

Developing a Statechart-to-ECMAScript Compiler Optimized for SVG User Interface Development for the World Wide Web



Jacob Beard, Hans Vangheluwe
September 1st, 2010
SVG Open 2010

Questions

- **What** is scxml-js?
- What **problems** does it solve?
- How do I **use** it?

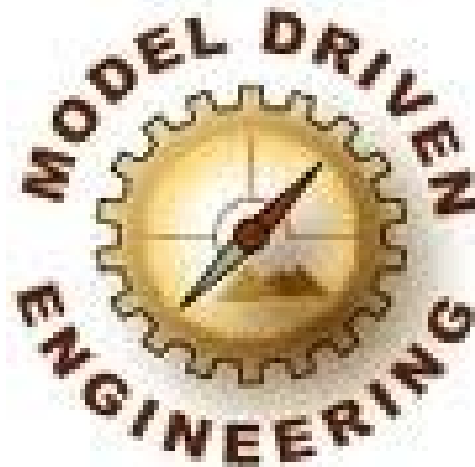
scxml-js is...

- A **tool** to facilitate development of **behaviourally rich, web-based User Interfaces (UIs)**
- Well-suited to UIs with complex, **state-based** behaviour requirements

Problem: UI development is hard

- Behaviour **autonomous** or **reactive**, and possibly **real-time**
- Behaviour **differs** between UI components
- Components operate **concurrently**
- Behaviour specification by means of **timeouts**
- **Scope**-delimited behaviour

Solution

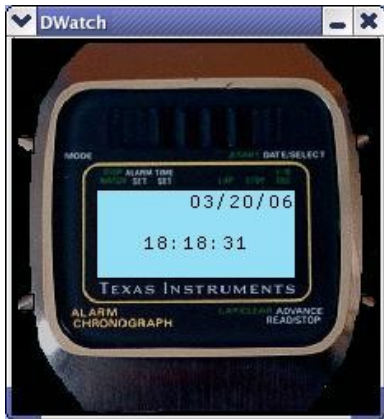


Model every aspect of the system-to-be-built explicitly, at the most appropriate level of abstraction, using the most appropriate formalism(s).

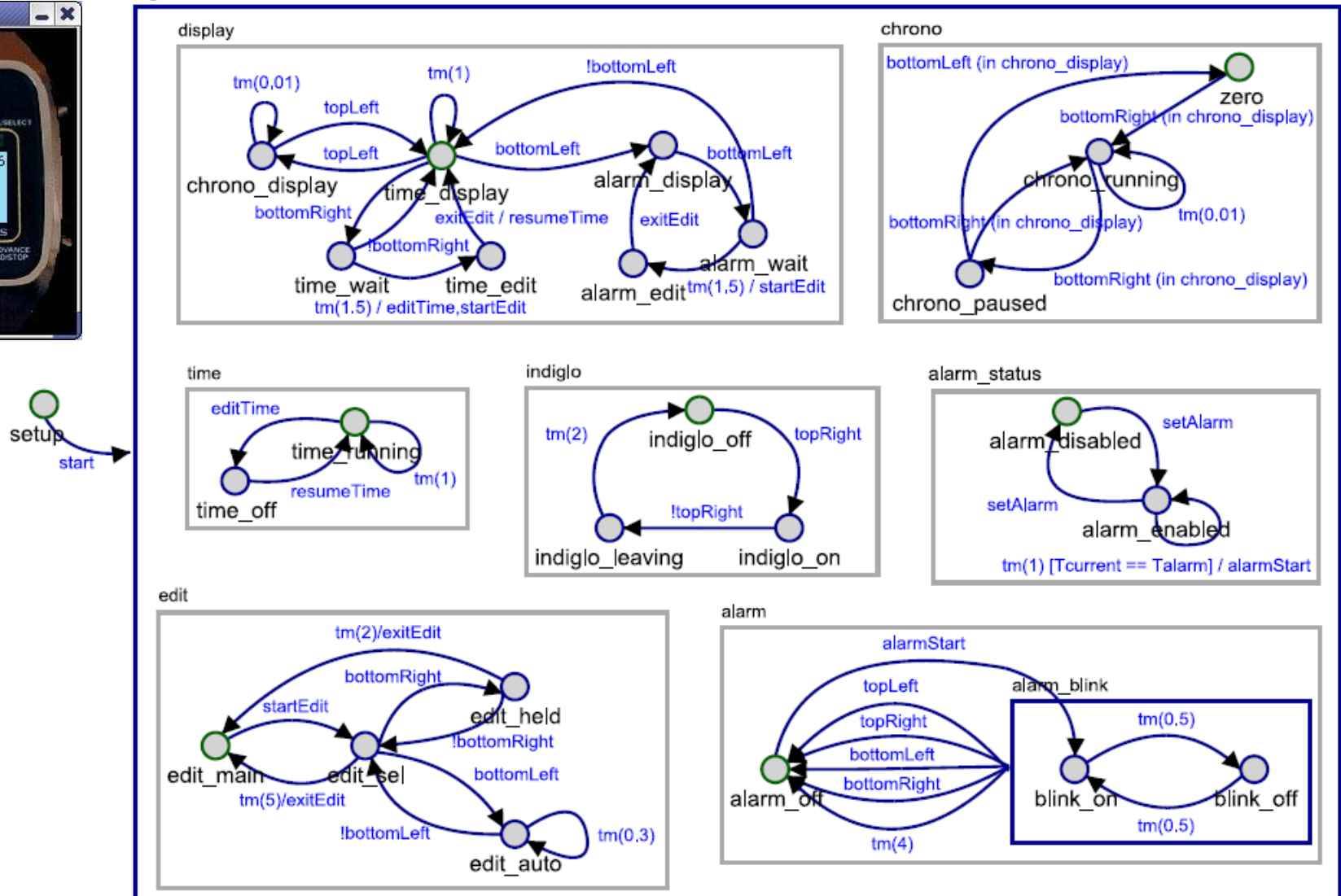
Statecharts (David Harel '87)

