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Challenges in Automation and Adaptation

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Problem with the Use of Terms in Autonomic computing

- The dictionary definition of autonomous or autonomic component is insufficient for the autonomic computing field. It is important to look back at the biological system that inspired the field in the first place and distil its specific technical capabilities. And finally derive consistent technical definitions for autonomic computing systems from these capabilities. Autonomic systems should be built on this basis.

Proliferation of Self managing properties.

- First Self-* management properties defined by IBM where *Self-Configuration, -Healing, -Optimization and –Protection*.
- Other Self-* management properties have been defined since including but not limited to *Self-awareness, Self-anticipatory, Self-stability, Self-adaptive, Self-Regenerative, Self-recovering, Self-knowledge, Self-organization* etc.

The above begs the following questions;

- Are the newer self-* properties a rehash of the older IBM defined properties e.g., does *Self-Regenerative* = IBM's *Self-Healing*?
- Are these new self-* properties implicit in the very definition of autonomic systems e.g., an autonomic manager should by default be able to stabilize its actions; if this is the case, then the need for an explicit self-stabilizing property is obviated.
- Does the self in self-* refer to how the autonomic manager manages itself or does this refer to how it (on its own = self) manages the assigned resources?

It is our opinion that the four self-* proposed by IBM suffices for most of the autonomic computing needs and therefore no need for extras. We also believe that the self in self-* should refer to what the autonomic managers do to the managed elements.

Pannel on autonomous / autonomic systems
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Automation and Adaptation

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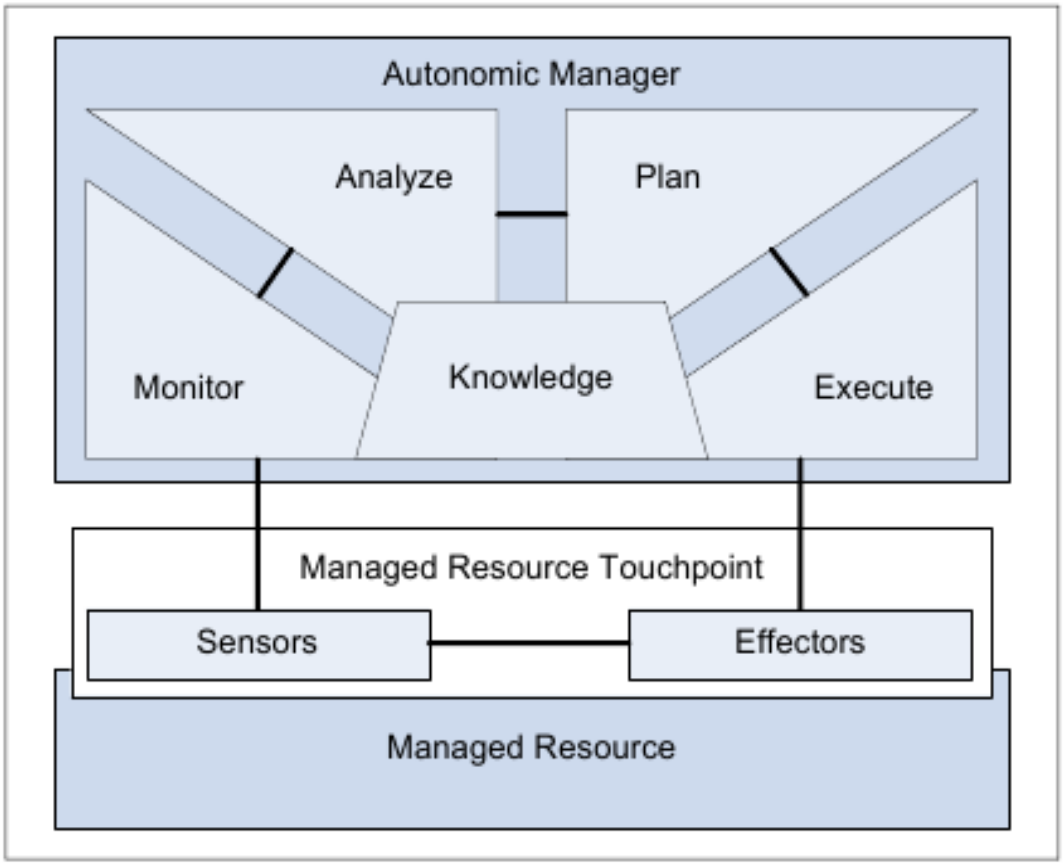
- My main interests: Software intensive systems
- Adapt the structure and the behaviour of the system to environnemnt driven changes

The MAPE-K context



- Planning: Analysis and Policies
- Distributed vs. centralized managers

1. Analisys and Policies

- An ontology of policies/planning methods/approaches
- Policies as first class entities in the MAPE-K schema
- How to implement this in (near) futur software frameworks

2. Interactions between self*-managers

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- Clearer relationships between mono/multi objective autonomic managers
  - Multi-decision problems
- Autonomic managers: Distributed / Hierarchical / Centralized
- Distributed managers:
  - Relationship with theory of DDES (observability, reachability, synthetis of controllers, …)
  - relationships with policies

Combinatorial Search Algorithms for Massively Parallel Machines

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Motivation

- Combinatorial problems cover a large range of application domains in O.R. and A.I. : resource allocation, scheduling, telecom, …
- Efficient sequential methods exist (local search, integer prog., constraint prog.)
- Supercomputers, Grids, Clouds are becoming easily available
- Google Exascale Program: problems with min execution time of 100 millions hour-cores
- Can sequential methods scale up ?

Challenges

- Need for :
  - efficient balancing of the search
  - Automatic tuning for many parameters
  - portfolio algorithms
  - Real-time reactive strategies
  - learning

- Adaptive Autonomous/Autonomic Systems

Challenges in Autonomic Computing

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Challenges in Autonomic Computing

1. Knowledge Acquisition
2. Unpredictability
3. Inability to test thoroughly
4. Expression of high-level policies – and the subsequent mapping of these policies onto low level system tuning/configuration parameters
5. Integration of autonomic features into current architectures
6. Coping with distribution – cross platform, cross industry, cross country applications
7. Lack of standards (or use of)
8. Human acceptance & trust