P2P Technologies Employed in Network Management

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Outline

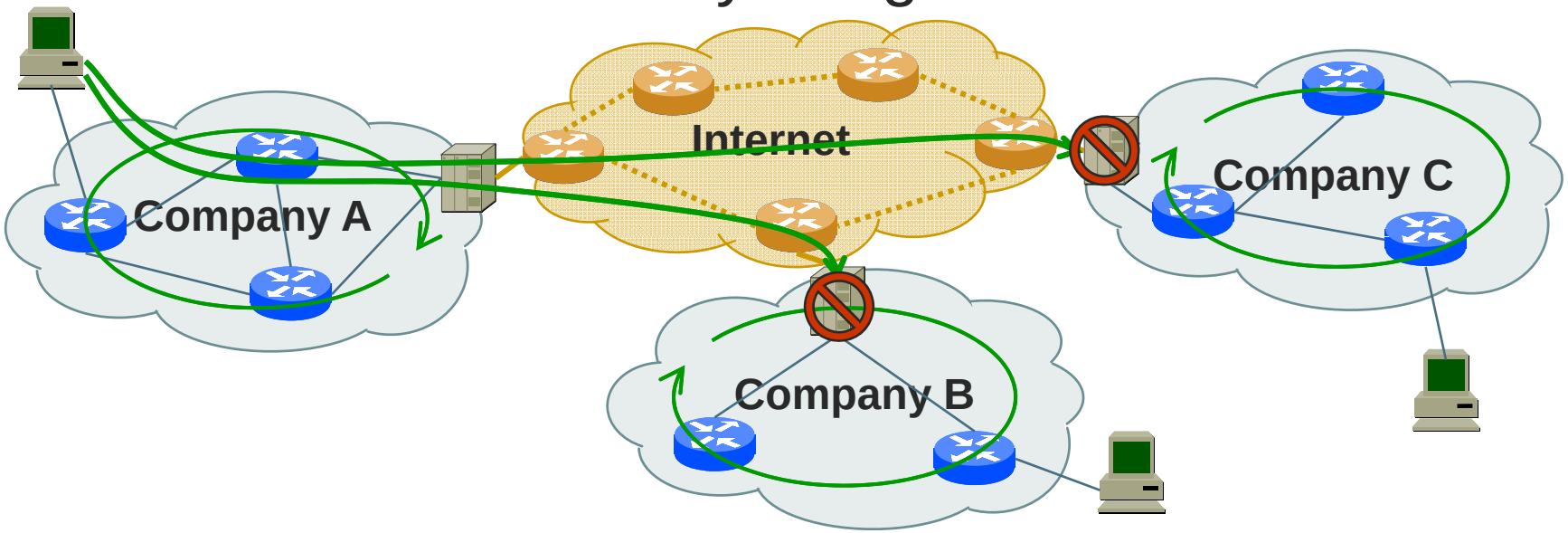
- Motivation
- (Fast) peer-to-peer (P2P) review
- Simple model for P2P-based network management
- P2P for human-based cooperative management
- Improving management entities connectivity
- Distributed management and peer groups
- Additional issues
- Summary

Introduction

- 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!

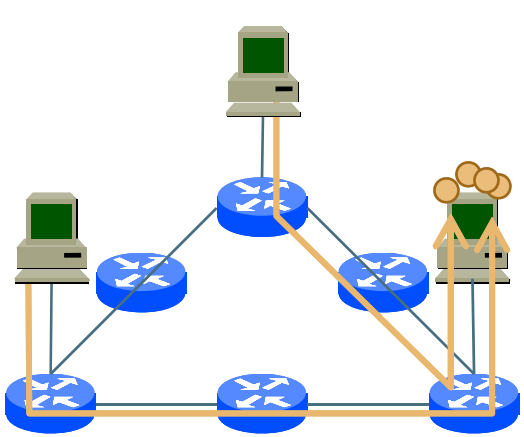
Introduction

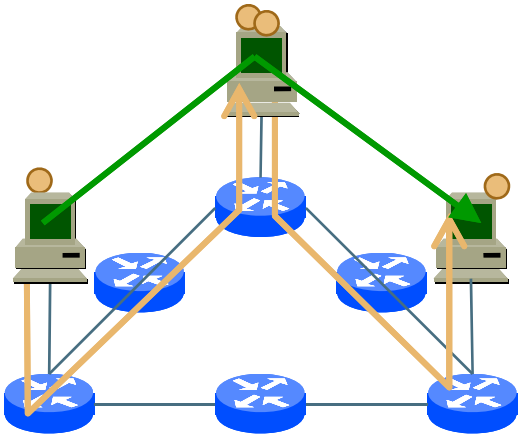
- P2P systems often mean problems to the network operator
  - More than 60% of the Brazilian academic backbone bandwidth is consumed by P2P systems
  - How to avoid P2P traffic?
  - How to limit P2P traffic?