- Visual language
- Finite State Automata extended with:
 - Hierarchy
 - Concurrency
 - Syntactic Sugar (History, Junctions, etc.)
- Semantics first formalized in “The STATEMATE Semantics of Statecharts”, Harel '96
- Meant to be intuitive
- One of the UML notations (behavioural)

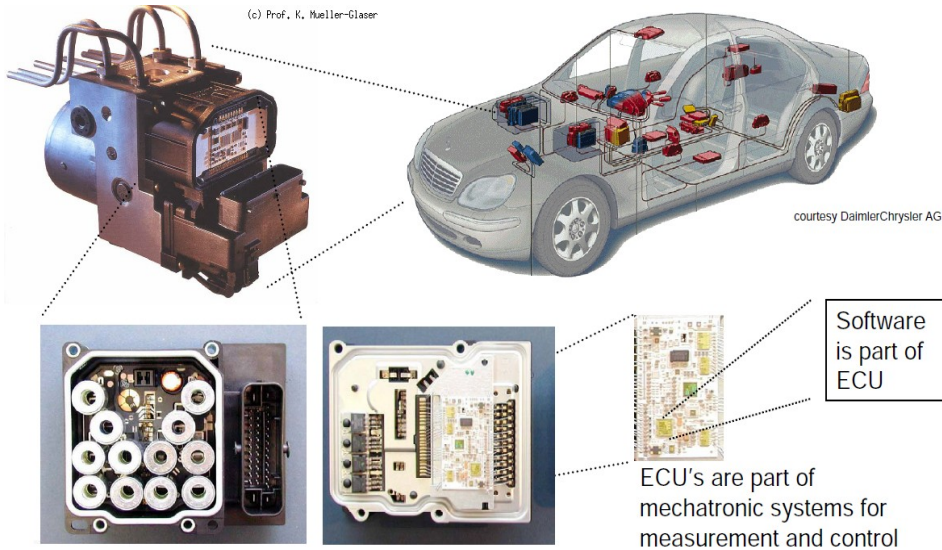
Statecharts Concepts



digiwatch



Applications



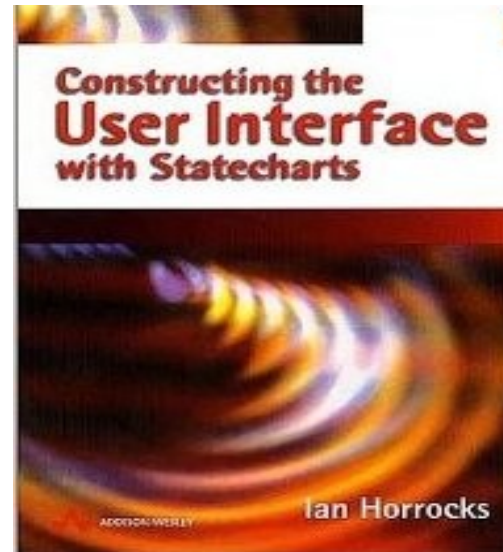
Embedded software



Web servers [Mongrel]



