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Distributed systems are fundamental to our modern computing and social infrastructures–
communication is everywhere. Good software is designed from structured data and control flows: but
how should we structure communications? Indeed, the development of rigorous and practical
languages and tools for programming distributed software is lacking, in comparison to the support
enjoyed for more traditional sequential and centralised models of computing. Key challenges:
asynchrony of communications, separate implementation of components by different parties,
heterogeneity of languages and platforms, partial failures, ...

We are looking for PhD students to work in the Scribble project. Scribble is an open source toolchain
being developed by a collaboration of researchers (Univ. of Hertfordshire, Imperial College London,
Brunel University London) and industry partners (Red Hat, Estafet, Cognizant, the Ocean
Observatories Initiative) for structured, type-safe distributed programming. The Scribble toolchain
comprises two main elements:
• Specification and validation of a multiparty message passing protocol from a high-level, global
perspective—a choreography;
• Projection of the protocol onto each endpoint, giving a protocol- and endpoint-specific API that
promotes compliant distributed implementations in the target language.

The key principles behind Scribble stem from the theory of Multiparty Session Types (MPST).

Scribble research is very active! Recent publications have featured at academic conferences on
programming languages, compiler construction and software engineering: POPL ’19, CC ’18, FASE
’17, ECOOP ’17, FASE ’16. Scribble featured at the F# Exchange ’18 developer conference.

Scribble is especially fun for people enthusiastic about:
• Rigorous approaches to practical communications-oriented programming
• Practically-motivated development and extensions of formal concurrent languages (π-calculus)

Currently, the actively supported target languages of Scribble are: Java, Go and F# (.NET)

Potential Topics
Hot topics:
• Scribble and MPST for Function-as-a-Service and Serverless Computing
• Distributed software tracing: Scribble-based run-time monitoring of Istio service behaviour

Other key topics and themes:
- Types-based model checking of message passing systems       - Type-safe event-driven programming
- Code generation for distributed APIs                        - Type providers and on-demand code generation
- Protocols with parametrised and dynamic participants       - Type refinements in protocol specifications
- Formal specification of real-world application protocols    - Types for fault-tolerance and exceptions

If you are interested in any of the above topics, or would simply like to know more:
Contact: Raymond Hu r.z.h.hu@herts.ac.uk
Scribble-Java tutorial: http://www.scribble.org/docs/scribble-java.html