Inferring Quality of Service Properties for Grid Applications

Author Lin Yang

Supervisors Prof A. Bundy

Dr D. Berry; Dr S. Huczynska

Introduction

The project will evaluate the applicability of compositional calculi for estimating quality of service (QoS) properties arising in the development of an e-Science infrastructure such as the Grid.

A compositional calculus is presented as a set of rules of inference or recursion equations, where each way of constructing new expressions from old corresponds to a rule or equation. And it is a method for forming logic combinations of QoS properties inherited by compound systems from their components.

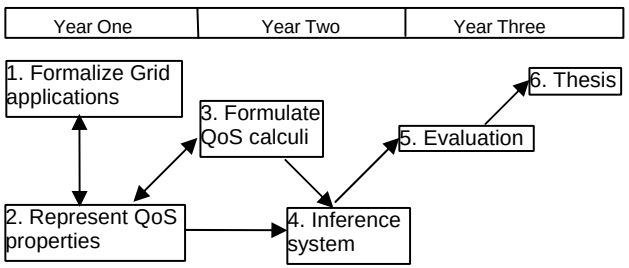

Figure 1: Diagrammatic Workplan

Grid-Relevant QoS Properties

1. Accuracy

Accuracy can be estimated by the propagation of error bounds, which are intervals representing the possible values of the result of the calculation.

A Grid calculation is viewed as a function form data to results. For a general function, it must have each of its arguments broken into monotonic regions, execute the interval calculation separately and then combine the result. The calculation can be improved using different compute servers, with different properties and so on.

2. Provenance

Provenance is an annotation able to explain how a particular result has been derived.

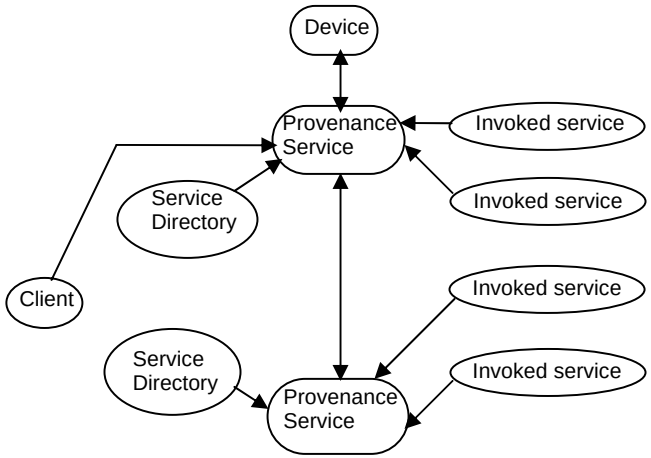

Figure 2: Architectural Vision
[Provenance: Problem, Architectural issues, Towards Trust by Moreau L.]

A provenance service would provide support for storage, analysis, navigation or reasoning over provenance.

3. Run Time

Estimated run time is important in Grid applications because of its complex calculations with large data sets. A user needs to be warned and have the opportunity to abstract the data or simplify the calculations.

$$rt(f(t_1,\ldots,t_n)) = rt(f) + \sum_{i=1}^{n} rt(t_i)$$

Where run time rt is assumed a constant, for a procedure f.

Current Work

We are representing some provenance examples using pi calculus, which is a distributed peer-to-peer model for reasoning about the dynamic behaviour of web data.

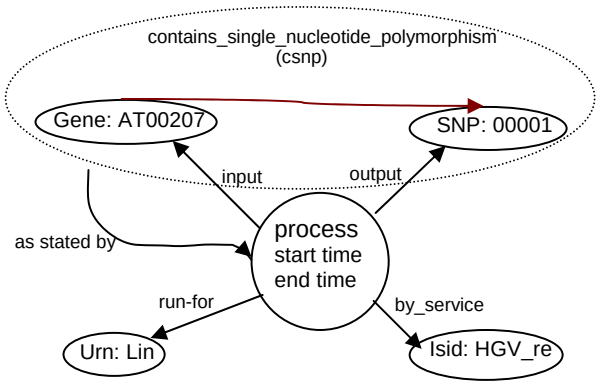

Figure 3: An Example for Provenance

$$\overline{input}\,csnp.Pro \mid input(c).\vec{c}\,gene.SNP \xrightarrow{\tau} Pro \mid \overline{csnp}\,gene.SNP$$

Future Work

1. different interpretations of provenance in different areas
2. representation using more calculi
3. apply logic inference to numeric expressions