Web frameworks



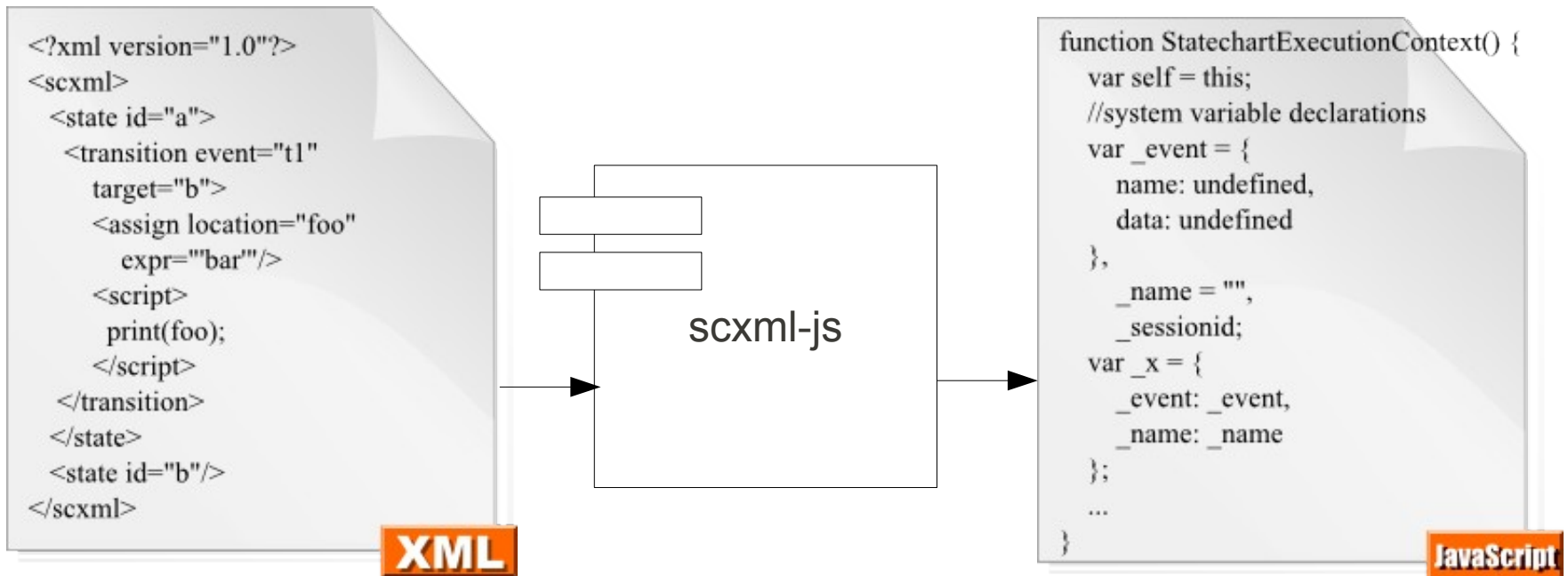
User Interfaces

scxml-js is...

*A Statechart-to-ECMAScript compiler optimized
for UI development for the World Wide Web*

scxml-js is...

SCXML



SCXML is...