Introduction

- We look at P2P from a different perspective
  - P2P systems may be valuable network management tools to enable inter-domain management

P2P review

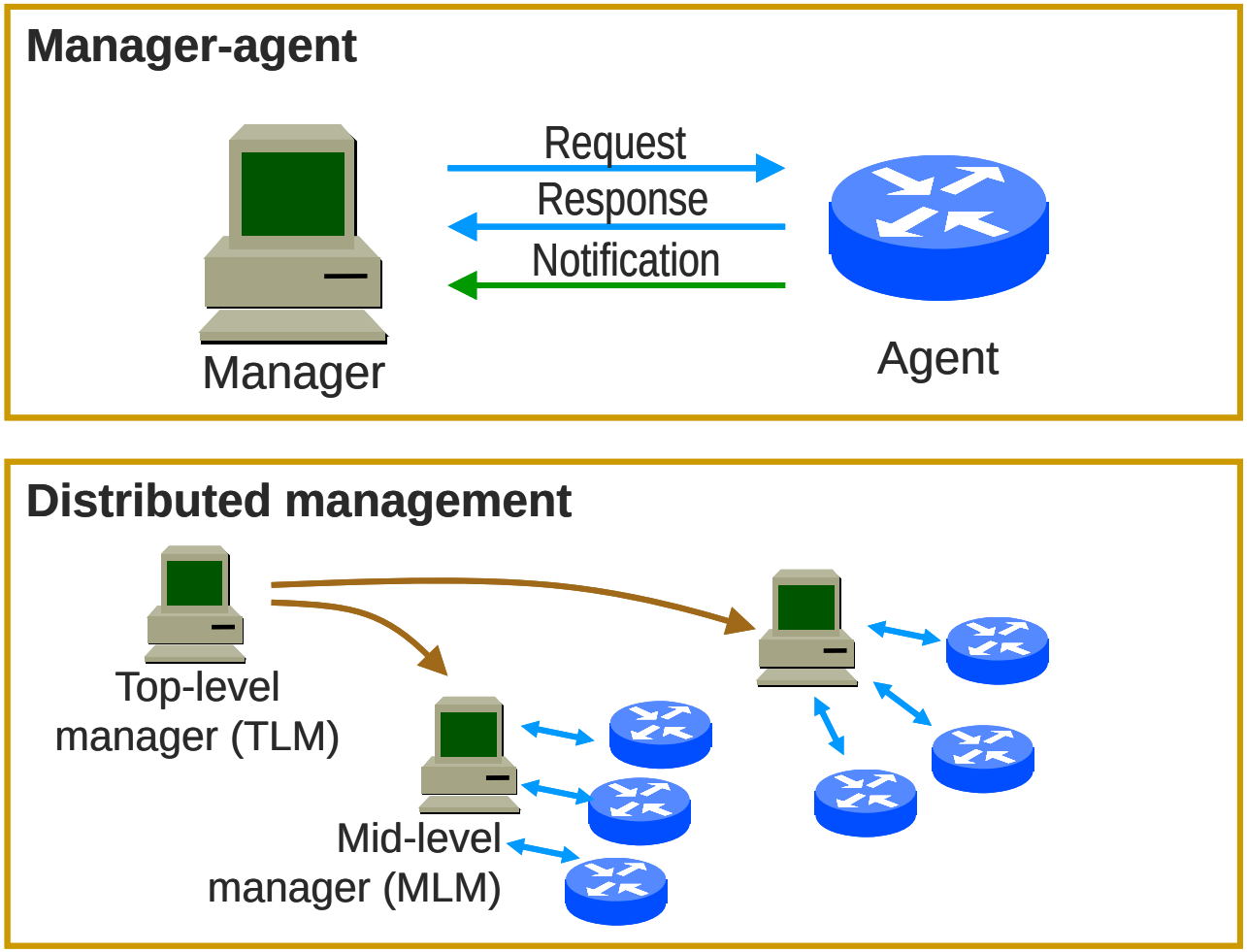




	Client-server	P2P
Resources	Centralized at the server	Distributed along peers
Addressing	Internet DNS	Own addressing system
Routing	IP routing (network layer)	P2P routing (app. layer)

