

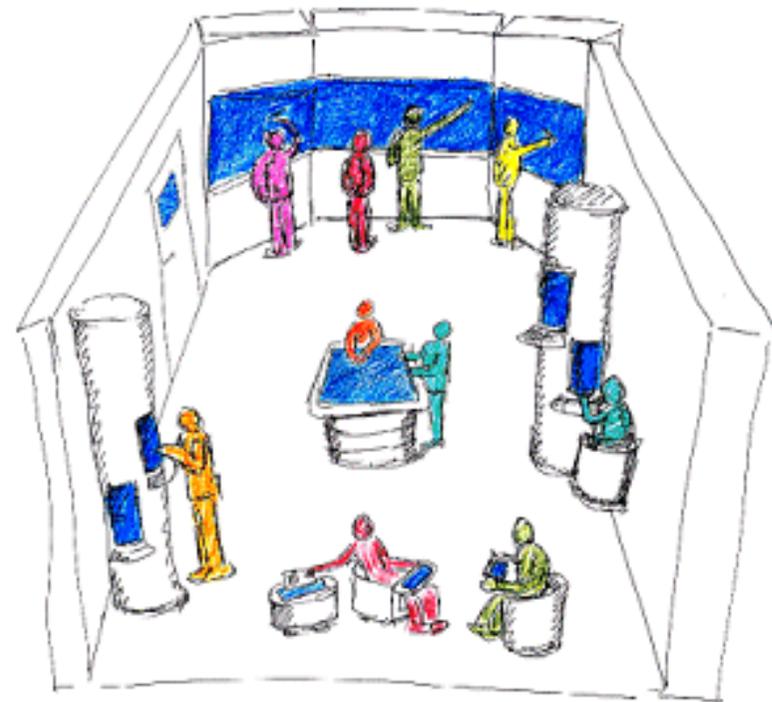
# Transparency in Self-Adaptive Systems

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# Provocative question

Dependability in self-adaptive systems:  
How to justify trust in the face of “unknown unknowns”?



- There is no option, we have to do it
  - Dependability is one of the main goals of self-adaptive systems
- *dependable*: able to be trusted to do what you need or expect
- Trust is not granted - It must be conquered

# How to build trust in self-adaptive systems

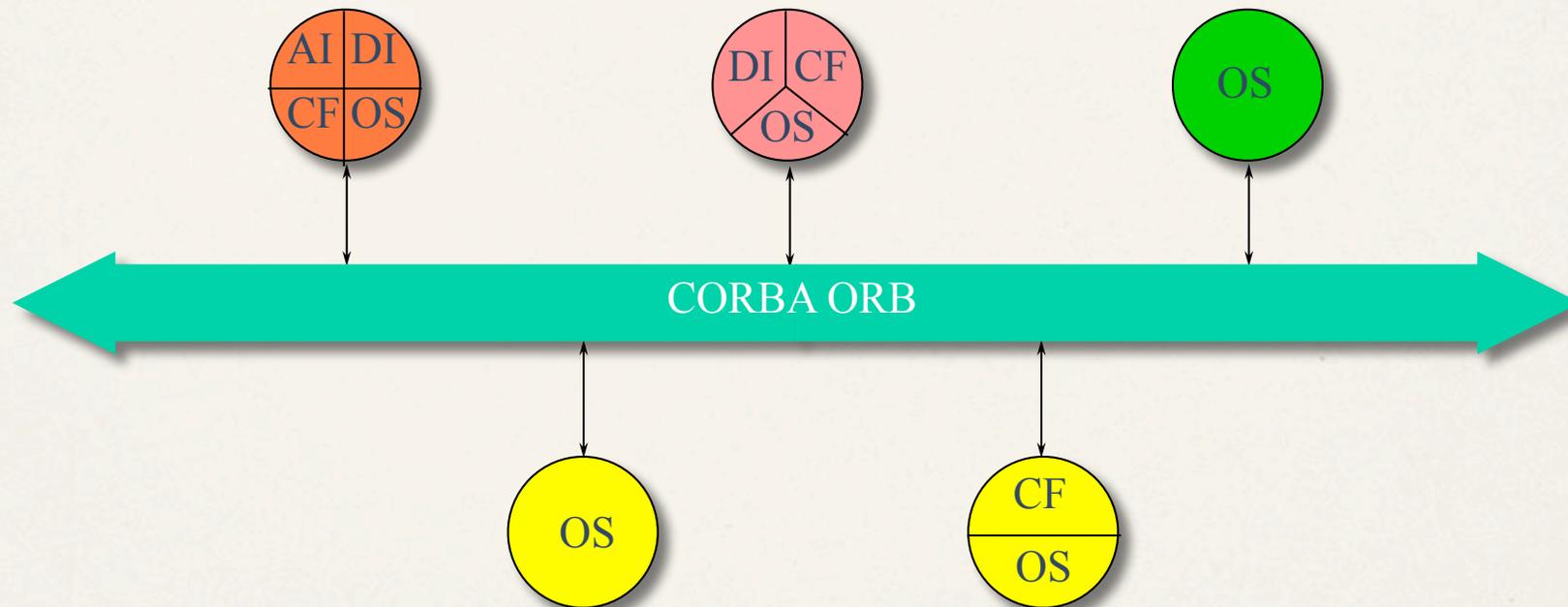
- transform “unknown unknowns” into “known knowns”



