DynaRIA: a Tool for Ajax Web Application Comprehension

Dipartimento di Informatica e Sistemistica

University of Naples “Federico II”, Italy

Domenico Amalfitano
Anna Rita Fasolino
Armando Polcaro
Porfirio Tramontana
Background

• Ajax is a set of Web Technologies (XHTML, JavaScript, XML, and XMLHttpRequest) used for implementing a new generation of Web applications (Rich Internet Applications).

• Key aspects of Ajax applications:
  ▫ The UI is composed by widgets that are updated, deleted or added independently at run time.
  ▫ The UI is dynamically built on the basis of the events that are fired by the user.
  ▫ Events are managed by an Ajax Engine (AE).

• The Ajax Engine (AE) composed of JavaScript modules
  ▫ manipulates the UI components,
  ▫ communicates with the server (exchanges few amounts of data, by asynchronous or synchronous requests)

• Most popular examples are: Google Maps, Flickr, Gmail, etc.
Challenges for AJAX application comprehension

- Heterogeneous nature (JS, DOM, XML, ...)
  - Several parsers are needed
- Dynamically configured code (JS code is loaded or built at run-time)
  - Code static analysis is not sufficient
- Based on large variety of frameworks
  - Make their behaviour opaque and complicate the analysis of generated code
- **DynaRIA** is a tool designed for the comprehension of Ajax applications based on dynamic analysis of user sessions.
- It produces several types of abstractions and visualizations about the run-time behaviour of the application.
The approach of DynaRIA – user session analysis

- User sessions are traced and recorded through the Web browser offered by DynaRIA.
- Each user session trace collects the following data:
  - User events fired on widgets of the UI.
  - JavaScript functions activated by user event handlers.
  - Executed lines of code of JS functions.
  - Changes (such as add, delete, or change) to UI widgets by DOM analysis.
  - Message exchanges between client and server.
  - Exceptions and errors occurred at runtime (such as JavaScript errors, Network warnings, etc.).
- Collected information about user sessions are shown in several Session Monitor Views provided by the tool.

ICPC 2010, Braga, Portugal; 30 June - 2 July, 2010

![Screenshot of DynaRIA Session Monitor](image-url)
The approach of DynaRIA - UML sequence diagram abstraction

- DynaRIA abstracts UML sequence diagrams at various levels of detail and abstraction from each user session or from its parts.
- UML sequence diagrams are viewed and managed by another tool, *dynaRIA Sequence Diagram Viewer*. 

Excerpt of an high level UML sequence diagram

Excerpt of a low level UML sequence diagram
The approach of DynaRIA - testing and debugging activity support

- DynaRIA provides functionalities of Capture & Replay.
- During user session replay, the tool:
  - traces the JS code execution and keeps track of performed network traffic,
  - detects run-time JS exceptions (such as JS syntax errors, array out of bound errors, etc.) and network warning occurred at run-time.
- The tool computes several JS code coverage metrics with respect to a replayed set of user sessions.