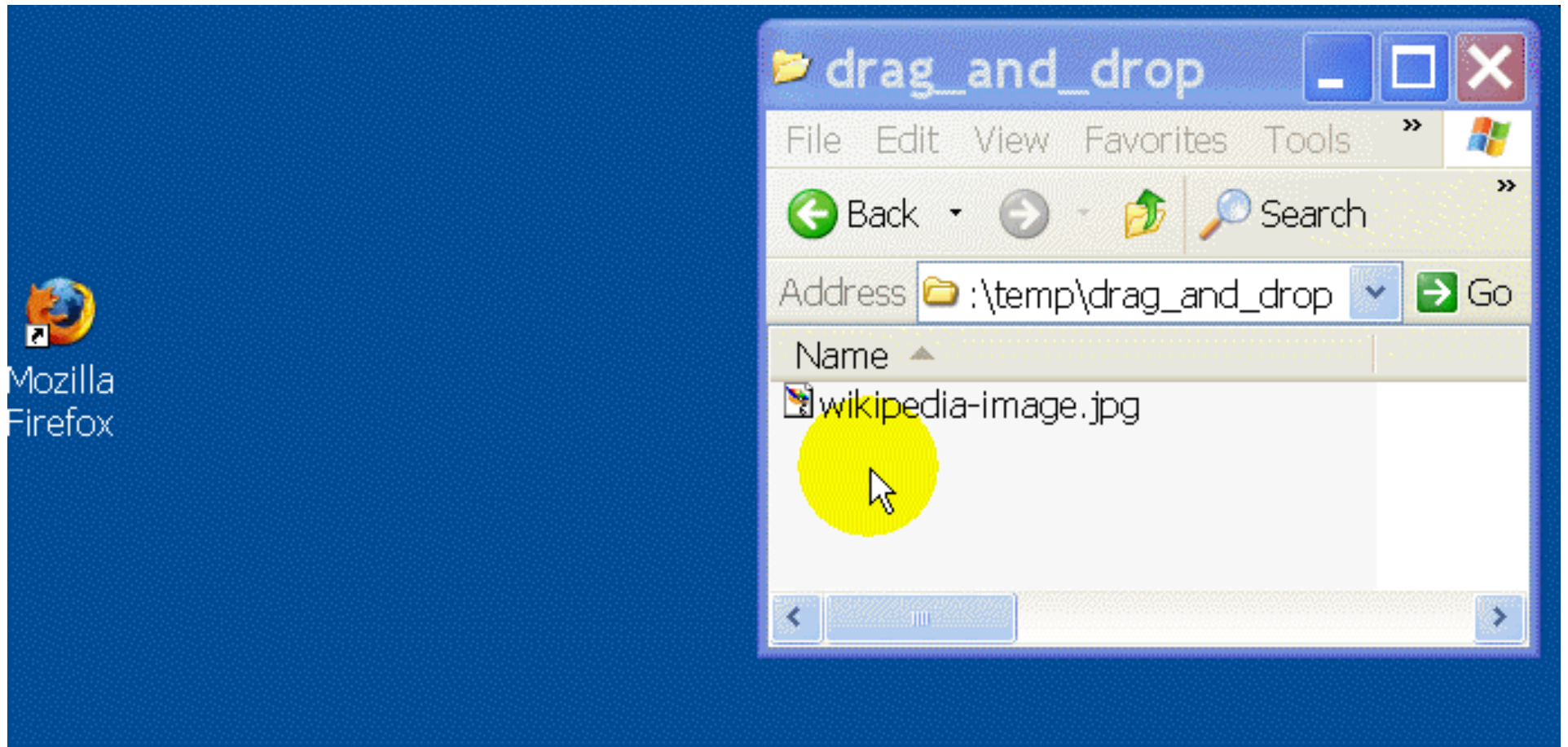
- Draft specification by W3C
- XML
- Human-Usable Textual Notation
 - *Although you still want tool support*
- scxml-js aims to comply with SCXML syntax and semantics

scxml-js is...

- Apache Commons Sandbox project
- Google Summer of Code 2010 project
- Open Source Software (Apache license)



