P2P Technologies Employed in Network Management

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Outline

- Motivation
- (Fast) peer-to-peer (P2P) review
- Simple model for P2P-based network management
- P2P for human-based cooperative management
- Improving management entities connectivity
- Distributed management and peer groups
- Additional issues
- Summary
Companies need to manage their networks to avoid economic losses.

Today, there are well-established network management standards (e.g., SNMP framework).
Introduction

- But what if once isolated networks need to be managed together?
- Boundary boxes (NAT, firewalls) break the network layer logic
Introduction

- P2P is about cooperation and resource sharing
  - User cooperation (e.g., Groove)
  - Among processes (e.g., SETI@home)
  - P2P entities, i.e., peers, LOCATED IN DIFFERENT DOMAINS!
Introduction

- P2P systems often mean problems to the network operator
  - More than 60% of the Brazilian academic backbone bandwidth is consumed by P2P systems
  - How to avoid P2P traffic?
  - How to limit P2P traffic?
We look at P2P from a different perspective

- P2P systems may be valuable network management tools to enable inter-domain management
## P2P review

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**P2P** → Unpredictable and scalable
Management models

Manager-agent

Manager

Agent

Request
Response
Notification

Distributed management

Top-level manager (TLM)

Mid-level manager (MLM)
Management models

P2P-based management

TLM  MLM  MLM for device access
Cooperative management

- Helps independent administrators to accomplish a common task

Examples:
- Interconnected networks
- Large corporate networks
- Networks with administrators having complementary roles (e.g., change and security)
Cooperative management

- Share of network views (topology maps)
- Notification handling
- Virtual management teams
Cooperative management
Management connectivity

- Management entities (managers, MLMs, agents, etc.) in traditional management rely on the IP default route to communicate with one another.
- If the default route is unavailable, alternative routes cannot be selected.
Management connectivity

Application (P2P) layer routing

<172.16.1.2, 161>
SNMP agent

SNMP@172.16.1.2:161 service
The use of P2P messages to manage devices may introduce performance problems:
- Bandwidth consumption
- End-to-end delay

P2P protocols (we have been using JXTA) versus SNMP
Management connectivity

Scenario 1: SNMP

Scenario 2: JXTA and SNMP
Management connectivity

![Graph showing network usage (KB) vs. number of routing table rows.]

Network usage (KB) vs. Number of routing table rows.

- SNMP: Blue line
- P2P: Green line
Management connectivity

![Graph showing download delay (ms) vs. number of routing table rows for SNMP and P2P connections. The graph demonstrates a linear increase in download delay with an increase in the number of routing table rows. The SNMP connection shows a steeper increase compared to the P2P connection.](image-url)
Device access & peer groups

- **Load balancing**
  - Top managers balance the management load among MLMs
  - With group of peers, management balancing is provided by MLMs inside the group (freeing TLMs)

- **More robust services**
  - While at least one single peer is up, the services of a group will be available
Further issues

- Revisiting some investigated technologies in the presence of P2P
  - Peer software is more easily updated
  - P2P as an intermediate substrate for network management
  - Peers can be seen as an flexible and programmable extension of a physical device
    - E.g., experiences with the DCN (Dynamic Circuit Network) of Internet2
Further issues

- Enabling user (or customer)-based management
  - (Domestic) users may participate in the management process
  - Light and restricted version of TLMs available in the user desktop
    - View network status
    - Restart a server in the ISP
    - Request resource reservation to the ISP
  - Users of optical infrastructures may setup their own networks
Further issues

- Distributed storage and replication of management information (e.g., history of monitoring data, notification caching)
- Policy-based management using P2P infrastructure
  - Policy translating entities (PDPs) may be implemented as peers
- Management of new technologies
  - Optical networks
  - WiMAX-based metropolitan networks
Summary

- P2P-based network management does NOT replace traditional management: it compliments traditional management enabling further functionalities:
  - Cooperative management
  - Application (P2P) layer routing
  - Management provided by groups of peers
Summary

- New challenges in network management has been motivating the investigation of new solutions.
- Are P2P-based management interesting and worthwhile?
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Thanks for your attention!
Questions?