Grid Computing

Making the Global Infrastructure a Reality

Edited by

FRAN BERMAN

University of California, San Diego & San Diego Supercomputer Center, USA

GEOFFREY FOX

Community Grids Lab, Indiana University, USA

TONY HEY

Director e-Science Core Programme & University of Southampton, UK

WILEY

Contents

Table of Contents

```
StateSpec     ::= InternalState Ψ, EstimatedExternalState ξ̄
MethodSpec    ::= MethodSet Π, each π∈Π : Σ × Ψ × ξ̄ → Φ × Ψ × ξ̄
StrategySpec  ::= Efficiency η, Strategy α : Σ × Ψ × ξ̄ → Π
```

The functional behavior of C is captured by a relation, $\beta \subseteq \Sigma \times \Phi$, where Σ is the input alphabet, Φ is the output alphabet and β is a relation specifying valid input–output pair. Thus, if C receives an input $u \in \Sigma$, it delivers an output $v \in \Phi$, satisfying the relation $\beta(u, v)$. The output variability permitted by the relation β (as opposed to a function) is very common to most systems. As illustrated in Figure 13.1, a client is satisfied to get any one of the many possible outputs $(v, v', \ldots)$ for a given input u, as long as they satisfy some property specified by β. All implementations of the component preserve this functional behavior.

The state information maintained by a component comprises two parts: internal state Ψ and external state $\bar{\xi}$. Internal state, Ψ, contains the data structures used by an implementation and any other variables used to keep track of input–output history and resource utilization. The external state ξ is an abstraction of the environment of C and includes information on the input arrival process, the current level of resources available for C and the performance levels of other components of the system whose services are invoked by C. The component C has no control over the variability in the ingredients of ξ, as they are governed by agents outside C. The input arrival process is clearly outside C. We assume an external global resource manager that may supply or withdraw resources from C dynamically. Finally, the component C has no control over how other components are performing and must expect arbitrary variations (including failure) in their health. Thus the state information, ξ, is dynamically changing and is distributed throughout the system.

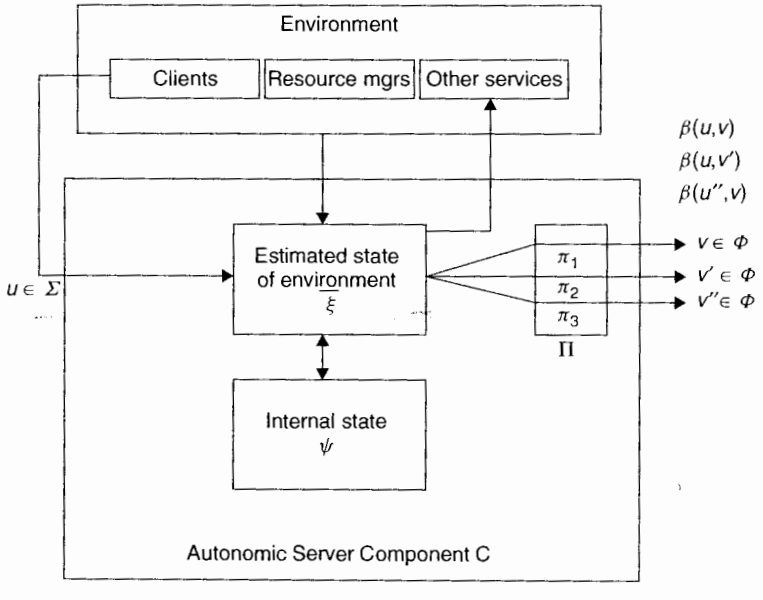

Figure 13.1 Schematic view of an autonomic component and its environment.