Using Multicast-SNMP to Coordinate Distributed Management Agents

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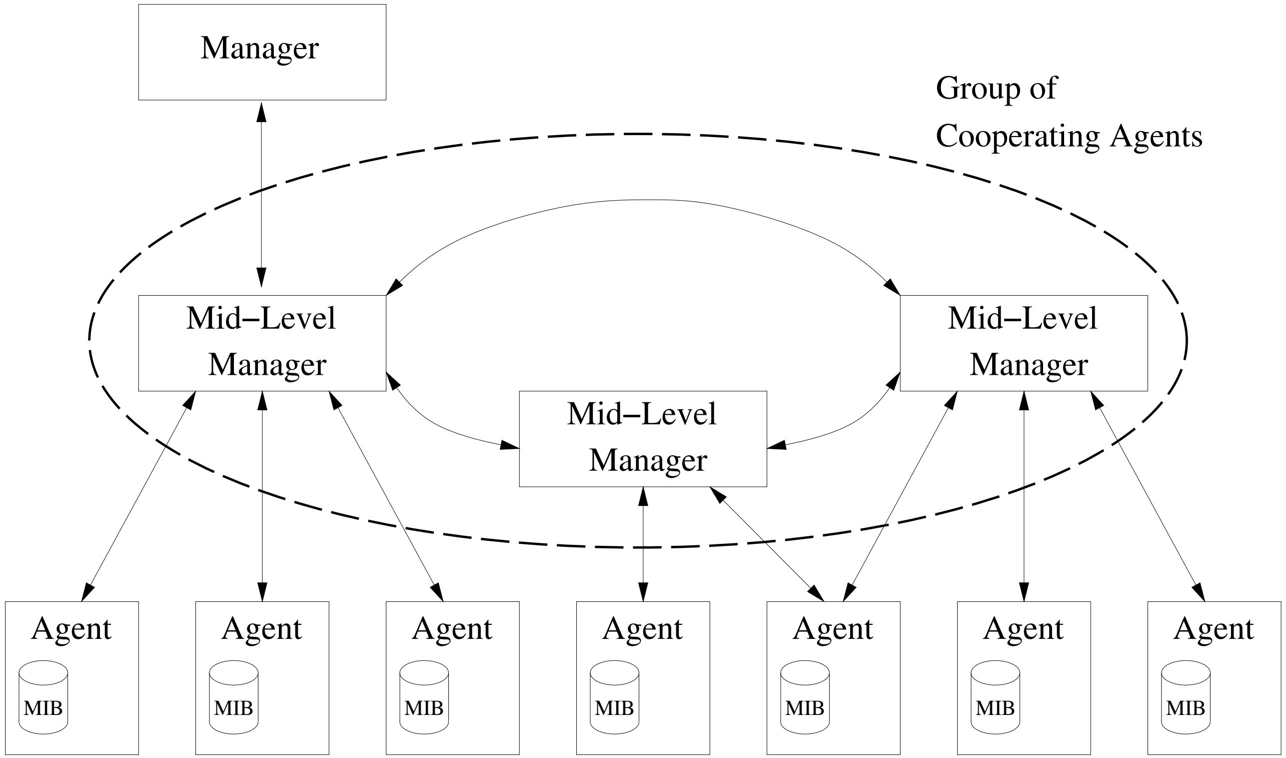
The Management-By-Delegation Approach

- Define and delegate management functions dynamically (scripts).
- Allows to define arbitrary site specific management procedures (policies).
- The structure of the management system itself can change dynamically to achieve load-balancing and fault-tolerance (cooperating agents).