- How to improve awareness? **Transparency**
  - Self-adaptive systems cannot be black-box
  - What is the system behavior in the face of unpredictable situations?
  - Can we understand or follow the system behavior?

# Idealized system architecture

*Example: Object Management Architecture (OMA)  
from the Object Management Group (OMG)*

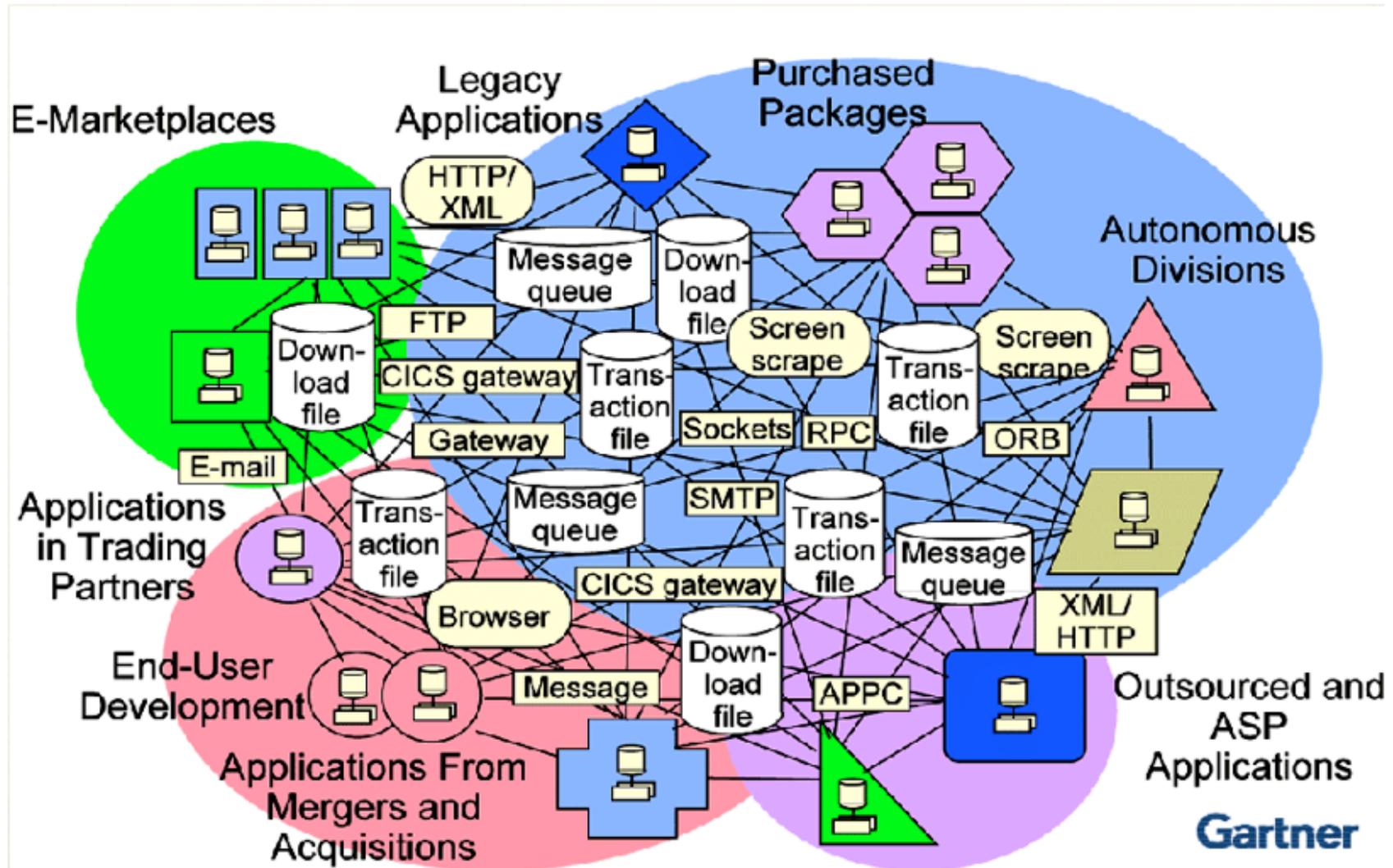


AI = Application Interfaces  
CF = Common Facilities

DI = Domain Interfaces  
OS = Object Services

source: Steve Vinoski, keynote speech at Middleware 2009

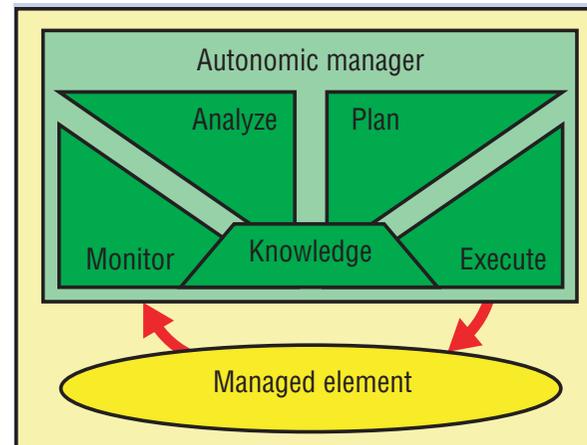
