Managing Polling Adaptability in a CIM/WBEm Infrastructure

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Introduction

- General Context
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### GENERAL CONTEXT

- **Heterogeneity**
- **Virtualization**
- **Mobility**
- **Embedding**

**Systems**

**Services**

**Network**

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**Decisions for management need to be taken**

- **Autonomy**
- **Decentralization**

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**SELF-ADAPTATION**

(Operational phase)
THE MONITORING IN THE MANAGEMENT LOOP

MANAGEMENT LOOP
MONITORING MANAGEMENT

HOW TO MAKE MORE FLEXIBLE AND ADAPTABLE THE MONITORING MECHANISMS?

Managing Polling Adaptability in a CIM/WBEM Infrastructure
Characterization of Polling Adaptability

- Monitoring Characterization
- Polling Configurability
- Polling Adaptability
THE MONITORING ACTIVITY

- **Polling Adaptability**
- **Alignment with DMTF**
- **Experimentation**
- **Synthesis**

**Description and State**

- **Managed System**

**Behaviour**

- **Monitoring module**
- **Monitored view of the managed entity**

**Polling**

- **Request**
- **Data**

**Event Reporting**

- **Events**

**Active Monitoring**

- **Passive Monitoring**

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Introduction

- Polling Adaptability
- Alignment with DMTF
- Experimentation

MONITORING CHARACTERIZATION

⇒ Polling

Request → Managed System

Data → Managed System

⇒ Event Reporting

Managed System → Event Reporting

Events

$M_T = P_T \cup E_T \neq \emptyset$

$\forall n \in \mathbb{N}, T = \langle t_1, t_2, ..., t_n \rangle$

$C_f = \{\text{inst}(Pa_{mdf})\} \cup \{\text{inst}(Pa_{-mdf})\}$
Polling Definition

∀ i ∈ N, \( P_T = \langle C_1, C_2, ..., C_i \rangle \)

such that ∀ i, \( \text{start}TC_i < \text{start}TC_{i+1} \)
1ST PARAMETER: EXECUTION MODE

Introduction

Polling Adaptability

Alignment with DMTF

Experimtation

Synthesis

Periodic

NoOverlapping

Target

M

\[ \Delta startC_{(i,i+1)} = startTC_{i+1} - startTC_i \]

\[ interC_{(i,i+1)} = startTC_{i+1} - endTC_i > 0 \]
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Termination Mode

- Unlimited Polling
- Iteratively Bounded
- Temporally Bounded

2nd Parameter: Termination Mode

- Total duration = 10 min
- Total iteration = 2 occ.
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3rd Parameter: Waiting Time and Productivity

- Polling Adaptability
- Alignment with DMTF
- Experimentation

Introduction

Polling Adaptability • Alignment with DMTF • Experimentation

Waiting Time and Productivity

Productive Request

Unproductive Requests

Response Waiting Delay

MaxTC_i

Target

M

MaxTC_i

Target

M

MaxTC_i

Target

M

MaxTC_i

Target

M
4TH PARAMETER: AUTONOMOUS TER MN I N AT I ON MODE

- Target
- M

Successive Unproductive Getting Operation Threshold

Threshold = 4 successive unproductive

Autonomous Termination Mode

Off

Rate = 80 % unproductive

Unproductive Getting Operation Maximum Rate

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Managing Polling Adaptability in a CIM/WBEM Infrastructure

5TH PARAMETER: REQUEST MODE

- Direct and From the Source Polling
- Local Polling
### Selector parameters (Types `enum`)

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<thead>
<tr>
<th>Label</th>
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<td>Execution mode</td>
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<td>Termination mode</td>
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<td>Iterative</td>
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<td>✗</td>
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<td>RateImp</td>
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<td></td>
<td>Local</td>
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### Other parameters

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<tr>
<td>Answer delay</td>
<td>ulong</td>
<td>✓</td>
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<tr>
<td>Polling period</td>
<td>ulong</td>
<td>✓</td>
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<tr>
<td>Request delay</td>
<td>ulong</td>
<td>✓</td>
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<tr>
<td>Maximal number</td>
<td>ulong</td>
<td>✓</td>
</tr>
<tr>
<td>Total duration</td>
<td>ulong</td>
<td>✓</td>
</tr>
<tr>
<td>Succ. unprod. op.</td>
<td>ushort</td>
<td>✓</td>
</tr>
<tr>
<td>Unprod. op. max. rate</td>
<td>float</td>
<td>✓</td>
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</tbody>
</table>
Adaptability occurs when at least one parameter changes: the monitoring state turns into another state.