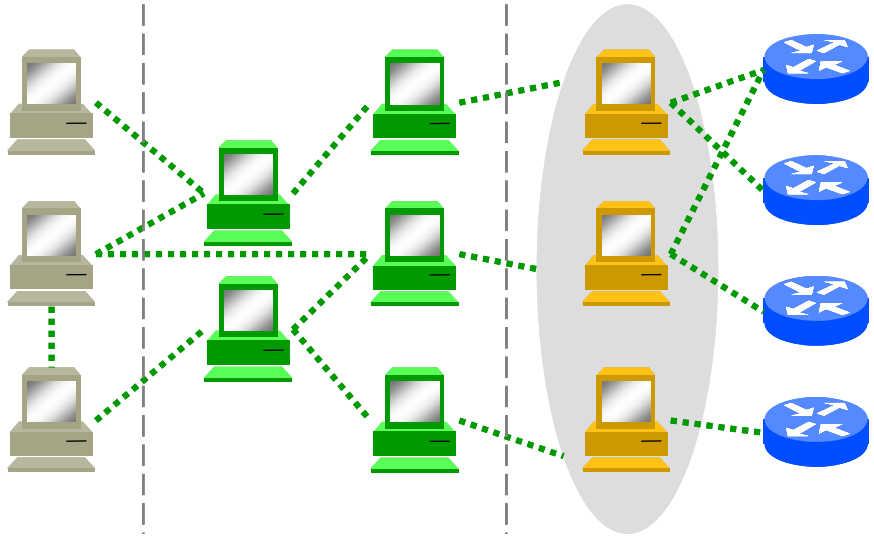
P2P → Unpredictable and scalable

Management models



Management models

P2P-based management



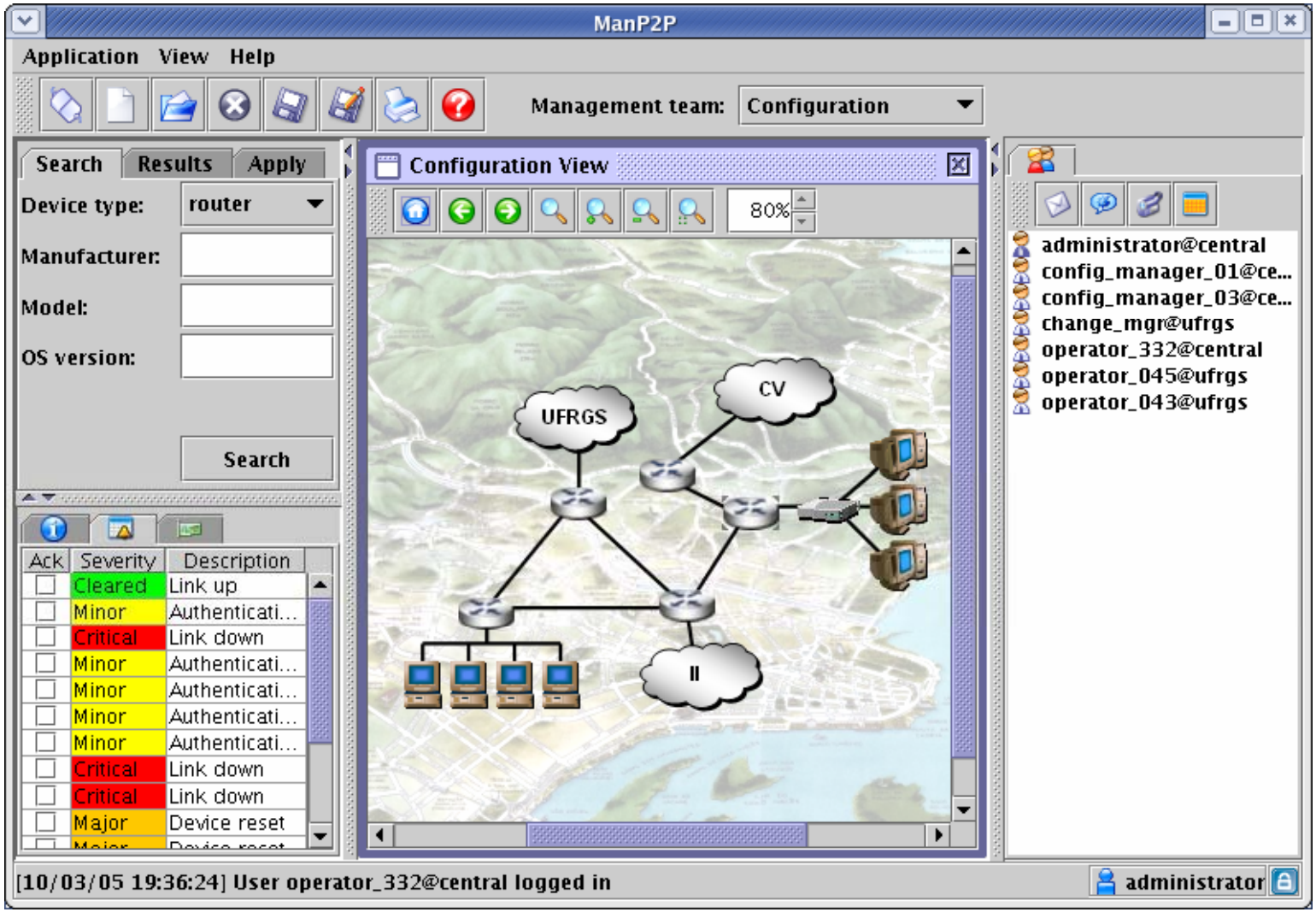