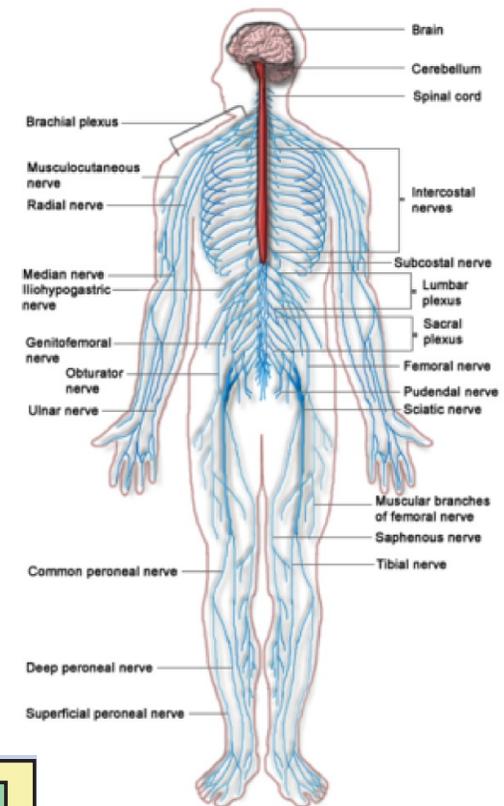
# The reality...



source: Steve Vinoski, keynote speech at Middleware 2009

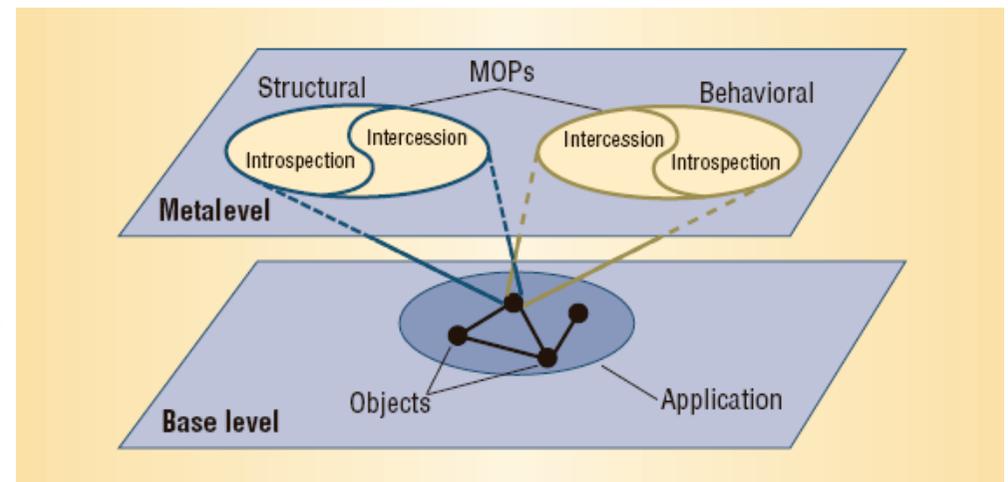
# Autonomic Computing

- term introduced by IBM in 2001 by analogy with the autonomic nervous system
- the increasing **complexity** of the computing systems motivates models and technologies to build **self-managed systems**
- key characteristics
  - autonomic
  - adaptive
  - aware
- enabling technologies
  - closed control loop
  - supporting middleware platforms
- 2012: **Cognitive Computing**



