

Scalable policy management system for heterogeneous mobile ad hoc networks

Ad Hoc Network Management Challenges

- Frequent reconfiguration of networks due to node mobility.
- Limited computing capability on battery-powered nodes with limited storage capacity.
- Unstable communication link capacity and quality due to environmental conditions (weather, terrain, etc) and mobility.
- Requires situation-aware, adaptive management.



Management Policies

Component	Description
Event	A named <i>event</i> that triggers the execution of a policy. A Policy Agent will evaluate the <i>condition</i> when the <i>event</i> occurs.
Condition	A binary expression of the system status appropriate for enforcing a policy. The <i>condition</i> is evaluated by a Policy Agent in conjunction with <i>scope</i> .
Action	A task to be executed by a Policy Agent. To provide additional parameters for a task, the <i>action</i> is divided into action code and action parameter.
Scope	A role criterion by which a Policy Agent determines whether to enforce a policy based on its current role. The possible values of <i>scope</i> include all combinations of the roles of GPA, DPA, and LPA.

Management Policies (LPA)		
Exec	Policy	Scope
✓	Monitor Configuration	GPA_DPA_LPA
✓	Report Configuration	DPA_LPA
✓	Monitor Power Level	LPA
✗	Report on FAILURE	DPA
✗	Reassign Server on Evt	GPA

Management Policies (DPA)		
Exec	Policy	Scope
✓	Monitor Configuration	GPA_DPA_LPA
✓	Report Configuration	DPA_LPA
✗	Monitor Power Level	LPA
✓	Report on FAILURE	DPA
✗	Reassign Server on Evt	GPA

Management Policies (GPA)		
Exec	Policy	Scope
✓	Monitor Configuration	GPA_DPA_LPA
✗	Report Configuration	DPA_LPA
✗	Monitor Power Level	LPA
✗	Report on FAILURE	DPA
✓	Reassign Server on Evt	GPA

Platform-neutral

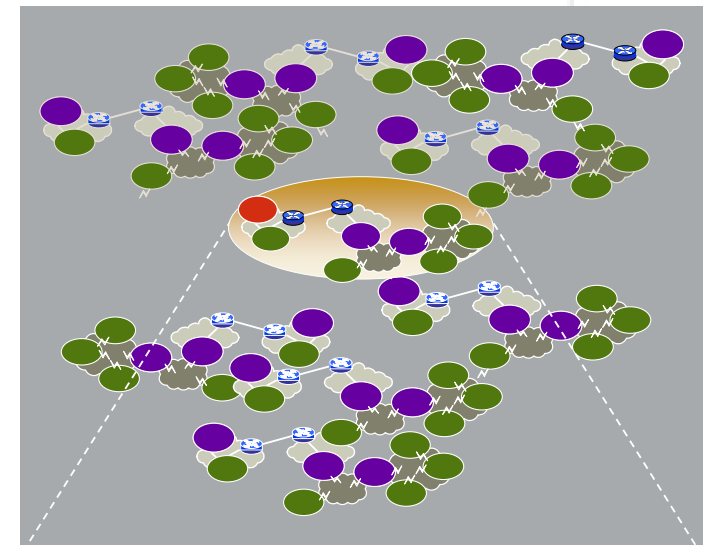
Autonomous
Resilient
Distributed
Simulation-verified
Self-healing
Policy-Based
Scalable
Adaptive
Customizable

System Features and Benefits

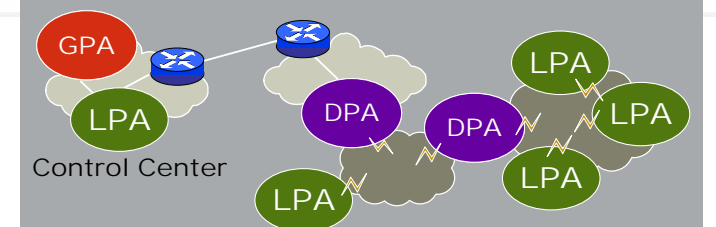
- Enables flexible and modular composition of policies
 - The set of management policies can be tailored easily based on the given management requirements
 - The enforcement of policies is determined by the criteria associated with the policies
- Supports distributed management with Policy Agents
 - Policies are distributed to Policy Agents scattered across the network for autonomous enforcement
 - Policy agents sense and adapt to environmental condition changes
- Manages dynamic networks with a self-forming, self-healing and scalable hierarchy of policy agents that
 - Provide resilient network services
 - Automatically correct network faults, reconfigure network components as needed, and optimize network performance
- Supports heterogeneous networks
 - Java-based, platform-independent
 - SNMP-capable

A Wide Spectrum of Application Possibilities

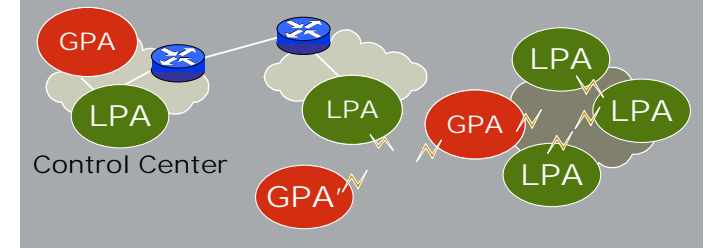
- **Military:** Management of any type of tactical ad hoc networks, sensor networks, and unmanned networks.
- **Commercial:** Management of any distributed applications that rely on on-demand networking services, including assistance to theme park visitors, guidance to museum tourists, health monitoring of the elderly, services for first-responder squads, control of distributed robots, coordination of sensor-equipped household appliances, vehicular telematics, and so on.



Detailed Example



Unstable Wireless Connectivity



Legend

GPA : Global Policy Agent
 DPA : Domain Policy Agent
 LPA : Local Policy Agent
 Wireline Network
 Ad hoc Network