit 2 - Technology Overview
Eclipse

- Formed in November 2001
- An open source software development project dedicated to provide a robust, full-featured, commercial-quality, industry platform for the development of highly integrated tools
- Composed of projects, each of which is overseen by a Project Management Committee (PMC) and governed by its Project Charter
- Each project is composed of its own subprojects and is licensed under the CPL (EPL starting 2005)
Test and Performance Tools Platform (TPTP)

- Eclipse Tools Project, Dec 2002
- Formerly Hyades
- An integrated test, trace and monitoring environment, based on Eclipse
- Provides an open source platform for Software test and performance tools platform
- Aims to move software quality practices earlier into the application development cycle
- Provides a unified data model, a normative user experience and workflow, and a united set of APIs and reference tools that work consistently across the range of targets
- Aims to bring software test and performance tools into the Eclipse environment in a consistent way that maximizes integration with tools used in the other processes of the software lifecycle
- Reduce the cost and complexity of implementing effective automated software quality control processes
- Share data through an OMG-defined test profile model, Common Base Event Model and trace model implemented via the Eclipse Modeling Framework (EMF)
The Eclipse Test and Performance Tools Platform Project

- Eclipse top-level project created by the Eclipse Foundation in August 2004
- Based on and extends the TPTP Project
- To build a generic, extensible, standards-based tool platform
- Provides an open development platform supplying frameworks and services for test and performance tools that are used throughout the software lifecycle
- Provides a platform for software developers to create specialized, differentiated, and interoperable offerings for world class test and performance tools
- Supports a spectrum of computing systems, from standalone through highly-distributed, and from embedded to enterprise
Project Principles

- Extension of the Eclipse Value Proposition
- Vendor Ecosystem
- Vendor Neutrality
- Standards-Based Innovation
- Agile Development
- Inclusiveness & Diversity
TPTP Project Structure

- **TPTP Platform Project**
  covers the common infrastructure in the areas of user interface, EMF based data models, data collection and communications control, remote execution environments and extension points

- **TPTP Monitoring Tools Project**
  collects, analyzes, aggregates and visualizes data that can be captured in the log and statistical models

- **TPTP Testing Tools Project**
  provides specializations of the platform for testing and extensible tools for specific testing environments, initially 3 test environments: Junit, manual and URL testing

- **TPTP Tracing and Profiling Tools Project**
  extends the platform with specific data collection for Java and distributed applications that populate the common trace mode, also viewers and analysis services
Participants

- Intel
- IBM
- Scapa Technologies
- Compuware
- Computer Associates
- OC Systems
- SAP
- FOKUS
Profiling Tool

- Broadly useful for performance analysis and for gaining a deeper understanding of a Java program
- Consists of the Profiling and Logging Perspective and a number of graphical and tabular views
- Enables you to profile and interact with your applications, to work with profiling resources, and to examine your applications for performance and memory usage problems
- Help you to visualize and understand your program execution, pinpoint the operations that take the most resource, as well as to explore patterns of program behavior
- Enables you to test your application's performance early in the programming development cycle for improvements
Agent Controller

- A daemon process that resides on each deployment host and enables client applications to launch host processes and interact with agents that coexist within host processes
- Contains a server that has the capability to launch and manage local or remote applications from a local TPTP workbench
- The Java profiling engine included uses the JVMPI to profile local or remote Java applications from a local TPTP workbench
- Launch and profile local or remote Java applications and import local or remote logs
- Platform support: Windows, Linux, Solaris, HP-UX, AIX, Z/OS, OS/400
Agent Controller

- Eclipse Workbench
- Agent Controller
- Java Profiling Agent
- Host Process
### Agent Controller Terminology

- **Host process**
  The process that contains the application under test

- **Agent**
  A reusable binary file that provides services to the host process, and more importantly, provides a portal by which application data can be forwarded to attached clients

- **Client**
  A local or remote application (e.g., Eclipse Workbench) that is the terminal destination of host process data that is externalized by an agent

- **The Agent Controller**
  A daemon process that resides on each deployment host and provides the mechanism by which client applications can either launch new host processes, or attach to agents that coexist within existing host processes. The client can reside on the same host as the Agent Controller, or it can be remote. The Agent Controller can only interact with processes on the same node, and it is required on the same machine the targeted JVM is on.
The Java Profiler

