Policy Control Model: a Key Factor for the Success of Policy in Telecom Applications

Michel Sim, Fernando Cuervo
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Service Goal: Don’t Allow Traffic to Site A during Business Hours

IF (SrcA=192.122….& DstA=47.125….&T1< Time_of_Day < T2 )
Then Deny

Store policy according to policy schema

COPS Protocol (Push='provisioning')

End Result:
Centralized, top-down unwieldy process
Same as before.
Change the Policy Control Model

> Upgrade NEs:
  • Native PEP support
  • Role semantics
> Rely on role-based pull
> Decentralize policy control
> Leverage self-organizational characteristics of the network
Separation of tasks

> Role-Capability Manager (RCM):
  • Role life-cycle (definition, deployment, assignment, …)
  • Resource management

> Policy Server (PS):
  • Policy life-cycle (definition, evaluation, deployment, …)
  • Resource configuration

> Service Application (SA):
  • Service life-cycle (definition, deployment, instantiation, …)

> Policy-Enabled Device (PED):
  • Role/Policy/Service implementation
Policy Control Model: Service definition

- Role definition (based on capabilities)
- Capability registration

- Role-Manager
- Service Application
- Policy Server
- Policy-Enabled Device
Policy Control Model: Service commissioning

Role- Capability Manager

Service Application

Policy Server

Policy- Enabled Device

Service Request
Policy Control Model: Service commissioning

Resource request (based on role)

Service Request

Role-Capability Manager

Service Application

Policy Server

Policy-Enabled Device
Policy Control Model: Service commissioning

- **Role-Capability Manager**
- **Service Application**
- **Policy Server**
- **Policy-Enabled Device**

1. Service Request
2. Resource request (based on role)
3. Role assignment
Policy Control Model: Service commissioning

Role-Capability Manager → Resource request (based on role) → Service Application → Policy Server

Service Request

Response

Policies

Role assignment

Policy-Enabled Device
Policy Control Model: Service provisioning

Role-Capability Manager

Service Application

Policy Server

(Policy-Enabled Device)

(Notification)
Policy Control Model: Service provisioning

Role-Capability Manager

Service Application

Policy Server

Policy Enabled Device

(Notification)

Policy request
Policy Control Model: Service provisioning

- Role-Capability Manager
- Service Application
- Policy Server
- Policy-Enabled Device

Policy request

Policy Configuration

(Notification)
Self-organization of PEDs: An example

RCM

PS

SA

Provides role, with multicast address

Rx

Dn: Destination PEDs

Dj

Di

Dk

Dm
Self-organization of PEDs: An example

RCM

Configuration request

SA

PS

Provides role, with multicast address

D_a

D_v

D_i

D_j

D_k

D_m

D_n: Destination PEDs

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Self-organization of PEDs: An example

\[ D_n: \text{Destination PEDs} \]
Self-organization of PEDs: An example

Provides role, with multicast address

RCM

SA

{Filter, Directives, PSReference}

Register D_j, D_k, D_m for notification

D_a

D_i

D_j, D_k, D_m

D_n: Destination PEDs

PS
Self-organization of PEDs: An example

- **RCM**: Provides role, with multicast address
- **SA**: Configuration request
- **Da**: {Filter, Directives, PSReference}
- **Dv**: Register Dj, Dk, Dm for notification
- **Di**: Request policy (Dm)
- **Dj, Dk, Dm**: Destination PEDs

**Dn**: Destination PEDs
Self-organization of PEDs: An example

- **Configuration request**

- **RCM**
  - Provides role, with multicast address

- **PS**
  - {Filter, Directives, PSReference}
  - Register Dj, Dk, Dm for notification
  - Request policy (Dm)
  - Decision (Dm)

- **Dn**: Destination PEDs
Self-organization of PEDs: An example

- RCM: Provides role, with multicast address
- SA: Configuration request
- \( D_a \): \{Filter, Directives, PSReference\}
- \( D_v \): Request policy (Dm)
- \( D_i \): Decision (Dm)
- \( D_{j,k,m} \): OK (Dm)
- \( D_n \): Destination PEDs
- PS: Stateless

Legend:
- \( \rightarrow \): Provides role, with multicast address
- \( \rightarrow \): Configuration request
- \( \rightarrow \): Request policy (Dm)
- \( \rightarrow \): Decision (Dm)
- \( \rightarrow \): OK (Dm)
- \( \rightarrow \): Stateless
Self-organization of PEDs: An example

- Configuration request
- {Filter, Directives, PSReference}
- Register D_j, D_k, D_m for notification
- OK notification
- Request policy (D_m)
- Decision (D_m)
- OK (D_m)

RCM

Provides role, with multicast address

PS

\( D_n \): Destination PEDs
Illustration: Sensor Networks

Role Assignment

Application

Sleep-Measure
Illustration: Sensor Networks

Role Assignment

Need • at x,y

Application

Sleep-Measure
Illustration: Sensor Networks

Role Assignment

Need at x,y

Application

Sleep-Measure

X

Y
Illustration: Sensor Networks

Role Assignment

Need at x,y

Application

Sleep-Measure
Illustration: Sensor Networks

Role Assignment

Application

Need at x,y

Y

Sleep-Measure

X
Illustration: Sensor Networks

Role Assignment

Need at x,y

Application

Sleep-Measure
Illustration: Sensor Networks

Role Assignment

Need at x,y

Application

Sleep-Measure
The application knows the position of the sensors but does not need to be concerned with their organization when changing measuring Policy, thresholds, etc.
Summary

> Policy Control Model
  • Decoupling of functionality in the management plane
  • Simplification of service management
  • Flexibility of distributing/combining the functions

> Semantics of roles
  • Service awareness in the NEs

> Self-organizational behaviors in the network
  • Stateless pull
Future Work

- Application of self-organizing concepts in NEs
- Role-based dynamic resource discovery
- Trust model between PCM entities
- Policy conflict resolution
- Protocols and standardization
Thank you!!

Questions?