Enabling Future Smart Networks

Problem

Benefits of policy-based control of devices and networks include

- Customizable control for location, user, time, and mission
- Vendor- and platform- independent solutions
- Flexible adaptation to changing regulatory environments

However, future policy landscape is characterized by

- Broad range of policies (e.g., network and topology management, security, routing, QoS)
- Lack of central control (e.g., many authors in many countries; many languages)
- Dynamics of changing regulatory requirements and evolving device capabilities

To fully achieve the vision of policy-based network and system control we need technology that

- Helps in understanding a complex, diverse policy base
- Discovers opportunities that meet mission and user goals while ensuring compliance with policies

Solution

SRI Policy Language is general enough to express a broad range of policy

SRI Policy Reasoner provides "Yes", "No", and "Yes, if" answers

It determines opportunities through "Yes, if" replies

- "Yes, if" answers provide potential for future, cognitive networks
- Requirements are constraints that must be satisfied to achieve policy compliance
- When fulfilled, requirements become opportunities

Application Domain: Spectrum Management

In DARPA's NeXt Generation communication (XG) communication project, the SRI Policy Reasoner (PR) was successfully applied to dynamically determine transmission opportunities that

- Are compatible with all loaded policies
- Result from combined policy base

SRI PR responds to transmission requests with several "Yes, if" answers

Each answer constitutes constraints that must be satisfied to achieve valid transmission

SRI System Strategy Reasoner (SSR) uses strategies for cost-benefit analysis to choose among opportunities

- Cost example: additional expensive operation such as sensing is necessary
- Benefit example: opportunities offer different bandwidths or power levels

Benefit: As cognitive radios proliferate and spectrum will be used more efficiently, policy-aware identification of transmission opportunities provides a solution

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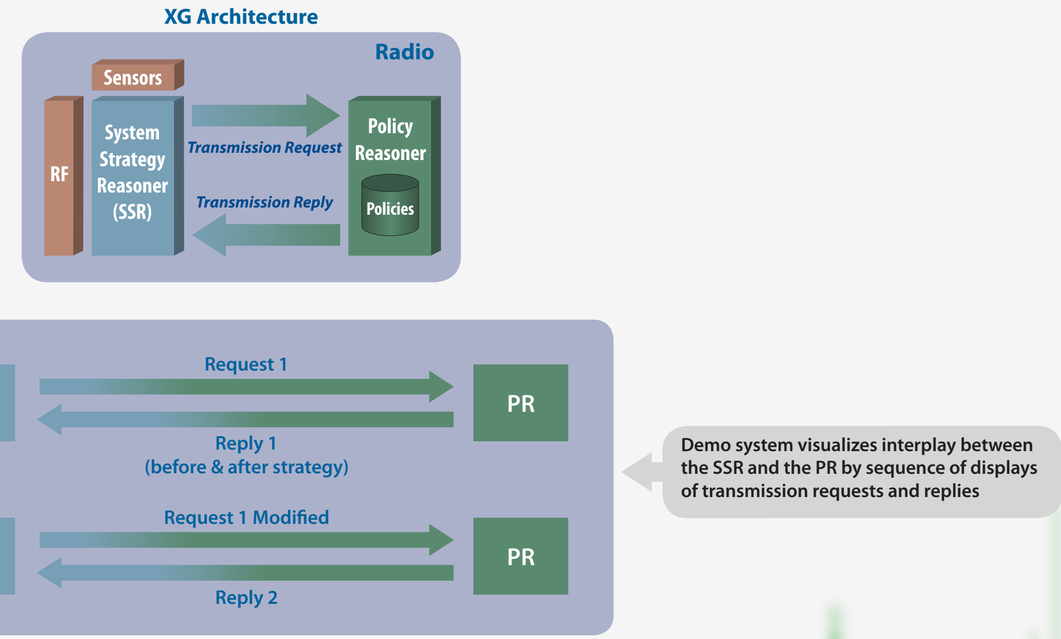


Demo system visualizes interplay between the SSR and the PR by sequence of displays of transmission requests and replies

SSR requests transmission from PR

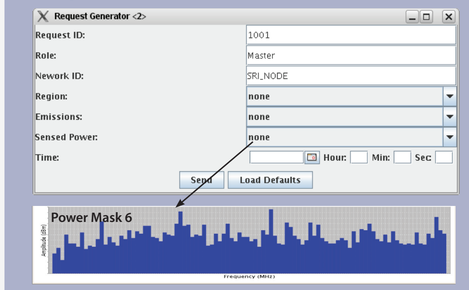
Transmission request contains information such as requested frequency, transmission power, and sensed spectrum

PR responds to transmission request with one of three answers

1. Yes, loaded policies allow transmission
2. No, transmission request does not comply with loaded policies
3. Yes, if the following "requirements" can also be fulfilled. Requirements determine allowed frequencies, transmission power or location

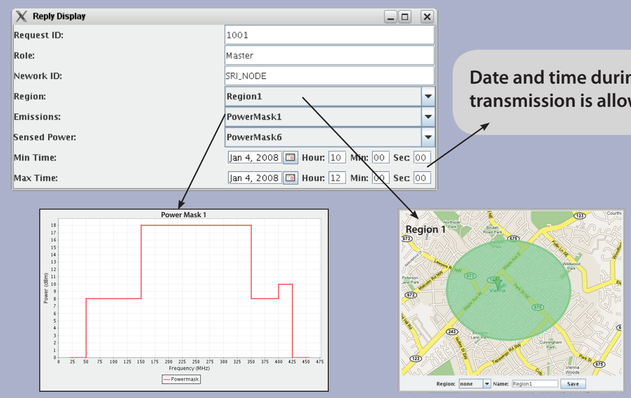
Example SSR-PR Interaction

Request 1



Sensed spectrum

Reply 1



Date and time during which transmission is allowed

Combined power masks of all allowing and disallowing policies (can be arbitrarily complex)

Region in which transmission is allowed