- A library that attaches to a JVM to capture and record the Java application's behavior
- Is a type of agent managed by the Agent Controller
- Runs in the JVM (Java Virtual Machine) process and receives notifications of JVM events, based on the JVMPI (Java Virtual Machine Profiler Interface). This agent is best used to identify performance details such as classes or methods responsible for the poor execution performance, also be used to analyze application heap and find memory leaks
- Output from the profiling agent is in the form of XML fragments
- Can be launched from the TPTP workbench, Applications can be in workbench's workspace or binaries that are on the file system
- Can also be invoked using the -Xrun JVM option in command line
Eclipse Test and Performance Tools Platform (TPTP)
Unit 3 - Profiling and Logging Perspective
Profiling and Logging Perspective

- The profiling tools available in the Profiling and Logging perspective provide comprehensive information about the performance of an application.
- The profiling tool (in this scenario i.e. – Java Profiling) provides information pertaining to:
  - JVM performance
  - Object allocations and references
  - Garbage collection
  - Object methods performance
  - Object->Object interactions
  - Thread interactions to name a few
Profiling and Logging Perspective

- Profiling and Logging perspective provides combinations of views and editors that are best suited to performing application profiling

- Profiling Monitor view
  - Multiple views provide the profiling and logging perspective - Profiling Monitor view is the Primary view
  - Project
  - Monitor
  - Host
  - Process & Agent
Profiling and Logging Perspective

Monitor contains processes from hosts that are being monitored.

Hosts being monitored in a profiling session.

Java processes associated with a host.

Profiling agents.
Profiling and Logging Perspective

- Profiling and Logging perspective provides resources to administering and managing profiling
- Profiling resources are organized to provide granularity of usage
- Profiling resources
  - Project: Make a project of your profiling effort
  - Monitor: Aggregate different processes and agents
  - Host: The host you are profiling
  - Process: Very simply the executing program
  - Agent: Provides services to a process, a mechanism by which process data can be sent to (attached) clients
  - Profiling Type: Group profile data collection
Profiling Monitor View

- A Profiling session creates numerous resources
- Administer and Analyze Profiling activity
- Object Control: Choice of action depending on the type of the object
  - Start and Stop the monitoring on an agent
  - Attach and Detach the agent from process
  - Terminate a process
- Context menu is resource-sensitive
Profiling Monitor View

- **Project:**
  - Container of the profiling resources

- **Monitor:**
  - A logical container for the profiling information that is collected from a group of agents. The views at the monitor level show data from these agents. Monitors are useful for aggregating processes and agents from a distributed application

- **Host:**
  - Owns the processes that are profiled. A host runs processes. You can specify a host either by its name or by its IP address

- **Process & Agent:**
  - In the Agent Controller architecture model, an agent is a binary file that provides services to the host process by which application data can be transferred to attached clients
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Unit 4 – Launch an application
Launch Configuration

- Profiling Tool provides the ability to attach to a running application or to launch an application for profiling with launch configurations.
- Attaching an application means that a monitor is created to contain the results observed by an associated agent.
- Launch a process means that the process is started a process with an agent associated to the process.
Configurations

- Attach Java Process:
  -- local or remote
- External Java Application:
  -- local or remote
- Java Applet: workbench (local)
- Java Application:
  -- workbench (local)
- Run-time Workbench: local
- Other launch configurations:
  - for Statistical data
    - Host
    - J2EE App Server
  - for Test
    - URL, JUnit, Manual
Configuration tabs

- Each type of launch configuration defines a group of tabs that collect and display information about the configuration
- Tabs for profiling:
  - Host tab: defines the location of the process to be launched or attached
  - Agents tab: used for attach launch configurations, list the agents available for attach
  - Profile tab: defines detail of data collection on the profile process
Host tab

Create, manage, and run configurations

Configurations:
- Attach - Java Process
- New configuration
- External Java Application
- Host - Linux
- Host - Windows (Performance Monitor)
- Hyades URL Test
- J2EE App Server - JBoss
- J2EE App Server - JOnAS
- Java Application
- JUnit
- JUnit Plug-in Test
- Run-time Workbench
- Test

Name: New_configuration (1)

Default Hosts:
- localhost:10002

Host name or IP address:
Agent Controller port: 10002

Buttons:
- New
- Delete
- Host
- Agents
- Profiling
- Common
- Delete
- Test Connection
- Add
- Apply
- Revert
- Profile
- Close
Agents tab
Profile tab

Create, manage, and run configurations

Select a profiling set:
- Code Coverage - Method Level
- Execution History
- Memory Analysis