Cooperative management

- 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

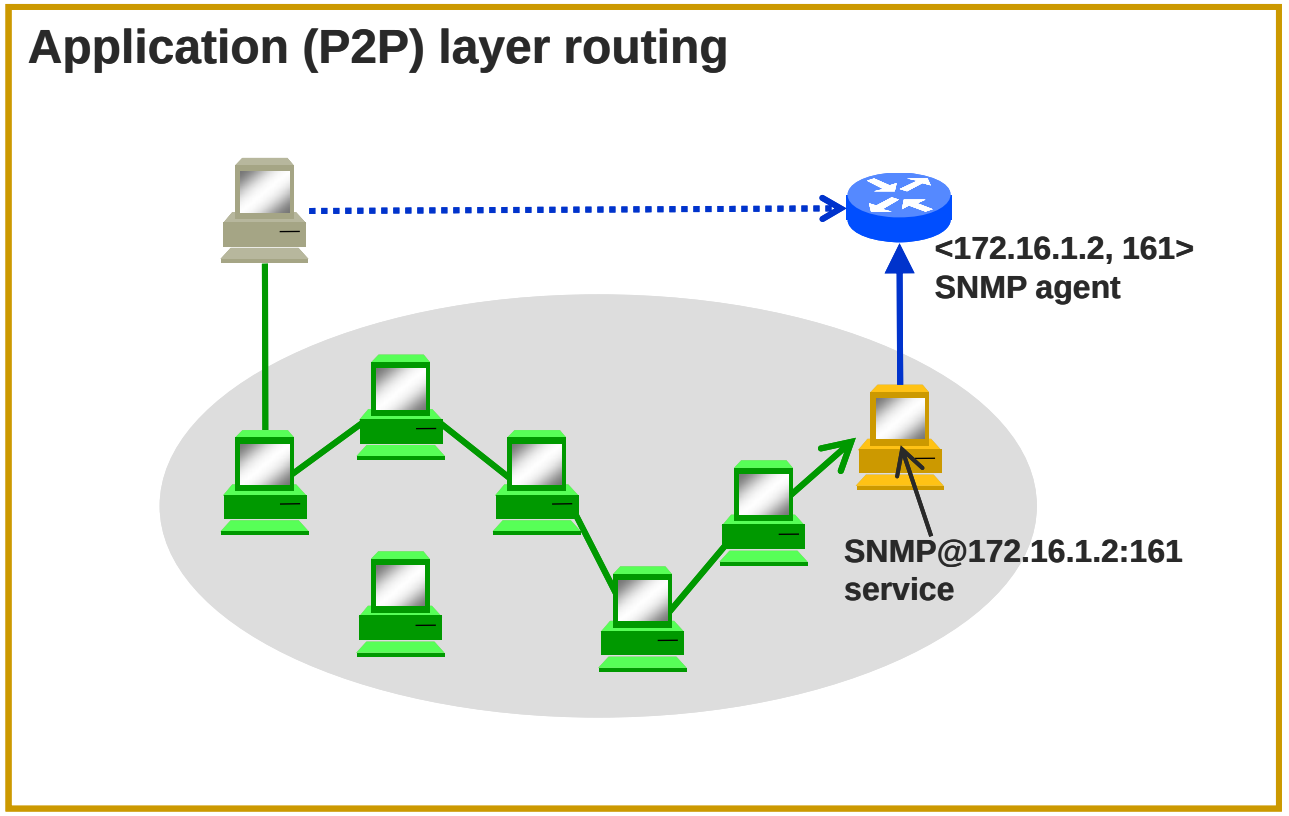
Cooperative management



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