Example: Drag-and-Drop

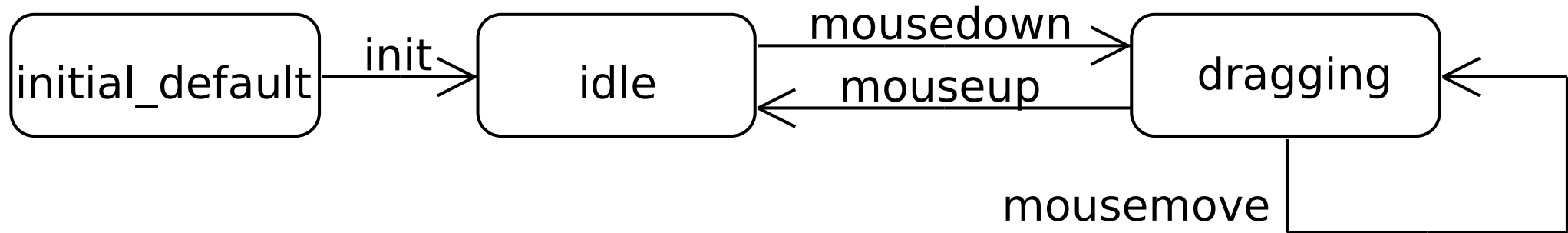


Source: http://en.wikipedia.org/wiki/File:Drag_and_drop.gif

Example: Drag-and-Drop

- Events
 - Mousedown
 - Mousemove
 - Mouseup
- States
 - Dragging
 - Idle

Drag-and-Drop Statechart



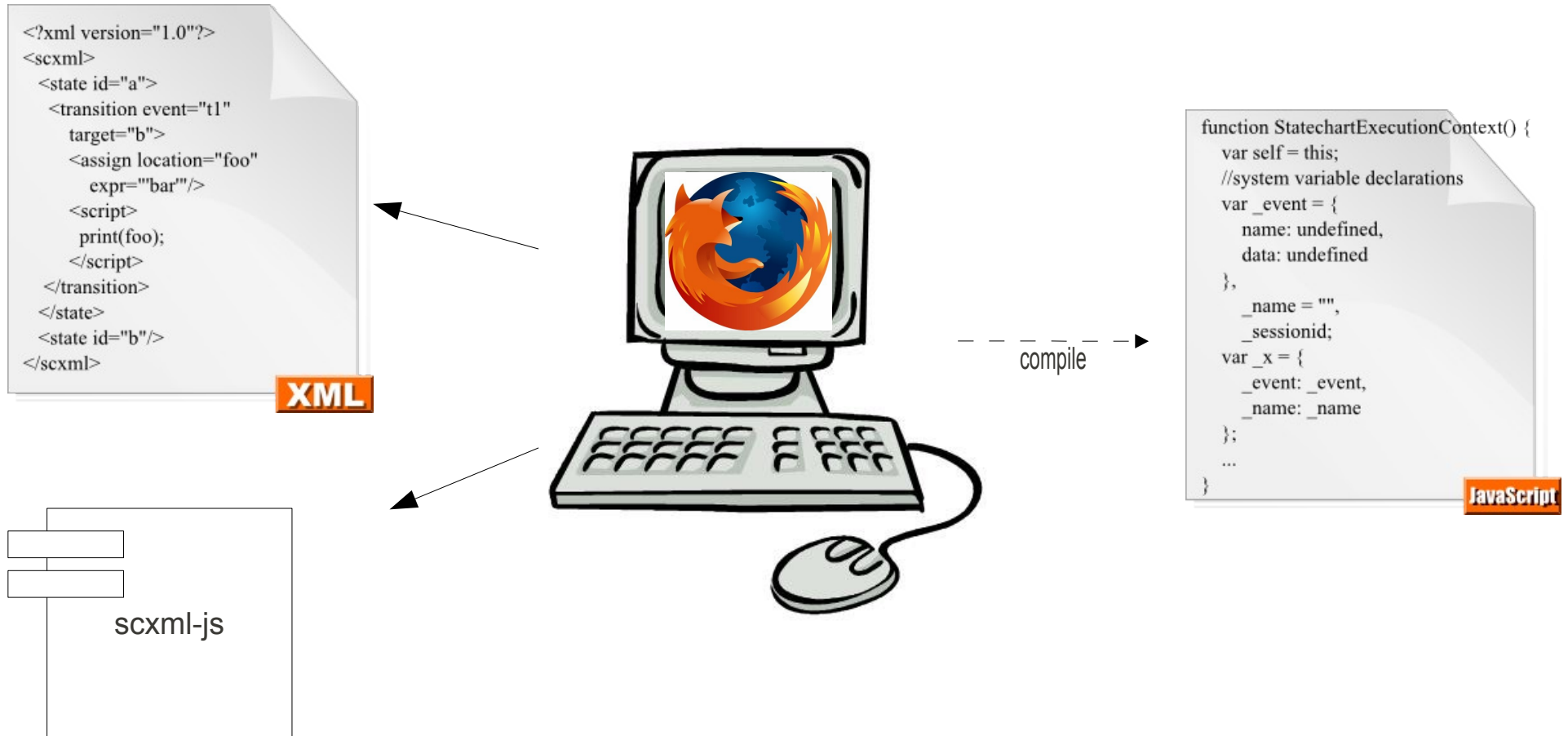
Drag-and-Drop Demo 1

- [Link to demo](#)