Contents of profiling set selected:
- Profiling Type
  - Basic Memory Analysis

Description:
Analyze the application heap. See how many classes were loaded, how many instances are still alive and the memory size allocated by every class.
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Unit 5 – Attaching to a Java application
Attaching to a Java application

- Attaching to a Java Application
  - Local Java Application
  - Remote Java Application
- Attach to a running application or to launch an application for profiling.
  - Attaching : Gather data observed by an associated agent.
  - Launching : the process is started with an agent associated to the process.
Attaching to a Java application

- What is happening?
  - A logical representation of the Java process is created in the Profiling Monitor view
  - The process object i.e. logical representation of the Java process, is identified both by name and an ID number (PID) that appears in the view along with the associated agents.
Attaching to a Java application

![Image of Eclipse IDE showing the profiling configuration window with options for attaching to a Java application.](image-url)
Attaching to a Java application

- Attach to the java process and start monitoring

- Start a java program with the profiling agent

```java
java -XrunpiAgent:server=enabled <<test>>
```
Attaching to a Java application - Local

- Profiling and Logging perspective to attach to a running process locally
Attaching to a Java application - Remote

- Required to Install Eclipse Data collection engine on the remote machine
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Unit 6 – Profiling Options
Profiling Options

- The profiling options are used to control the type of profiling data collected
- Profiling Set
- Profiling Type
- Profiling Filter
- Profiling Limits
- Profile to File
Profiling Set and Profiling Type

- Specify an existing or build a set of profiling type to control the type of profiling data
- Pre-defined Sets:
  - Execution history
  - Memory analysis
  - Method Level Coverage
Profiling Filter

- Limit the classes and method profiled
- Avoid unnecessary visual clutter and speed up the profiling task
Profiling Limits

- Profiling Limits page can be used to limit the amount of data collected from the application.
- Specify the amount of data you want collected by specifying a limit on method invocations or on time.
Profiling File

- Route the profiling events to an xml file instead of the profiling views
Import profiling file

- Profiling file can be imported into workbench for visual presentation and analysis
- File -> Import... -> Profile File
- Select range of file to be imported
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Unit 7 – Profiling Views
Profiling Views

- Number of views to visualize and organize profiling data
  - Memory Statistic view
  - Execution Statistic view
  - Coverage Statistic view
  - Object Reference view
  - Execution Flow view and table
  - Method Invocation view and table
  - UML2 Trace Interactions view
Statistical Views

- Profiling Type oriented
  - Execution
  - Memory
  - Coverage
- Drill down capability
  - Package
  - Class
  - Method
  - Instance
- Additional Information available on toolbar
  - Choose columns
  - Show deltas
  - Show as percentage
  - Open Source
  - Export to HTML
- View shortcut on selection
  - Selection sensitive on context menu
  - Show Object Reference on Class
  - Show Method Invocation on Method
Object Reference View

- Displays references by a set of objects.
- Examine data structures
- Help identify memory leaks
- To find unexpected references
- How? Collect Object References action
- Show reference TO or reference BY.

<table>
<thead>
<tr>
<th>Show Reference By</th>
<th>Package</th>
<th>Size</th>
<th>Number of References</th>
</tr>
</thead>
<tbody>
<tr>
<td>process2</td>
<td>org.eclipse.hyades.samples.processes</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>process2</td>
<td>org.eclipse.hyades.samples.processes</td>
<td>56</td>
<td>Is referenced by 1 object(s).</td>
</tr>
<tr>
<td>[Object.2858</td>
<td>java.lang</td>
<td>24</td>
<td>Is referenced by 1 object(s).</td>
</tr>
<tr>
<td>Vector.2857</td>
<td>java.util</td>
<td>96</td>
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<tr>
<td>Properties</td>
<td>java.util</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PropertyChangeEvent</td>
<td>java.beans</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>PropertyChangeSupport</td>
<td>java.beans</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Execution Flow View

- Give a clear global view on the overall application execution
- Analyze the application execution at the thread level.
- Threads are represented by vertical lines
- Execution stack goes from left to right
- Execution time goes from top to bottom
- Interactive: Zoom In/Out or Select Zoom
Method Invocation View

- Graphical representation of the application execution that lets you see the method execution at the method invocation level
- Makes it easier to identify the execution patterns and differences between invocations of the same method
- Traverse between invocation
- Show Caller or Callee
- Open from any Method Selection
Interactions Views (UML2 Trace Interactions View)

- The Interactions Views present execution flow of an application according to the notation defined by UML
- Host Interactions
- Process Interactions
- Thread Interactions
- Agent Interactions
- Class Interactions
- Object Interactions
Enabling Graphical information

