

Post-doctoral position

Communicating rewriting systems for Web-Services

Distribcom team, INRIA Rennes, France

Contex :

The Distribcom team in Rennes, France, develops a research line on composite web services, also called services orchestrations. Our first studies have addressed the active document paradigm, as proposed by Serge Abiteboul [1] in Active XML (AXML). Active documents are semi-structured documents (such as XML documents) that embed, in addition to data, references to services that can be called to complete a document.

The main concept of active document can be illustrated via the following example : let us consider a website that provides its users with real-time information on the weather of major cities around the world. Users can query this site to obtain current weather in a city, and the answers can be XML documents containing: the name of the city, the current weather, and a forecast for tomorrow. Note that this service is not originally a forecast service, and it needs not return the forecast part to fulfill its requirements. Note also that a user calling this service does not necessarily need a forecast. So, another possible answer from the website can be a city name, the current weather, and a reference to another service (URL) to call for a forecast. Active documents work this way, and integrate to data some references to services that can be called to enrich a document with additional data. This concept allows for lazy evaluation of information (services are called only when needed).

This concept of active document is very powerful: when calls to an embedded service are guarded (usually by some predicate evaluated on the document), a set of active documents and its attached services allows for the definition of a real distributed program, with complex workflows. This way, AXML models can simulate Turing machines.

We think that the concept of active documents is well suited to model and study workflows in composite web services, where control and data aspects are tightly connected. Indeed, one frequently meets control decisions which depend on data (“if the amount of shipping is greater than 200 euros, then subscribe an insurance”) or conversely situations where data stems from control issues (“if command is confirmed before expiry date, then shipping is free”).

There are many possibilities to model and implement web-based distributed systems. Active documents were one possible solution that was studied during the last 4 years in Distribcom. However, many other solutions exist. For a particular kind of model, one has to consider expressiveness of the model, but also whether this model allows for the analysis of several interesting properties. Within the context of Web services the questions that arise immediately are:

Compatibility: are two web services compatible, i.e. is a service A calls a service B, do the data sent by A to B comply with the legal use of service B? When B returns an answer, is it always compatible with the values expected by A?

Termination: Does any call to a service A terminates, i.e. can we always expect A to return an answer, or are there situations in which A does not provide answers ?

Correctness : is a system composed of several interacting services correct if it uses a service A to implement a functionality f of the system ? Is the system correct for **any** implementation of f by a service that satisfies some requirements (data compatibility, QoS, ...) attached to f ? Can a system reach a dangerous configuration ? Does a system satisfy some logical properties described with a (temporal) logic formula?

As one may expect, most of these questions are undecidable as soon as the considered models are expressive enough to model real-life Web-Services. Then, one has to reason on abstractions or on a subset of the whole language to get back to decidable problems.

The distribcom team has considered these questions for several models of active documents that combine tightly data and control aspects. Among the considered models, we can cite Active XML [1], the Tree Pattern Rewrite Systems [4,5], or more recently Docnets [7], a variant of Petri nets. All these studies have as common assumption that active documents systems can be considered as communicating distributed rewriting systems.

The first objective of this post doc is to pursue the studies on this concept of active documents from the viewpoint of communicating distributed rewriting system (CDRS). The challenge is to define the good properties of such models:

- To allow composition of CDRS to obtain larger systems
- To ensure decidability of CDR compatibility
- To verify logical properties of CDRS.

The second objective of this post-doctoral position is to contribute to the development of our active documents platform.

We have developed a Web-Service platform implementing active documents using REST. This platform is composed of a cluster of 4 machines that manipulate active documents and REST services jointly. We would like to open this platform to use other formalisms, such as the ORC orchestration language developed in Austin [3]. We also plan to integrate results from recent studies on Quality of Service and contracts (SLA) to this platform. Last, the examples that are currently running on the platform are small toy examples, and we would like to design a complete case study exploiting the advantages of active documents (distribution, mixed data/control,...)

Contact :

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Application:

Send a Curriculum vitae, motivation letter and references to loic.helouet@inria.fr .

Profile:

Applicant should have a PhD in computer Science, on the topic of Web-services, formal methods, or databases. In addition, candidates should not be frightened by theoretical issues related to distributed systems.

The development language for the project is JAVA (mandatory). Competences and experience with this language will be appreciated. Competences in the domain of Web Services are also welcome.

This position is open to non-french applications. Knowledge of French is appreciated, but is not mandatory. Knowledge of english is mandatory.

Position description:

This position is a one year post doctoral position at INRIA Rennes, within the Distribcom research group. Interactions with other researchers from the S4, and VERTECS groups at IRISA as well as with academic and industrial partners outside IRISA are also expected. The main tasks for this position are:

- Contribution to the studies around Web-Services and Active Documents in the Distribcom group.
- Contribution to the development of the Web-service platform of the Distribcom group: integration of new functionalities, new models, case studies,

All developments will be performed with JAVA, and using REST as service infrastructure. As our prototypes are supposed to be distributed, a particular attention shall be paid to the proposed technical solution, and also to the portability, readability, and documentation of the produced code.

Depending on the candidate's profile, the position shall be oriented to a more "theoretical" or more "development" position.

Bibliographie :

[1] Serge Abiteboul, Luc Segoufin, Victor Vianu: Static analysis of active XML systems. PODS 2008: 221-230

[2] Loïc Héliouët, Albert Benveniste, Distributed active XML and service Interfaces, INRIA reserach report no 7082, 2009.

[3] David Kitchin, William R. Cook, Jayadev Misra: A Language for Task Orchestration and Its Semantic Properties. CONCUR 2006: 477-491.

[4] Blaise Genest, Anca Muscholl, Zhilin Wu. Verifying Recursive Active Documents with Positive Data Tree Rewriting, FSTTCS 2010.

[5] Blaise Genest, Anca Muscholl, Olivier Serre, Marc Zeitoun. Tree Pattern Rewrite Systems. ATVA 2008.

[6] Albert Benveniste, Loïc Héliouët, Document Based Modeling of Web Services Choreographies Using Active XML, ICWS 210, Miami, Florida, 2010.

[7] Benoît Masson, Loïc Héliouët, Albert Benveniste. Compatibility of Data-Centric Web Services, WS-FM 2011.