

Towards Ubiquitous End-User Programming

Rob Hague, Peter Robinson & Alan Blackwell



UNIVERSITY OF
CAMBRIDGE
Computer Laboratory

We believe that end-user programming capabilities are an essential part of any flexible ubiquitous computing system, allowing users to add functionality that was not, and in many cases, could not have been, anticipated by the system's designers, and thus enabling them to benefit fully from the possibilities ubiquitous computing offers. The *Lingua Franca* system is designed to allow end-user programming in multiple notations, in order to adapt to the large variation in users, tasks and communication channels present in a ubiquitous computing environment (specifically, the networked home).

Lingua Franca is an XML-based intermediate representation of scripts that permits translation both to and from source notations. Scripts are stored in a central database with which a set of *language environments* communicate over the network.

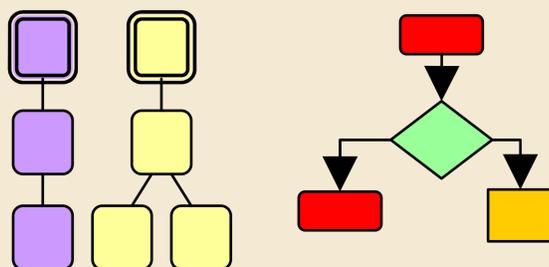
Lingua Franca

```
<group name="Shops">
  <receive>
    <nt>GoShopping</nt>
    <dispatch>
      <nt>Order</nt>
      <nt>Milk</nt>
    </dispatch>
  </receive>
</group>
```

- Allows a single program to be manipulated via multiple notations.
- Transformations preserve structure and secondary notation.
- Facilitates automatic processing, e.g. for policy enforcement.

```
[Shops]
?GoShopping ->
  {!Order/Milk}
[/Shops]
```

A traditional *textual* language will be provided for use by those familiar with conventional programming languages. This is likely to be used by “power users” for complex scripting tasks. (It is possible to edit *Lingua Franca* XML directly, but doing so is not advisable as it bypasses integrity and policy checks.)



A *visual language* will provide a means for users with a variety of levels of experience to both view and edit scripts in a straightforward manner.

A second visual language will be provided for *presentation*; this notation does not need to support editing, and hence can be optimised for navigation and searching.

The *Media Cubes* are a “tactile” language in which programs are constructed by manipulating physical objects. The notation can only be used to create programs, not to view or edit them.

Lingua Franca allows other notations to be used for these tasks, making specialised languages such as this feasible.



William Gates Building
15 JJ Thomson Avenue
Cambridge CB3 0FD
<http://www.cl.cam.ac.uk/>