MANAGING THE INTERNET

TUTORIAL FOR THE CENTRAL ORGANIZATION OF THE TELEMATICA INSTITUUT

14-12-1999

AIKO PRAS
CENTRE FOR TELEMATICS AND INFORMATION TECHNOLOGY
UNIVERSITY OF TWENTE
THE NETHERLANDS

pras@ctit.utwente.nl
http://wwwhome.ctit.utwente.nl/~pras

CONTENT

OVERVIEW OF INTERNET MANAGEMENT

• PRINCIPLE OPERATION
• NEW DEVELOPMENTS
• OTHER APPROACHES
  • ISO-ISO
  • ITU-T / TMN
  • DMTF / CIM

BREAK

TECHNICAL DETAILS

• SIMPLE NETWORK MANAGEMENT PROTOCOL
• MANAGEMENT INFORMATION BASES
• FURTHER INFORMATION
PRINCIPLE OPERATION

MANAGER

GET / SET

TRAP

AGENTS

TABLES

VARIABLES

MANAGER

TABLES

VARIABLES

AGENTS
**SNMPv3**

**ALLOWS SECURE COMMUNICATION**

<table>
<thead>
<tr>
<th>THREAT</th>
<th>ADDRESSED?</th>
<th>MECHANISM</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASQUERADE</td>
<td>YES</td>
<td>MD5 / SHA-1</td>
</tr>
<tr>
<td>REPLAY</td>
<td>YES</td>
<td>TIME STAMP</td>
</tr>
<tr>
<td>DISCLOSURE</td>
<td>YES</td>
<td>DES</td>
</tr>
<tr>
<td>INTEGRITY</td>
<td>YES</td>
<td>(MD5)</td>
</tr>
<tr>
<td>DENIAL OF SERVICE</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>TRAFFIC ANALYSIS</td>
<td>NO</td>
<td></td>
</tr>
</tbody>
</table>

**ALLOWS ACCESS CONTROL**

**HAS A MODULAR ARCHITECTURE**

**MANY IMPLEMENTATIONS**

---

**MODULAR SNMPv3 ARCHITECTURE: AGENT**
NEW DEVELOPMENTS

DISTRIBUTED MANAGEMENT

EXPRESSION AND EVENT MIB

TOP LEVEL MANAGER

INTERMEDIATE LEVEL MANAGER

AGENT

NEW DEVELOPMENTS

DISTRIBUTED MANAGEMENT

SCRIPT MIB

TOP LEVEL MANAGER

INTERMEDIATE LEVEL MANAGER

AGENTS
NEW DEVELOPMENTS

POLICY BASED MANAGEMENT

COPS VERSUS SNMP

COPS:
- DEDICATED "CONFIGURATION MANAGEMENT" PROTOCOL
- HIGHER LEVEL OBJECTS THAN USUAL WITH SNMP
- POLICY INFORMATION BASE (PIB)
- SINGLE OPERATION TO ADD OR DELETE TABLE ROWS
- RELIABLE COMMUNICATION BETWEEN PDP AND PEP (BECAUSE OF TCP)
  - EACH PEP IS CONNECTED TO SINGLE PDP

SNMP:
- INTEGRATED APPROACH TO MANAGEMENT
- POLICIES CAN BE DEFINED WITHIN MIBs
- EACH PEP MAY BE CONNECTED TO MULTIPLE PDPs
NEW DEVELOPMENTS

IRTF NETWORK MANAGEMENT RESEARCH GROUP

EFFICIENT TRANSFER OF BULK MANAGEMENT DATA

• SNMP OVER TCP
• COMPRESSION
• GET-SUBTREE OPERATOR

SMI NEXT GENERATION

• INDEPENDENT FROM OTHER EXTERNAL STANDARDS
• BASED ON AUGMENTED BNF
• MORE DATA TYPES
• EASIER TO PARSE

ACTIVE MANAGEMENT

• ALLOW MANAGEMENT FUNCTIONS WITHIN MIBs
• CAN BE USED OVER SNMP OR COPS
• POWERFUL NEW IDEA!

OTHER APPROACHES: CMIP

<table>
<thead>
<tr>
<th></th>
<th>CMIP</th>
<th>SNMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>model</td>
<td>event based</td>
<td>polling based</td>
</tr>
<tr>
<td>information approach</td>
<td>object oriented</td>
<td>variable oriented</td>
</tr>
<tr>
<td>complexity</td>
<td>agent is complex</td>
<td>agent is simple</td>
</tr>
<tr>
<td>state information</td>
<td>kept by agent</td>
<td>kept by manager</td>
</tr>
<tr>
<td>underlying service</td>
<td>CO - reliable</td>
<td>CL - unreliable</td>
</tr>
<tr>
<td>implementation</td>
<td>difficult</td>
<td>simple</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(V2 &amp; V3 are more difficult)</td>
</tr>
<tr>
<td>retrieves</td>
<td>objects</td>
<td>scalars (tables)</td>
</tr>
</tbody>
</table>
### OTHER APPROACHES: CMIP - 2

<table>
<thead>
<tr>
<th></th>
<th>CMIP</th>
<th>SNMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>actions</td>
<td>possible</td>
<td>via 'trick'</td>
</tr>
<tr>
<td>object selection</td>
<td>scoping &amp; filtering</td>
<td>-</td>
</tr>
<tr>
<td>security</td>
<td>via underlying services</td>
<td>authentication / encryption / ACL-lists</td>
</tr>
<tr>
<td>management functions</td>
<td>many</td>
<td>few</td>
</tr>
<tr>
<td>price</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>market acceptance</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

### OTHER APPROACHES: TMN

TELECOMMUNICATIONS MANAGEMENT NETWORK

ITU-T

DEFINITION STARTED 1985

DEFINED IN M-SERIES
  - M.3010

USES OSI SYSTEMS MANAGEMENT

FAMOUS FOR ITS MANAGEMENT HIERARCHY CONCEPT

ARCHITECTURES
  - FUNCTIONAL ARCHITECTURE
  - PHYSICAL ARCHITECTURE
  - INFORMATION ARCHITECTURE
  - LOGICAL LAYERED ARCHITECTURE
TMN: RESPONSIBILITY MODEL

OTHER APPROACHES: DMTF

DISTRIBUTED MANAGEMENT TASK FORCE

WEBM:
WEB BASED ENTERPRISE MANAGEMENT

CIM:
COMMON INFORMATION MODEL

DOCUMENTS:
• CIM SCHEMA
• XML ENCODINGS FOR CIM
• CIM OPERATIONS OVER HTTP
FURTHER INFO: WWW SERVERS

• IETF
  http://www.ietf.org/

• The SimpleWeb
  http://www.simpleweb.org/

• The Simple Times
  http://www.simple-times.org/

• The Smurfland NM Web Server
  http://netman.cit.buffalo.edu/