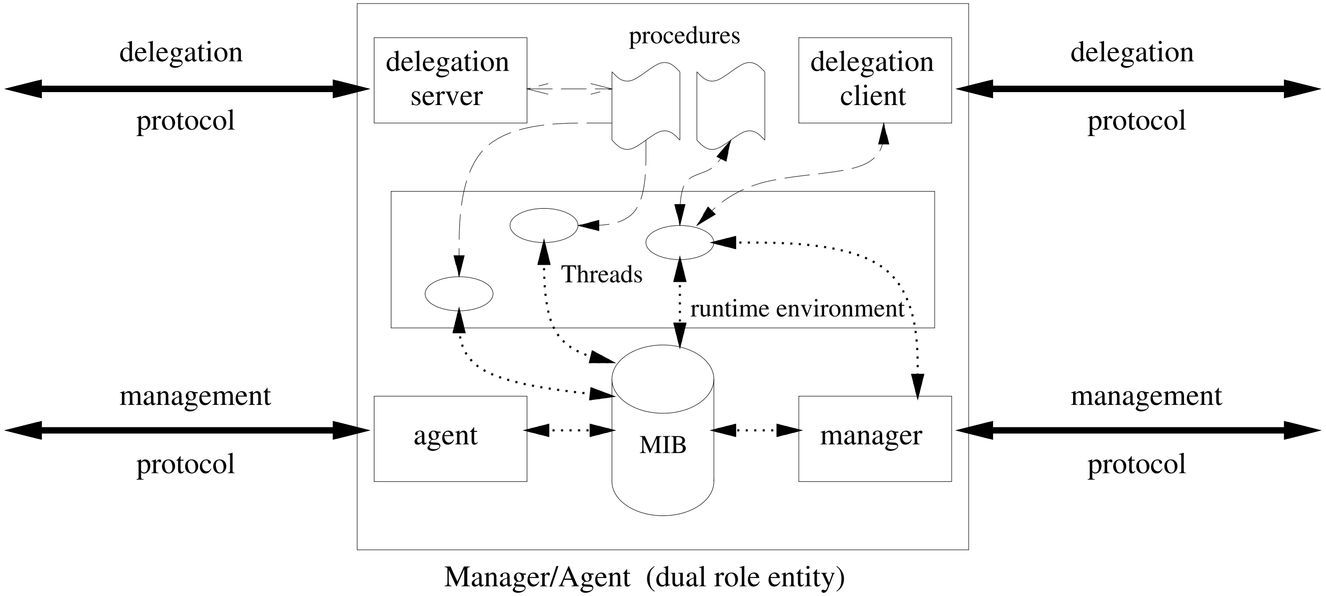
Problems:

- The distributed nature of cooperating management agents introduces a new management problem.
- It is necessary to discover the current structure of the distributed management system.
- It is necessary to coordinate activities in the distributed management system.

Management with Cooperating Agents



Prototype Implementation



- Symmetric interfaces allow to connect agents in various ways.
- Delegation via HTTP/SNMP based on the Tool Command Language (Tcl).
- Event-driven secure runtime environment executes management procedures.

Group Membership

Requirements:

- Cooperating agents must recognize them-self.
- Adding and removing an agent should require no manual intervention.

Solution:

- Cooperating agents are organized in groups.
- An agent may be a member of different groups.
- Cooperating agents periodically multicast `mcAliveTrap` SNMP traps to a well known IP multicast address to update group membership tables.
- A timeout mechanism is used to expire entries in the group membership table (soft state).

Master Election

Requirements:

- Cooperating agents should be able to synchronize and coordinate them-self by dynamically selecting a master agent.

Solution:

- The master agent periodically sends a `mcMasterTrap` SNMP trap.
- An agent which did not receive a `mcMasterTrap` message for some time starts an election by sending a `mcPanicTrap`.
- The agent wait for a `mcVoteTrap` from an agent with a higher number.
- The agent declares itself to be the master if it does not receive a `mcVoteTrap` for some time.

Discussion

Positive:

- Easy and straightforward to implement without any protocol changes.
- Works with the USEC SNMPv2 authentication model.

Problems:

- This solution requires IP multicast support in the underlying network.
- Group communication on top of SNMP tends to be inefficient.
- The election algorithm does not take into account asymmetric network partitions.