- Enable execution flow detail information be loaded and visualize in graphical views
- Execution Flow View
- Method Invocation View
- Interactions Views
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Unit 8 - Preferences
Preferences

- Preferences: Customize or modify Profiling and Logging Preferences
- Enable or disable profiling or logging
- Specify the port number that the agent uses to connect to the Agent Controller
- If you are working with more than one machine, use Hosts to identify them
- To identify logging agents, use Logging Agents
- Associate views to Context menu of resources in the profiling monitor view
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Unit 9 – Extension Points
TPTP Extension Points

- Allow plug-ins to contribute and extend capability on profiling resources
- Companies can then build its solution on TPTP
- Trace Views
- Profiling Set and Type
- Examples
- More: Log Parser, Analysis Engine, Correlator
Trace Views

- Plugging an analyzer view into the Profiling and Logging Perspective is relatively simple
- Consists of 3 main tasks
  1. Write a plug-in that extends the extension point org.eclipse.hyades.ui.analyzerExtensions, adds an action entry to the *Open With* menu
  2. Add an Eclipse view to the said plug-in
  3. Add code into the view to handle the TPTP profiling data
Profiling Set and Profiling Type

- Profiling Set: A logical grouping of profiling Type
- Defined as extension point but can also be created or edited in user interface
- Extension point: `org.eclipse.hyades.trace.ui.profilingSet`
- Profiling Type: defines profiling options be sent to profiling agent.
- Extension point: `org.eclipse.hyades.trace.ui.profilingType`
- A profiling type can be linked to more than one profiling set
TPTP Examples

- Designed to simplify the creation of project samples in Eclipse with New wizard
- Project(s) setup and creation, File(s) import, Open file(s) on wizard completion
- Extension point: org.eclipse.hydades.ui.sampleWizards
Logging

- Extension points are provided for extending the various logging feature
- Log Parser:
  - Plug in parser for new log file type to be imported in TPTP
- Log Analysis Engine:
  - Plug in new algorithm for analyzing log file entries with defined rules, return list of solutions and action items on known entries.
- Log Correlator:
  - Plug in new algorithm for associating log records between different or same logs, and result be visualized in log interactions view
Eclipse Test and Performance Tools Platform (TPTP)
Unit 10 – Summary
TPTP Test and Profiling Tools Project

- Extending Eclipse to support deployment testing and functional trace support facilities
- An open source Eclipse Platform and extensible framework for software test and performance tools
- Aims to move software quality practices earlier into the application development cycle
- Analyze application execution and identify performance problems, such as execution bottlenecks, object leaks, and system resource limitations
TPTP – Java Profiling

- Trace, Test and Monitoring
- Local and remote hosts
- Agent Controller and Agents
- Launch or Attach
- Profile Filter and Options
- Profiling actions: Start/Stop monitoring, Attach/Detach to agents, GC, Collect Object Reference, Terminate Process
- Profiling Views
Examples

- File -> New-> Examples...
- Examples on how to use TPTP, as well as how to extend TPTP
Need more information?

- TPTP
  
  http://www.eclipse.org/tptp/

- TPTP Online Help
Download TPTP

- Requirements
  - Java runtime (JRE) or Java development kit (JDK) 1.4
  - Eclipse SDK
  - Eclipse Modeling Framework (EMF) SDK
  - XML Schema Infoset Model (XSD) SDK
Community

- TPTP newsgroup - Questions and discussions about using the project and project-based tools
  news://news.eclipse.org/eclipse.tptp
- TPTP Mailing lists
  PMC communications (including coordination, announcements, and Group discussions)
    tptp-pmc@eclipse.org
    subscribe at http://dev.eclipse.org/mailman/listinfo/tptp-pmc
  Platform Project developer discussions
    tptp-platform-dev@eclipse.org
    subscribe at http://dev.eclipse.org/mailman/listinfo/tptp-platform-dev
  Testing Tools Project developer discussions
    tptp-testing-tools-dev@eclipse.org
    subscribe at http://dev.eclipse.org/mailman/listinfo/tptp-testing-tools-dev
  Tracing and Profiling Tools Project developer discussions
    tptp-tracing-profiling-tools-dev@eclipse.org
    subscribe at http://dev.eclipse.org/mailman/listinfo/tptp-tracing-profiling-tools-dev
Bugs

- [https://bugs.eclipse.org/bugs/](https://bugs.eclipse.org/bugs/)
- Product : TPTP  Eclipse Test & Performance Tools Platform Project