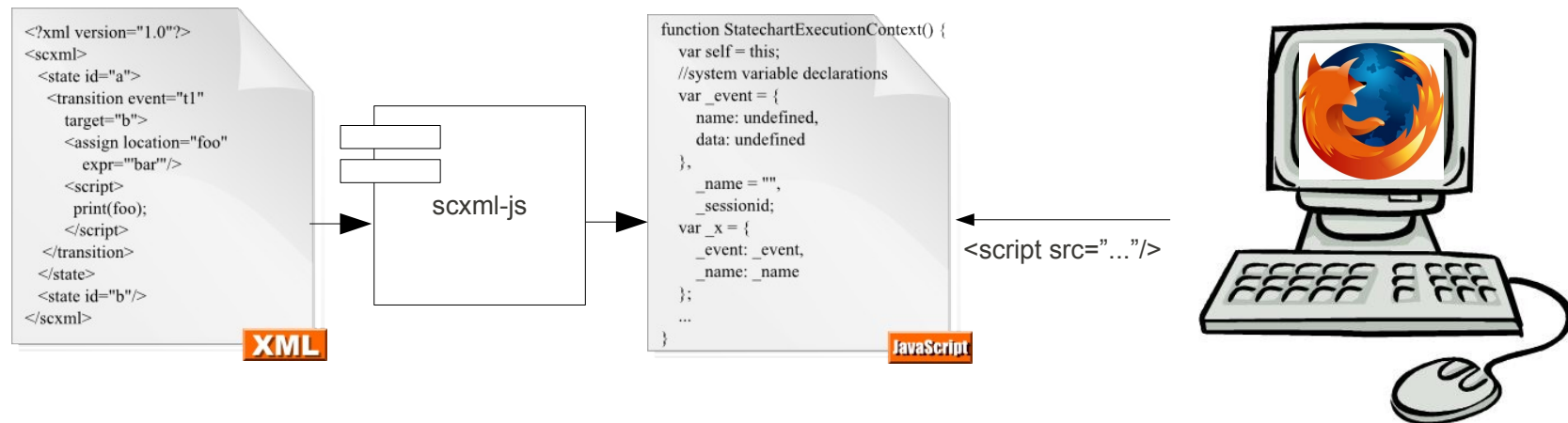
Drag-and-Drop Demo 1

- Query DOM for SCXML elements
- Compile SCXML content to ECMAScript
- Eval to produce a constructor function
- Instantiate and initialize statechart instance
- Hook up DOM events to statechart dispatcher

Just-in-Time Compilation



Ahead-of-Time Compilation



Drag-and-Drop Demo 2

- [Link to demo](#)

Inkscape Behaviour Spec

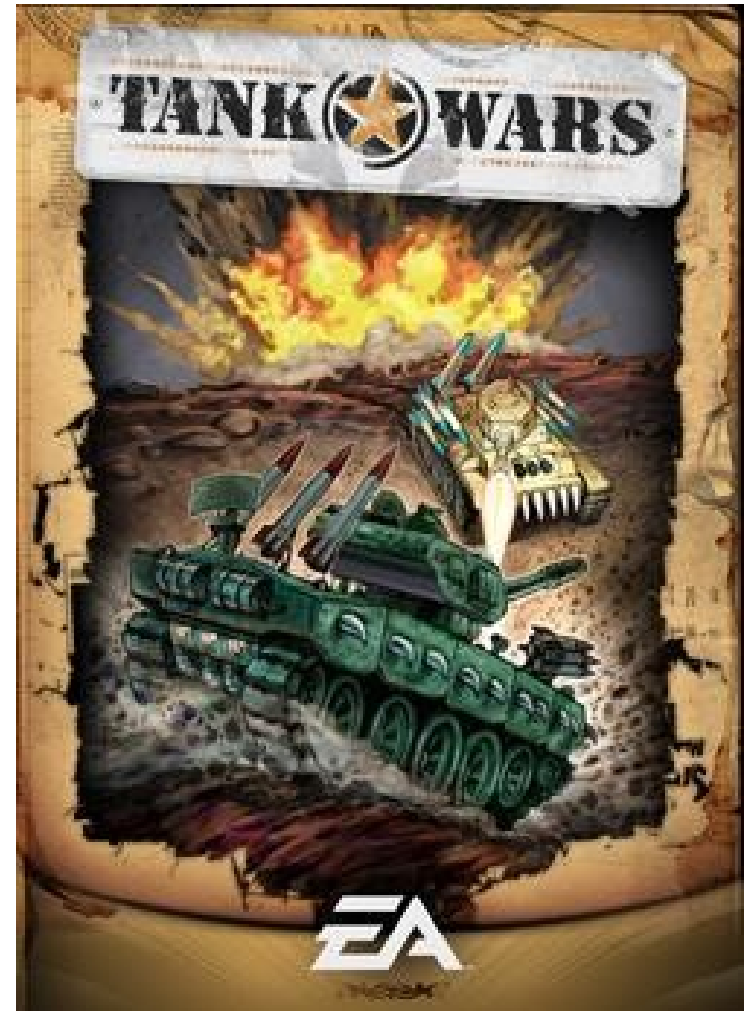
- Described [here](#)

