AUTONOMIC COMPUTING

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INTRODUCTION

- AUTONOMIC COMPUTING is the new trend in self-managed computing systems that configures, heal, protect themselves and adapt to the user's needs automatically.
- The idea drives from autonomic nervous system of the human body that helps controlling the entire system.
DEFINITION

- The term “autonomic” comes from an analogy to the autonomic central nervous system in the human body, which adjusts to many situations automatically without any external help.
- Autonomic computing is an approach to self-managed computing systems that will work independently, without human intervention.
IBM’s vision for Autonomic Computing

“Intelligent” open systems that:
- Manage complexity
- Know themselves
- Continuously tune themselves
- Adapt to unpredictable conditions
- Prevent and recover from failures
- Provide a safe environment

Providing customer value
- Increased return on IT investment
- Improved resiliency and quality of service
- Accelerated time to value

Focus on business, not infrastructure
The Autonomic Nervous System Monitors and Regulates:

- Tears
- Pupil Dilation
- Blood Vessel Dilation
- Blood Sugar
- Heart Rate
- Breathing Rate
- Blood Pressure
- Digestion
- Temperature
# Evolving to Autonomic Computing

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- **Benefits**
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**Manual** to **Autonomic**
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**Manual**

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ARCHITECTURE
An autonomic manager contains a continuous control loop that monitors activities and takes actions to adjust the system to meet business objectives.

- An autonomic manager learns from past experience to build action plans.
- Managed elements need to be instrumented consistently.
Autonomic elements make decisions based on observations of their environment, policies and goals, and "configuration-range". Examples:

- Install or upgrade software.
- Restart a system or component after a failure.
- Isolate systems after intrusion detection.
- Re-configure task to cope with changing conditions (e.g. CPU load)
ARCHITECTURAL BUILDING BLOCKS FOR AUTONOMIC COMPUTING

FUNCTIONAL DETAILS OF AUTONOMIC MANAGER

Alerts, events and problem analysis request interface

SLA/Policy interface interprets and translates into "control logic"

Sensors

- Analyze
  - Analysis Engines
  - Policy Validations
  - Policy Resolution
  - Rules Engines

- Monitor
  - Filters
  - Simple Correlators
  - Metric Managers

Effectors

- Plan
  - Policy Interpreter
  - Policy Transforms
  - Plan Generators

- Execute
  - Workflow Engine
  - Service Dispatcher
  - Scheduler Engine
  - Distribution Engine

Knowledge

- Topology
- Calendar
- Recent Activity Log
- Policy

Interface to real and virtualized resources and components that regulate control.
The control loop:

- collects information
- analyzes data
- finds a solution if needed
- executes actions accordingly
- Composite resources tied to business decision-making
- Composite resources decision-making, e.g., cluster servers
- Resource elements managing themselves
Nested intelligent control loops

Database management system

Customer database

Customer order system

Server management system
Touch points for managed resources

Knowledge resources

Autonomic manager

Manual manager

Conceptual Architecture From IBM
Summary of Autonomic Computing Architecture

- Based on a distributed, service-oriented architectural approach, e.g., OGSA
  - Every component provides or consumes services
  - Policy-based management
- Autonomic elements
  - Make every component resilient, robust, self-managing
  - Behavior is specified and driven by policies
- Relationships between autonomic elements
  - Based on agreements established and maintained by autonomic elements
  - Governed by policies
  - Give rise to resiliency, robustness, self-management of system
FEATURES & APPLICATIONS
Complex Heterogeneous Infrastructures Are a Reality!

Dozens of systems and applications

Hundreds of components

Thousands of tuning parameters
Operational speed too slow
IT flexibility too limited

Management of complex, heterogeneous environments too hard

Privacy, security and business continuity

Swamped by the proliferation of technology and platforms to support

The inability to manage the infrastructure seamlessly

IT asset utilization is way too low

Operational cost too high, efficiency too low

Autonomic Computing helps solve customer challenges by building an on demand infrastructure
AUTONOMIC COMPUTING ATTRIBUTES

- SELF HEALING
- SELF CONFIGURING
- SELF PROTECTING
- SELF OPTIMIZING
Self-Configuring Example: DB2 Configuration Advisor
Self-Healing Example: IBM Electronic Service Agent

Service agent detects a hardware problem

Fully Automatic

Sends error symptoms to IBM

Data Catcher

Problem Database

Sends Symptoms for Diagnosis

Analysis of Problem Record

Electronic Response

Dispatch CE

Voice Support

- Faster problem resolution
- Higher availability/resiliency
- Lower maintenance cost

""IBM's eService Agent allows me to sleep soundly knowing the system is being monitored 24x7."
Alex Tambellini, 7-Eleven Stores Pty Ltd.
Self Optimizing: Enterprise Workload Management

Self-tuning, end-to-end performance management

- Dynamic allocation of network resources
- Workload balancing & routing
- Cross platform reporting
- Policy-based for various classes of users & applications

Heterogeneous, distributed components working together
Self-Protecting Example: IBM Tivoli Risk Manager

- Automate incident response
- Protect systems and data
- Help prevent service disruptions

"The Tivoli security management software portfolio is helping our clients extend their businesses to the Internet while providing security and privacy..."
Mark Ford, Principal Deloitte & Touche

Rapid / automated analysis of complex situations

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BENEFITS OF AUTONOMIC

- SHORT TERM I/T RELATED BENEFITS

- LONG TERM I/T BENEFITS OR HIGH ORDER BENEFITS
Short-term I/T related benefits

- More responsive, Real-time system
- Scaled power, storage and costs
- Full use of idle processing power
- Fewer system or network errors due to self-healing.
Long-term or Higher Order Benefits

- Realize the vision of ennoblement by shifting available resources to higher-order business

- Achieving end-to-end service level management
As future researches, the following topics can be proposed in autonomic distributed computing domain:

- Performance evaluation of applying the autonomic behavior in a distributed computing system model.

- Designing an autonomic manager in multi-layer P2P form, so that autonomic behavior and management information as a knowledge base are stored in separated layers.
Studying languages, which develop autonomic management behavior in a distributed computing environment.

Implementing a self-healing system in a virtual organization.
THANK YOU