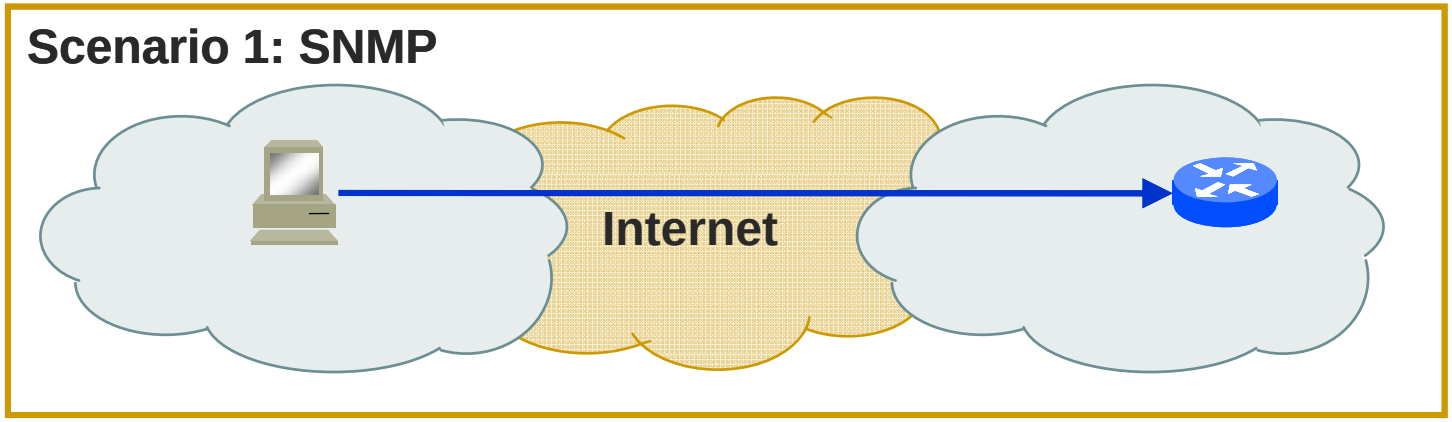
Management connectivity

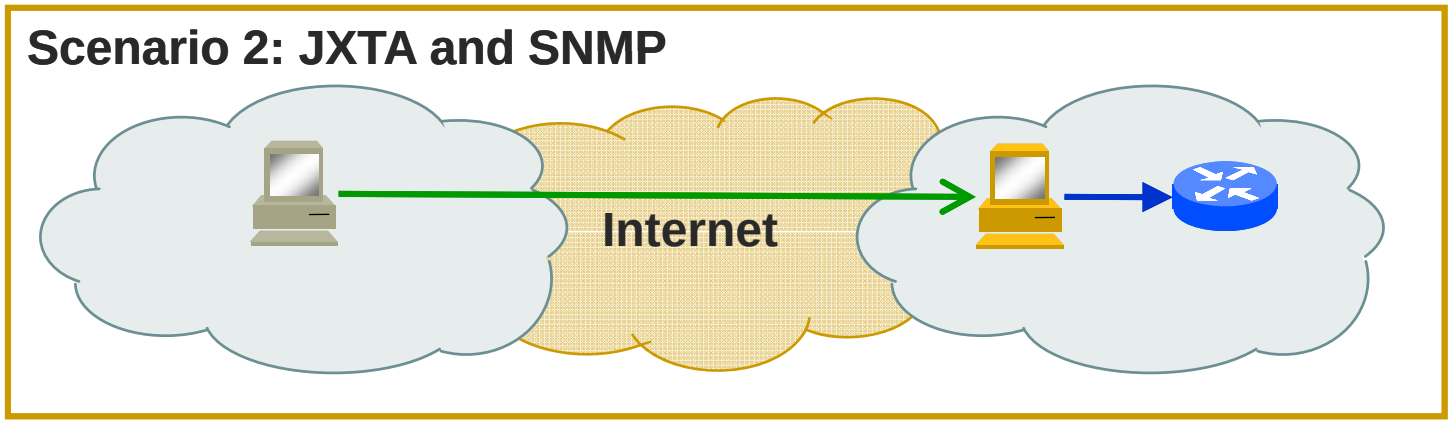


Management connectivity

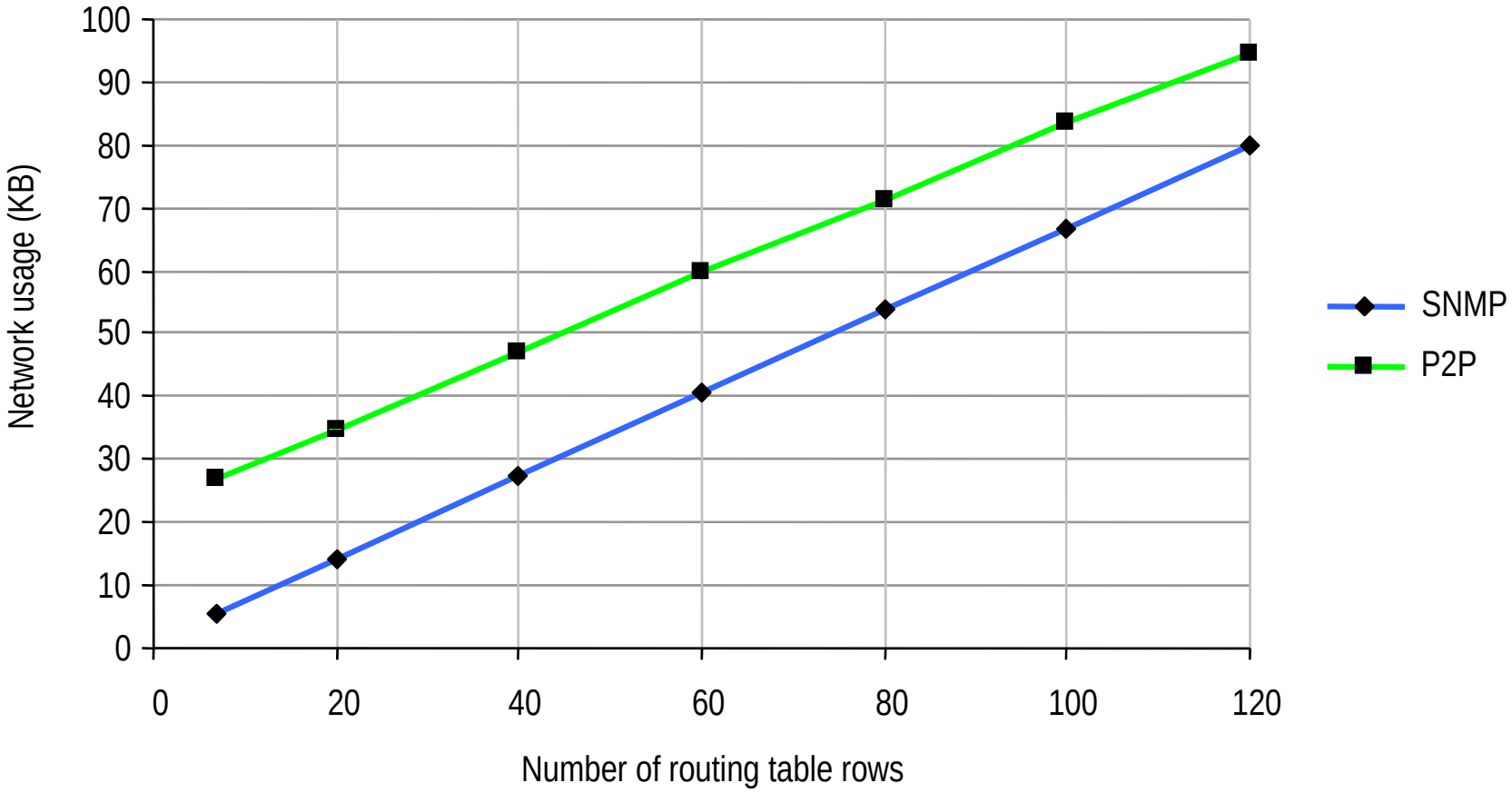
- The use of P2P messages to manage devices may introduce performance problems
  - Bandwidth consumption
  - End-to-end delay
- P2P protocols (we have been using JXTA) versus SNMP