# Computational Reflection to provide Transparency

- definition: the ability of a computer program to examine (*introspection*) and modify (*intercession*) its own structure and behavior at runtime
- provides the essential mechanisms for autonomic systems to monitor, inspect and change the system behavior
- system divided into a base-level and a meta-level
  - there is a causal relation between the two levels
- provides the basis for transparency in self-adaptive systems

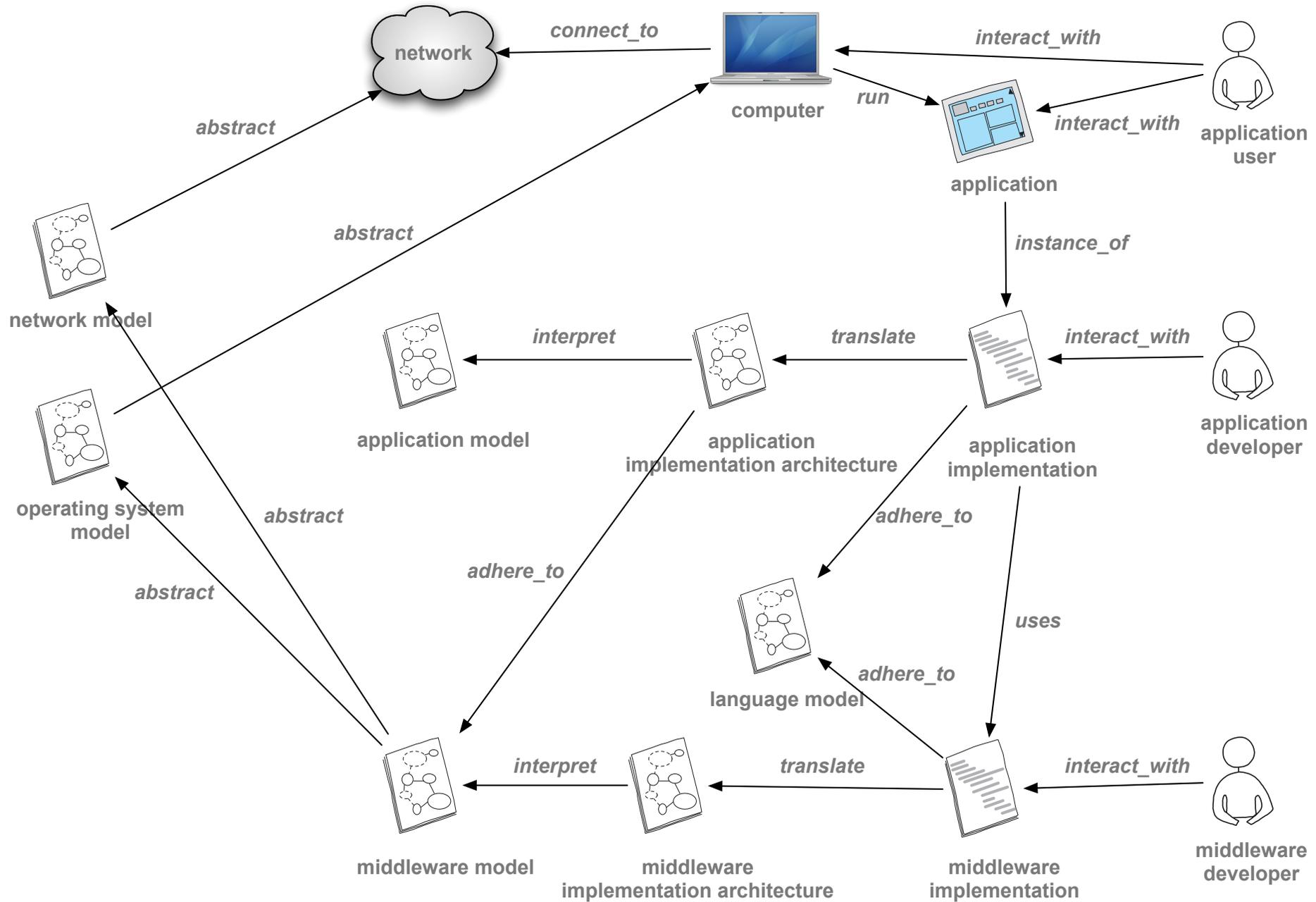


# Some challenges ahead

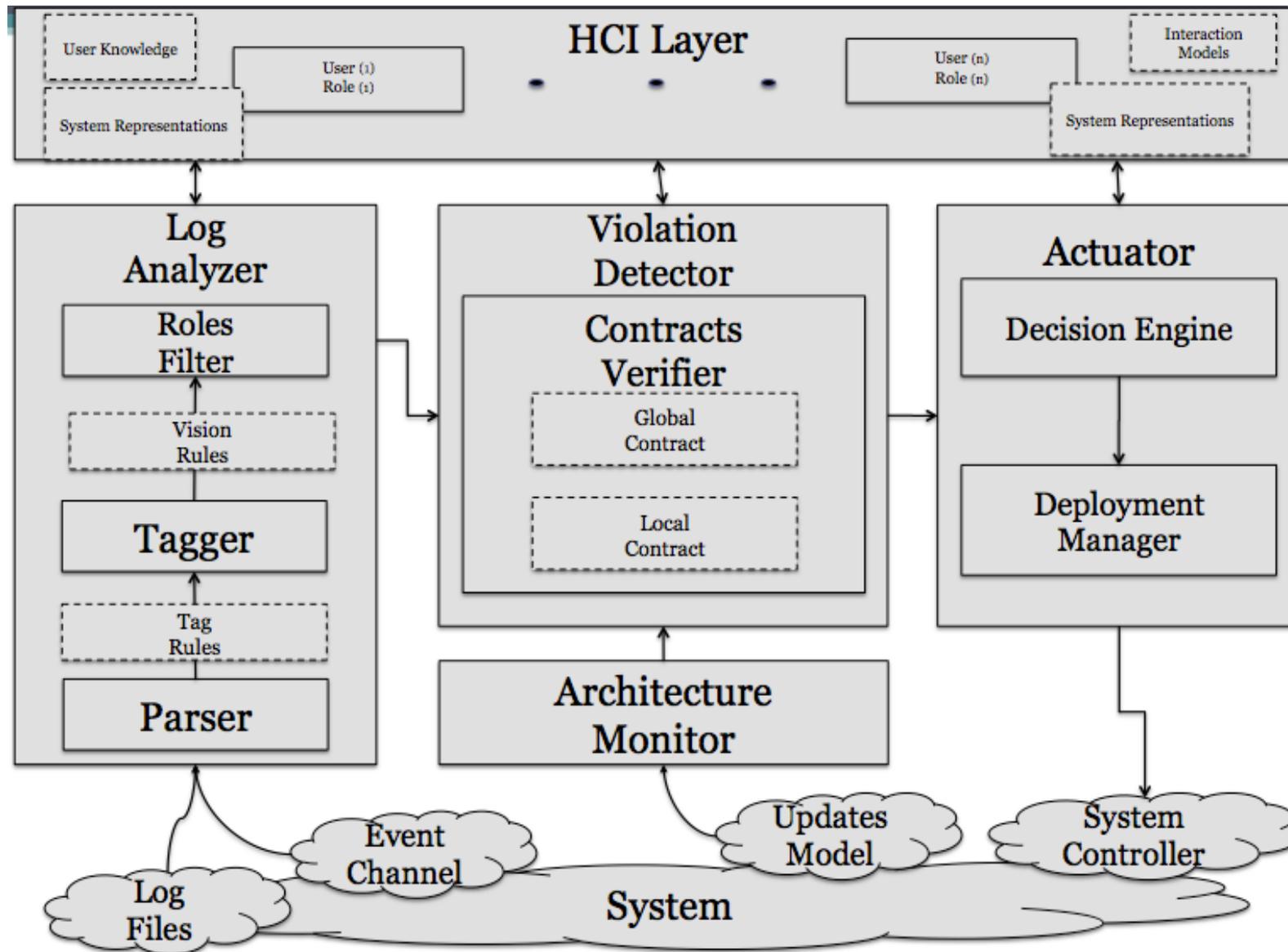
- process and supporting tools to develop and maintain (evolve) self-adaptive systems
  - suitable programming abstractions
  - model evolution / models@runtime
  - debugging / traceability
  - version control
  - configuration management
- user interaction
  - what to do when the autonomic behavior fails?
- progress evaluation
- *call-center* systems x cognitive systems x epistemic systems



# Multiple users and models



# Jazz Project



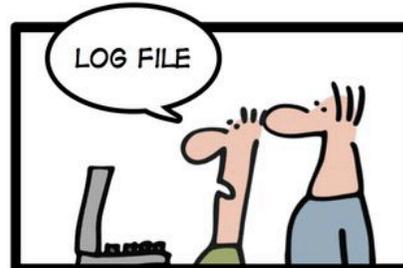
# Questions?

*SORRY, BUT...*



CORE DUMP?

geek & poke



LOG FILE

*... A LOG FILE IS NO PULITZER PRIZE WINNER*