Inkscape Demo

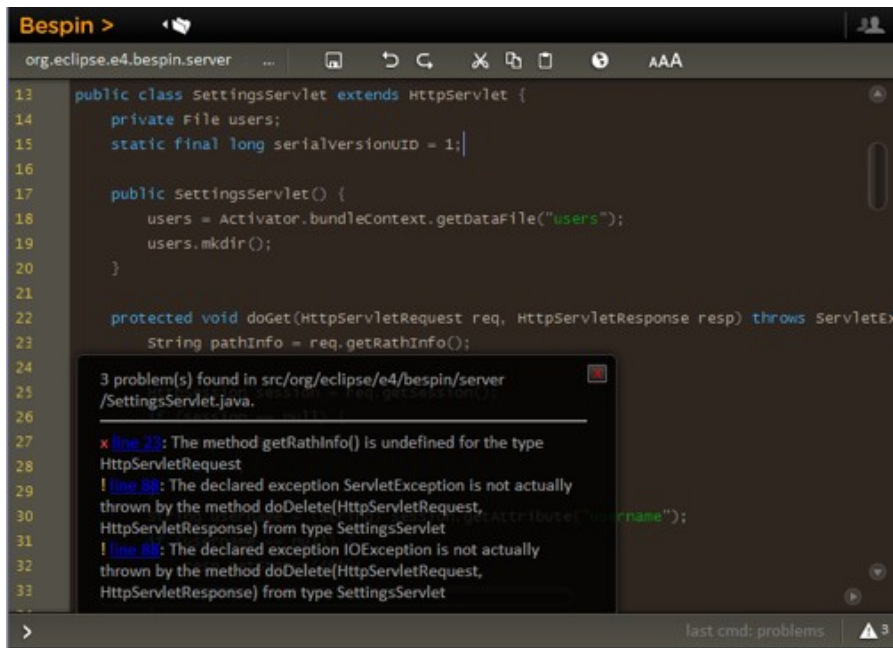
- Drawing Tool with graphical debugger

Other Applications we developed

- Browser Game AI
 - Tank Wars



Other Applications we developed



```
13 public class SettingsServlet extends HttpServlet {
14     private File users;
15     static final long serialVersionUID = 1;
16
17     public SettingsServlet() {
18         users = Activator.bundleContext.getDataFile("users");
19         users.mkdir();
20     }
21
22     protected void doGet(HttpServletRequest req, HttpServletResponse resp) throws ServletException
23         String pathInfo = req.getRathInfo();
24
25     3 problem(s) found in src/org/eclipse/e4/bespin/server
26     /SettingsServlet.java.
27     x line 23: The method getRathInfo() is undefined for the type
28     HttpServletRequest
29     ! line 29: The declared exception ServletException is not actually
30     thrown by the method doDelete(HttpServletRequest,
31     HttpServletResponse) from type SettingsServlet
32     ! line 31: The declared exception IOException is not actually
33     thrown by the method doDelete(HttpServletRequest,
34     HttpServletResponse) from type SettingsServlet
```

- Modal Text Editor
 - Bespin and Keyboard Manager

Other Applications

Have ideas?
Let us know!

Future Work

- Improve compiler
- Catalogue of Design Patterns for modelling Web UI behaviour
- High-level domain-specific language may emerge

References

- Read the paper
- Visit the **project page**
 - Check out the code
 - Try the demos

Thanks for attending!