MAPE-K adaptation control loop

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Kashif Dar

Background

➢ MAPE-K control loop was first introduced by IBM in their white paper:

- An architectural blueprint for autonomic computing.

➢ Later discussed in the context of self adaptive systems e.g. by:

- Brun et al, Engineering Self-Adaptive Systems through Feedback Loops, LNCS 5525, 2009.

➢ Also discussed in the seminal paper by:

- Kephart and Chess, The Vision of Autonomic Computing.

IBM vision of autonomic computing

➢ A computing environment with the ability to manage itself and dynamically adapt to change in accordance with business policies and objectives.

➢ Change Management - The process of planning (for example, scheduling) and controlling (for example, distributing, installing and tracking) software changes over a network.

IBM MAPE-K Architecture
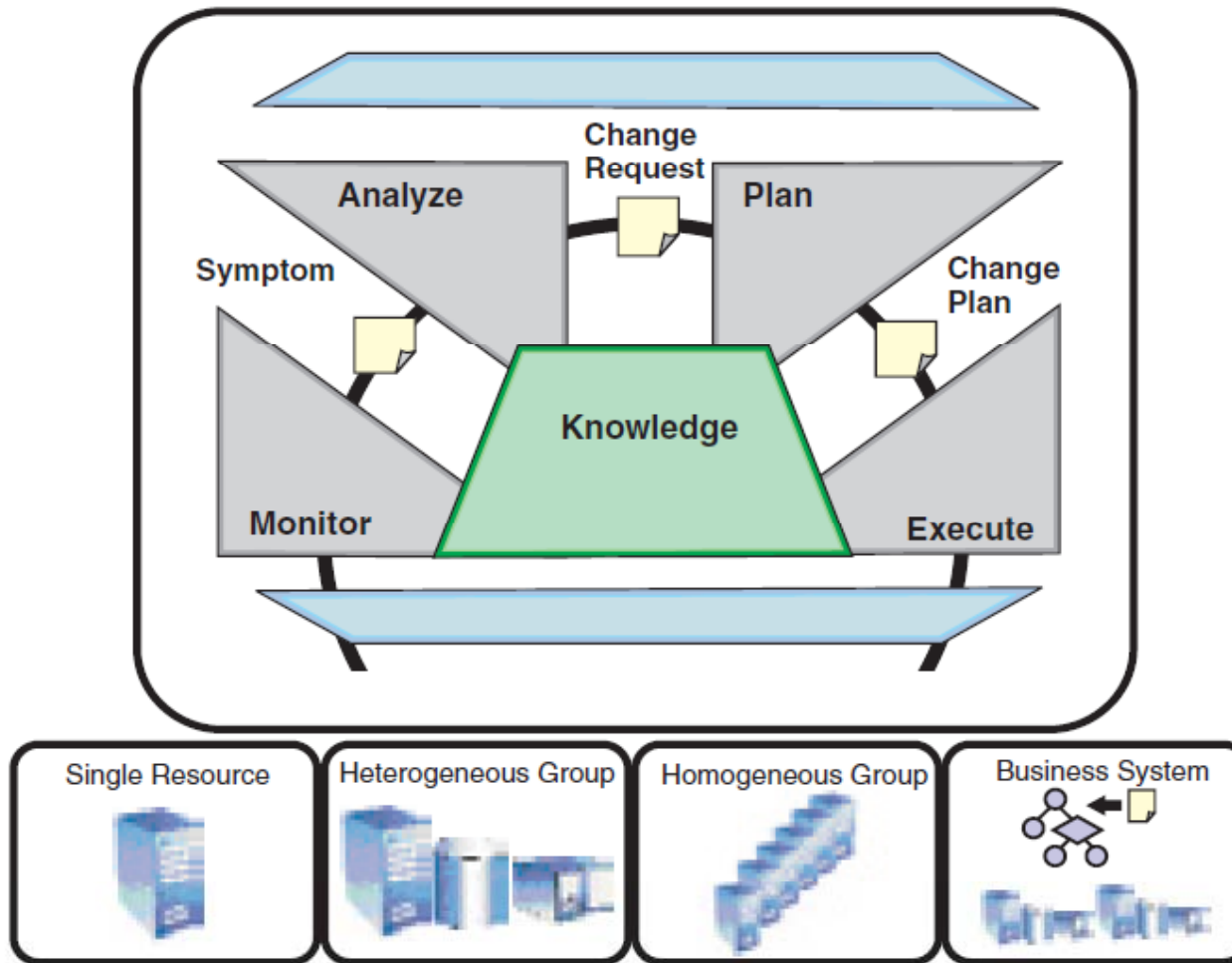
IBM MAPE-K

Monitor

- Collects the details from the managed resources e.g. topology information, metrics (e.g. offered capacity and throughput), configuration property settings and so on.
- The monitor function aggregates, correlates and filters these details until it determines a symptom that needs to be analyzed.

Analyze

- Perform complex data analysis and reasoning on the symptoms provided by the monitor function.
- Influenced by stored knowledge data.
- If changes are required, a change request is logically passed to the plan function.

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➢ **Plan**

- Structures the actions needed to achieve goals and objectives.
- The plan function creates or selects a procedure to enact a desired alteration in the managed resource.
- The plan function can take on many forms, ranging from a single command to a complex workflow.

➢ **Execute**

- Changes the behavior of the managed resource using effectors, based on the actions recommended by the plan function.

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➢ **Knowledge**

- ▪ Standard data shared among the monitor, analyze, plan and execute functions

- ▪ The shared knowledge includes data such as topology information, historical logs, metrics, symptoms and policies

- ▪ Created by the monitor part while execute part might update the knowledge

IBM MAPE-K-'Touchpoints'

"set" operations that allow the state of the manageable resource to be changed in some way

Expose information about the current state of a manageable resource.
Accessed through standard "get" operations.

Sensor

Effector

Properties: Identification, Metrics, State, Configuration

Relationships: Hosts, Users

Managed Resource Details

Logs   Events

Commands   APIs

Configuration Files

Managability Interface Mechanisms

Managed Resource

Managed Resource