Alternatives to SNMP
and Challenges in Management Protocols

Communication Systems Seminar
Talk 10
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Introduction
Structure

• Network management
  • Management approaches
• SNMP
• Alternatives:
  • NetConf
  • CORBA
  • Web Services
• Performance Comparison
• Conclusion
Network management

All the activities, methods and tools for the:

- Operation of the network
- Administration of the network
- Maintenance of the network
- Provisioning of the network
Management approaches

Two fundamental ways:

• Management by remote invocation
  • Agent - manager
  • Distributed object

• Management by delegation
  • Agent - manager
  • Full mobile agent
SNMP

- Standard defined in 1990 by IETF
- Simplicity gives high success
- Widely supported by network devices
- Agent – manager model
- UDP protocol for transport
SNMP concept

• Agent provides large number of variables

• Manager can query for specific information

• Variables can be read or write

• Variables mapped in a MIB
  • Many MIB simultaneously
  • Standard MIBs
  • Definition of custom MIBs
SNMP operations

• Messages are defined as Protocol Data Units (PDU):
  • GET: to get an object or a list of objects
  • GETNEXT: to retrieve a group of MIB objects in sequence
  • GETBULK: to retrieve large amount of objects in one request
  • SET: to change the value of an object or to create a new one
  • GETRESPONSE: the response of a get, getnext and set request
  • TRAP: alert message from the agent
SNMP operations summary

Network Management System

Router

Printer

MIB

SNMP manager

SNMP agent

GET

RESPONSE

SET

TRAP
SNMP evolution

• SNMPv1: security concern
  • Community names: read-only, read-write and trap
  • Community strings are password transmitted in clear text

• SNMPv2: add functionalities
  • GET BULK and INFORM REQUEST
  • Security was not improved

• SNMPv3: security implemented
  • Encryption
  • SNMPv1/v2 packets encapsulated in a SNMPv3 packet
SNMP summary

• The success is given by some advantages:
  • Small footprint of agent
  • Simple information model
  • Interoperable, extensible and flexible
  • Network effect

• The disadvantages caused that SNMP is not really used for configuration:
  • Absence of security
  • Absence of transaction control
  • Traps not reliable
  • Low efficiency
NetConf

- Attempt to accomplish shortcoming of SNMP
- Mainly dedicated to configuration management
- Document-based approach (management by delegation)
- XML configuration document uploaded on device
- Data modelling language YANG
NetConf details

• Communication using XML-encoded Remote Procedure Call (XML-RPC)

• Commands: <get-config>, <edit-config>, <delete-config>

• Configurations: running, candidate and startup

• Layered architecture
  • Content layer, Operation layer, Transport layer

• Many transport protocols possible (SSH, SOAP, BEEP)
CORBA

• Object-oriented Remote Procedure Call (RPC)

• Platform and language independent

• Distributed middleware

• Two components:
  • Interface Definition Language (IDL)
  • Mapping from IDL to specific language
CORBA for Network Management

- Extensible application framework
- Standard and open interfaces
- Universality

- BUT not successful as network management system
  - Substitute like Java RMI
  - Heavyweight and expensive
  - Evolution in direction XML
Web Services

- W3C standard for communication over WWW
- Language- and environment-neutral interfaces
- Standardized XML messages (SOAP)
- Interfaces described using Web Service Description Language (WSDL)
Web Services architecture
Web Services for network management

- Service Oriented Architecture
- XML for the interface definition
- HTTPS encrypted through any networks
- WS run inside web application servers: scalability, security and failure free
- Web Services Management Agent in CISCO IOS
IF-MAP

- Communication protocol between Metadata Access Point (MAP) and the clients

- MAP as a “publish/subscribe” database

- The “Facebook” for IP devices and systems

- Challenge is integration of all system on a network

- Concentrated on Enterprise security
IF-MAP for network management

- Collect unstructured data from many different systems
  - Aggregate and correlate data
  - User defined data-types

- Scalability and real-time transactions
  - MAP server is dynamically updated
  - MAP server as a real-time database of devices states

- Publish/subscribe functions for monitoring and configuration
Comparison response time

Response time

- SNMP
- CORBA
- WS

- 1 attribute
- 8 attributes
- 40 objects
- 40 obj. separately
Comparison management traffic

Management traffic

Bytes

1 attribute  8 attributes  40 objects  40 obj. separately

snmp  corba  ws
Comparison summary

• SNMP very fast with less than 20 queries

• CORBA very efficient for many queries (>20)

• XML encoding/decoding very expensive

• Curiosity: Java response time twice those of C++
Conclusions

• SNMP is ideal for monitoring applications

• NetConf is a configuration framework

• CORBA fast on transport but resource-hungry

• Web Services when XML important advantage in the integration and when SOA and application server part of the business architecture
Implementation

• Web Services:
  • many libraries
  • tools for WSDL
  • Eclipse integration

• SNMP:
  • Agents on nearly every network devices
  • Many SNMP manager implementation

• CORBA: high learning curve

• NetConf: some implementations and tools
QUESTIONS?

SNMP

XML

Web Services

NetConf

CORBA
Question 1

• Is there a concrete motivation to prefer a dedicated management protocol like SNMP over a general purpose solution like Web Services? Is universality good or bad?
Question 2

• Do you see Web Services as the future for network management or would you prefer the idea behind IF-MAP?
Question 3

• What are the incentives that vendors should have to provide native support for a protocol?
Question 4

- SNMP is a successful case difficult to beat, but is old-fashioned and not easy to handle; Web Services on the other hand is flexible and fashionable. If SNMP is still in use does it means that network management community needs something “up to the point”, very specific for the purpose and less general?