Management connectivity

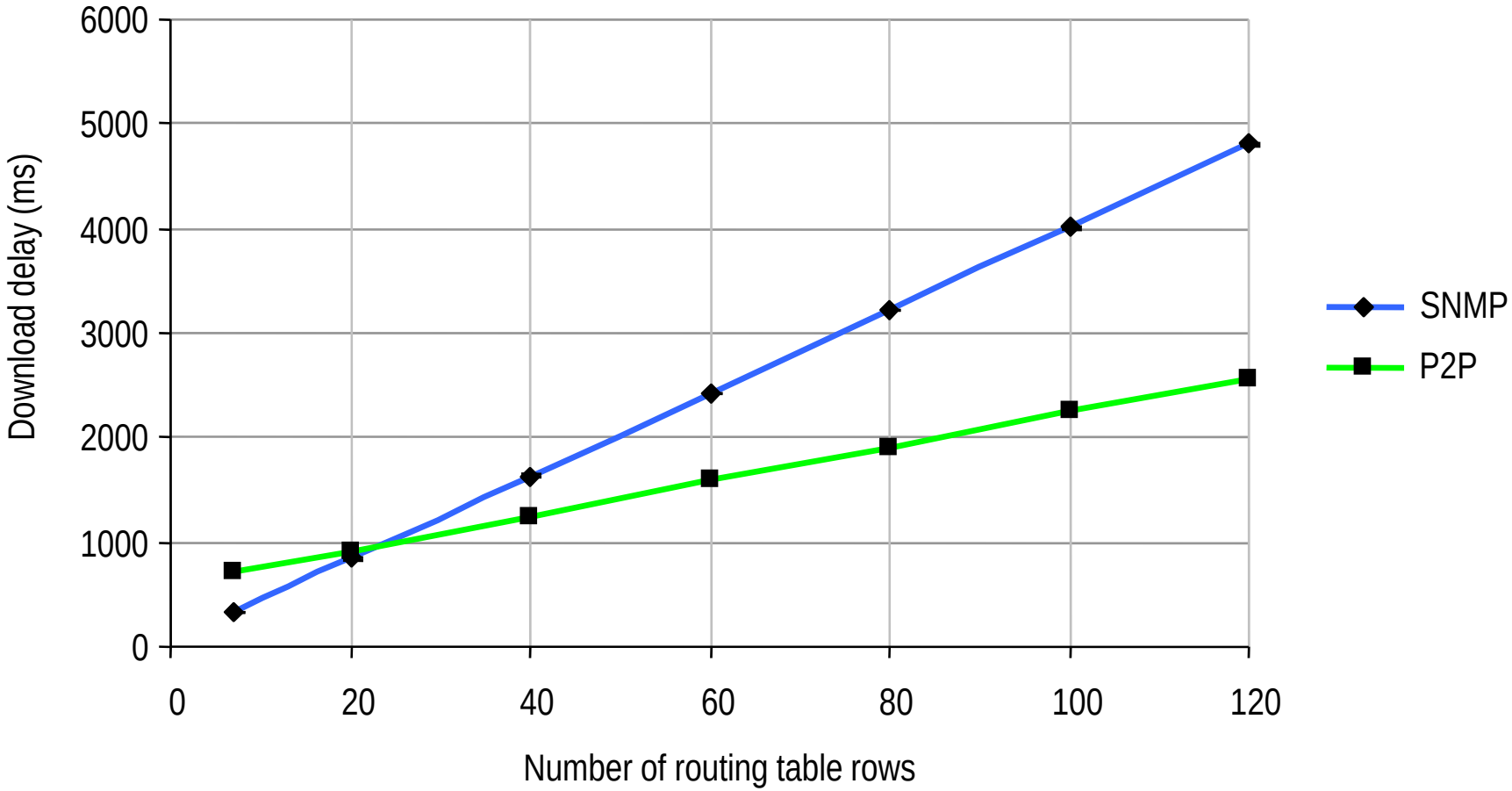




Management connectivity



Management connectivity



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 chaching)
- 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?

P2P Technologies Employed in Network Management

Thanks for your attention!

Questions?