Simon Dobson

Systems Research Group
School of Computer Science and Informatics
UCD Dublin Belfield, Dublin 4, Ireland

http://www.ucd.ie/csi

simon.dobson@ucd.ie

Everything interesting is composition

Applications *versus* systems

Are we talking applications or systems?

- Single point of design? Single agreed objective?
- …or *really* different views on the use of resources, the desirable outcomes of behaviour, what is acceptable and correct?

We have a well-understood path to applications

- They may be complicated and involved, but they're bounded and we can agree on and specify the acceptable outcomes

Systems, however, arise from (and are characterised by) the interactions and constraints between their component parts

- These interactions should be an object of study

What we *don't* understand

We don't understand how to compose components

- Their interactions come as a surprise, their composite behaviour is not bounded

In particular, we don't understand how to compose *adaptive* components

- Their adaptations do not fall within a common frame of reference and will typically be antagonistic rather than synergstic

And in *particular*, we don't understand adaptive components whose interactions are *complex*

- Sensitive dependence on initial *and ongoing* conditions, coupled behaviour modes, out of envelope

What we *need* to understand

It is *not* enough for autonomic systems to adapt

- Adapt in ways that are "correct" and "in the right direction" and "maintaining desirable properties" – or even "optimal"
- …all of which terms imply an external semantic frame of reference

To have proper autonomic systems, we need a proper science of composition

- Study the interactions, not just the components at the endpoints
- Semantics is interpretation, *not* description: it isn't enough to describe a component, we need to describe the *process* in which that component exists and adapts
- Ontology was the dominant method in the Middle Ages – we should embrace the Renaissance and a more process-oriented model

Goals – well, mine, anyway :-)

Understand *and state* the bounds on what we'll accept

- We can set the systems free within these bounds
- Open adaptation is good – but not at the cost of destroying the rationale for the system's construction
- Study the system within the system – reflective reasoning

Study and describe the processes that make up our systems *and* how they compose

- General systems theory, economics, game theory, category theory, process algebra, uncertain reasoning, …
- And they're *processes*, not *states*: semantics not syntax, dynamics not statics

Components change, but systems remain interesting