$$\delta_S = S \rightarrow S'$$

A monitoring strategy is the association between the mechanisms and their configurations.

$$S = (M_T, C_f) = \{\langle P_{t_1}, C_{f_1} \rangle, \langle P_{t_2}, C_{f_2} \rangle, \ldots, \langle P_{t_n}, C_{f_n} \rangle\}$$
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- **TI** = Time Interval
- **IB** = Iteratively Bounded
- **PP** = Polling Period
- **TB** = Temporally Bounded

**Alignment with DMTF**

**Experimentation**

\[
\left( (M_T, C_f) \xrightarrow{A} (M'_T', C'_f') \right) \Rightarrow \\
\left( (|M'_T'| > |M_T|) \land (T' \geq T) \right)
\]

\[
\left( (M_T, C_f) \xrightarrow{D} (M'_T', C'_f') \right) \Rightarrow \\
\left( (|M'_T'| < |M_T|) \land (T' \subseteq T) \right)
\]

\[
\left( (M_T, C_f) \xrightarrow{U} (M'_T', C'_f') \right) \Rightarrow \\
\left( (C'_f \neq C_f) \lor (T' \neq T) \right)
\]
Managing Polling Adaptability in a CIM/WBEM Infrastructure
Alignment with DMTF Standards

- WBEM Architecture Components
- CIM Information Model
Introduction

Polling Adaptability

- Alignment with DMTF -
  Synthesis

Experimentation

WBEM ARCHITECTURE COMPONENTS

- Generic approach
  - All possible polling configuration
  - Independence of all management protocols

- Uniformity of both the modeling and the formalization through the CIM Schema

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Managing Polling Adaptability in a CIM/WBEM Infrastructure
Experimentation with Open Pegasus

- Scenario
- UML Interaction Diagram
Managing Polling Adaptability in a CIM/WBEM Infrastructure

SCENARIO

More Freshness and Accuracy in order to DETECT PRECISELY THE FAILURE

ADAPTABLE POLLER

Polling Period ← 60 sec
Rely on refreshed data (SNMP agent)

Subscription in order to receive FAULT INDICATIONS (private protocol)

if event = FAULT INDICATION then
  Reduce the Polling Period
end if

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Managing Polling Adaptability in a CIM/WBEM Infrastructure

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**UML Interaction Diagram**

- **Legacy Protocol Notification ObjectProvider**
- **SNMP Operation ObjectProvide**
- **CIM Server OpenPegasus CIMOM**
- **AdaptablePoller**
  - CIM Client Polling
- **CIM Listener PollingOperation InstanceModify**
- **Adaptive Monitor**
  - (CIM Listener Legacy Protocol Indication & CIM Client Polling Manager)

- **Polling Loop (controlParameters)**
  - `getSNMP(oid)`
  - `OPRefresh(target)`
  - `getRefreshed(target)`
  - `Get(target)`
  - `value`
  - `value`

- **Notification**
  - `IndicationCreate(source)`
  - `IndicationNotify(source)`
  - `Modify(PollingOperation.PollPeriod, newPeriod)`
  - `InstanceModificationIndication`
  - `Get(PollingOperation)`
  - `value`
  - `InternalSignal`
  - `UpdatePollingControl(Loop.controlParameters)`

- **Minimal effort for development**
- **Overhead measure: 3 to 4ms**

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Synthesis and Future Work
SYNTHESIS AND FUTURE WORK

• Synthesis
  ➔ Services oriented vision of the monitoring concept
  ➔ Formalization of the polling configurability and adaptability
  ➔ CIM information model and WBEM architecture components
  ➔ Experimentation with Open Pegasus

• Future Work
  ➔ Extend the control capability of polling services
  ➔ Refine the formal representation of the polling mechanism
  ➔ Enlarge control capability to the event reporting mechanism
  ➔ Finally, a study is in progress to define a language for the control capability with the use of business monitoring strategies
REFERENCES


- Lahmadi, Performances des fonctions et architectures de supervision de réseaux et de services, *Doctorat de l’Université Nancy II*, Déc. 2007.