Toward Configurable Performance Monitoring

Introduction to Mathematical Support for Metric Representation and Instrumentation of the CIM Metric Model

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• Context and Issues
  – Context.
  – Issues: Characteristics & Existing Projects Lacks.

• Our Proposal: a Monitoring Architecture for Management and QoS Purposes

• Information Model

• Added Value and Future Works
Context

• SOA (Service-Oriented Architecture).
• Guarantee a certain level of the QoS committed during run time.
• Management and QoS treatment require an underlying monitoring capacities.
  – Configurable.
  – Reconfigurable during run time.
• Reconfiguration of monitoring capacities (instead of the SOA components)
Our proposal must be

- **Generic**
  - VOD
  - VoIP
  - DoS
  - Power Consumption
  - etc…
- **Extendible**
  - Adding new monitoring capacities during run time.
- **Able to detect the QoS.**
  - In case of deterioration, identify the root reason.
Existing Projects and Issues

- **Fixed Monitoring FWK.**
  - Using one monitoring FWK.

- **Predefined Metrics**
  - No way to add new metrics during run time.

- **Predefined Monitoring**
  - Modifying the evaluation references (ERs) rather than the monitoring itself.
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• Our Proposal: a Monitoring Architecture for Management and QoS Purposes
  – Architecture Evolution.

• Information Model

• Added Value and Future Works
Adaptive and Model–Driven Monitoring for Mgmt & QoS Purposes

Proposal

Context & Issues

Information Model

AV & FW

Research Projects

Existing Monitoring Frameworks

- SNMP
- WMI
- NetFlow
- Cisco IOS
- IP SLA
- WSDM
- ...

Our Monitoring System

Input

Adaptive Monitoring System

Loop: During the Monitored System Lifecycle

Determining the Appropriate Configurations

Par: Monitoring & Reconfiguring

Monitoring

Reconfiguring

- Regarding to Mgmt. Functionalities: Metrics + Evaluation References MODELS.
- Regarding to QoS Functionalities: Service Level Agreement MODELS.
- Regarding to Reconfiguration: Reconfiguration Patterns MODELS.
Architecture Evolution

• Traditional Functional Architecture: Service-Oriented Architecture

• Enhanced Functional Architecture: SOA Supporting Mgmt & QoS
Architecture Evolution (cont'd)

Management Architecture

Enhanced SOA
- Implementation independent
- Platform independent
- Dynamic Arch.
- Embedding Mgmt & QoS

WBEM Architecture
- Management
- Model-Driven
- Interoperability

Proposal

Context & Issues

Information Model

AV & FW

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Architecture Evolution (cont'd)
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• Our Proposal: a Monitoring Architecture for Management and QoS Purposes
• Information Model
  • CIM Metric Model (😊 & 😞).
  • Extending CIM Metric Model.
• Added Value and Future Works
Metric Representation Primordiality

Why is the metric representation important?

• From metric specification → monitoring configuration.
• Reconfiguring the monitoring after changes of the monitored environment.

The solution idea …

Embedding some parameters related to monitoring activities into the metric representation.
Positive Sides 😊

• Generic representation.

• The capacity of creating metrics at run time.

• “Bridging Factor”
  • Metric specification → monitoring configuration.
Negative Sides 😞

• It does not support mathematical metrics calculated by formulas.

• “Bridging Elements“ are not enough to compose the necessary Monitoring Tasks.

Existing CIM Metric Model (V 2.28.0)

Proposal

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Mediator Module (Representation)

- **Extended CIM Metric**

**Elementary Metrics**

- **Resource Metrics**
  
  Directly polled from the distant resource.
  
  - \( tcp\text{ActiveOpens} \ (\text{MIB-2}) \).
  
  - \( \text{One-Way Connectivity} \ (\text{IPPM MIB}) \).

- **Measurable Metrics**
  
  Must be measured / calculated by specific entity (Service Broker).
  
  - \( \text{Used / Available Bandwidth} \).
  
  - \( \text{Uptime / Downtime} \).

**Composite Metrics**

- **Mathematical Metrics**
  
  It’s common to compose new metrics based on the Elementary metrics.
  
  - \( \text{Availability} = \frac{\text{Uptime}}{\text{Uptime} + \text{Downtime}} \).
  
  - \( \text{Jitter} = \text{Jitter} + \frac{\left| \text{Delay}(i-1,i) \right| - \text{Jitter}}{16} \).

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Mediator Module (Instrumentation)

• Elementary Metrics
  • Resource Metrics
    • SNMP OP,
    • WMI OP,
    • WSDM OP,
    • etc...
  • Measurable Metrics
    Particular OP for each Elementary Metric.

• Composite Metrics
  • Mathematical Metrics
    Mathematical OP
    • Parses Formula string field, and
    • Executes mathematical or statistical operations over the concerned operands.
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The Added Value

• Concerning the Elementary Metrics
  • The flexibility of modeling metrics, either
    • As a Resource Metrics
    • Or as Measurable Metrics
      Depending on the available information by the remote resource agent.

• Concerning the Composite Metrics
  • Reducing the development
    • “Zero code” for instrumenting Mathematical Metrics.
Future Works

• **Short term perspectives:**
  – “Best Printer” use case.

• **Long term perspectives:**
  – Drawing a generic method, that enables:
    • Guiding administrators, in order to perform some management tasks.
Future Works

- **Short term perspectives:**
  - “Best Printer” use case.

- **Long term perspectives:**
  - Drawing a generic method, that enables:
    - Guiding administrators, in order to perform some management tasks.
    - Deriving metrics & ERs from SLAs.
  - Adding QoS Semantic of the Metric Model, in order to offer an intelligent analysis of QoS treatment.
  - Determining (re)configuration schemas (integrated in CIM) of metric monitoring. Taking into consideration:
    - “Reconfiguration Objectives” described in reconfiguration patterns.
Thanks for your attention . . .

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