Cognitive Spectrum Access

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MITRE Technology Program

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Problem

- Improving access to the electromagnetic spectrum is a long-standing challenge.
  - Communications, navigation, and surveillance systems depend on transmitting, receiving, or measuring energy transferred through the multidimensional spectrum "space."
  - Network-centric warfare, emergency response, and other emerging operational concepts require automated, dynamic, and adaptive decision making for spectrum use.
  - Applying cognitive techniques on "smart radios" may greatly improve spectrum access.

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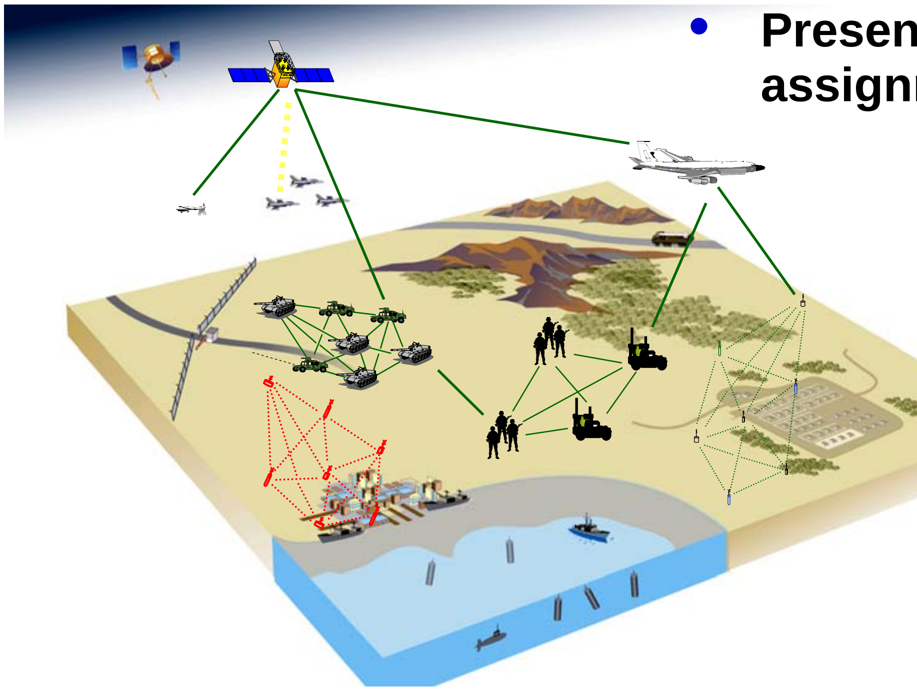
Background

- Complexity of future military and civilian networks requires:
  - Continuous evolution of membership and topology
  - Dynamic link quality and communication needs
  - Large numbers of nodes and connections



- Present static frequency assignments inadequate

Future Spectrum <u>Access</u>

Automated
Dynamic
Adaptive

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Objective

- Develop spectrum access architectures, algorithms, and radio device designs that utilize “cognitive” or “reasoning” techniques to improve access to the electromagnetic spectrum
- Take the software defined radio (SDR) to the next evolutionary step: “smart” radios

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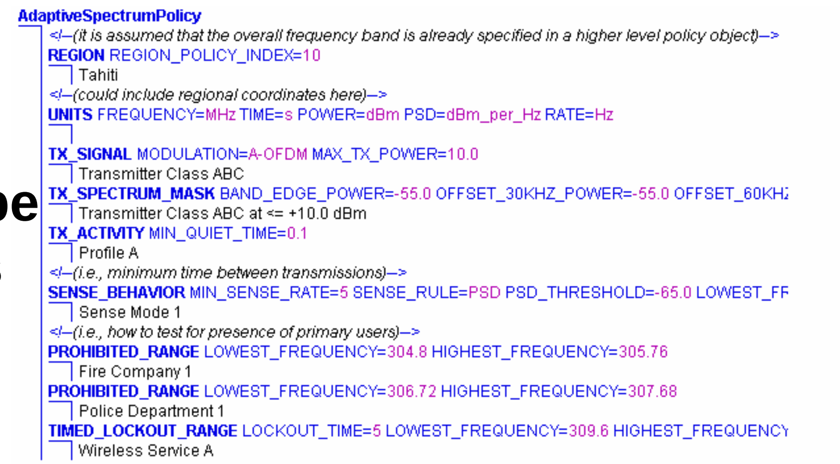
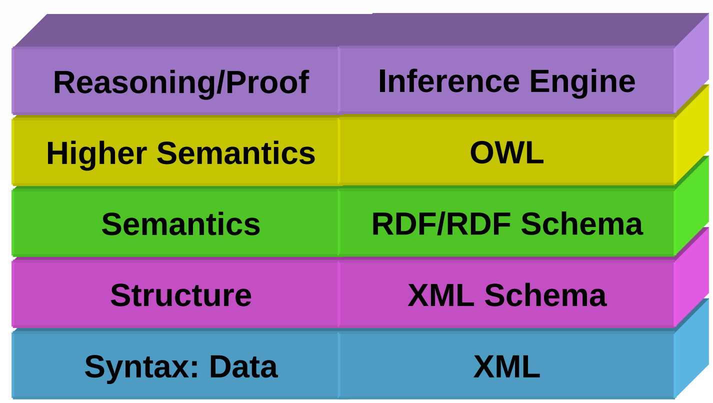
Activities

- Develop a spectrum ontology and apply inferencing processes
- Design radio architecture(s) with embedded policy engines that can coexist with legacy radio systems
- Create proof-of-concept demonstrations

Highlight

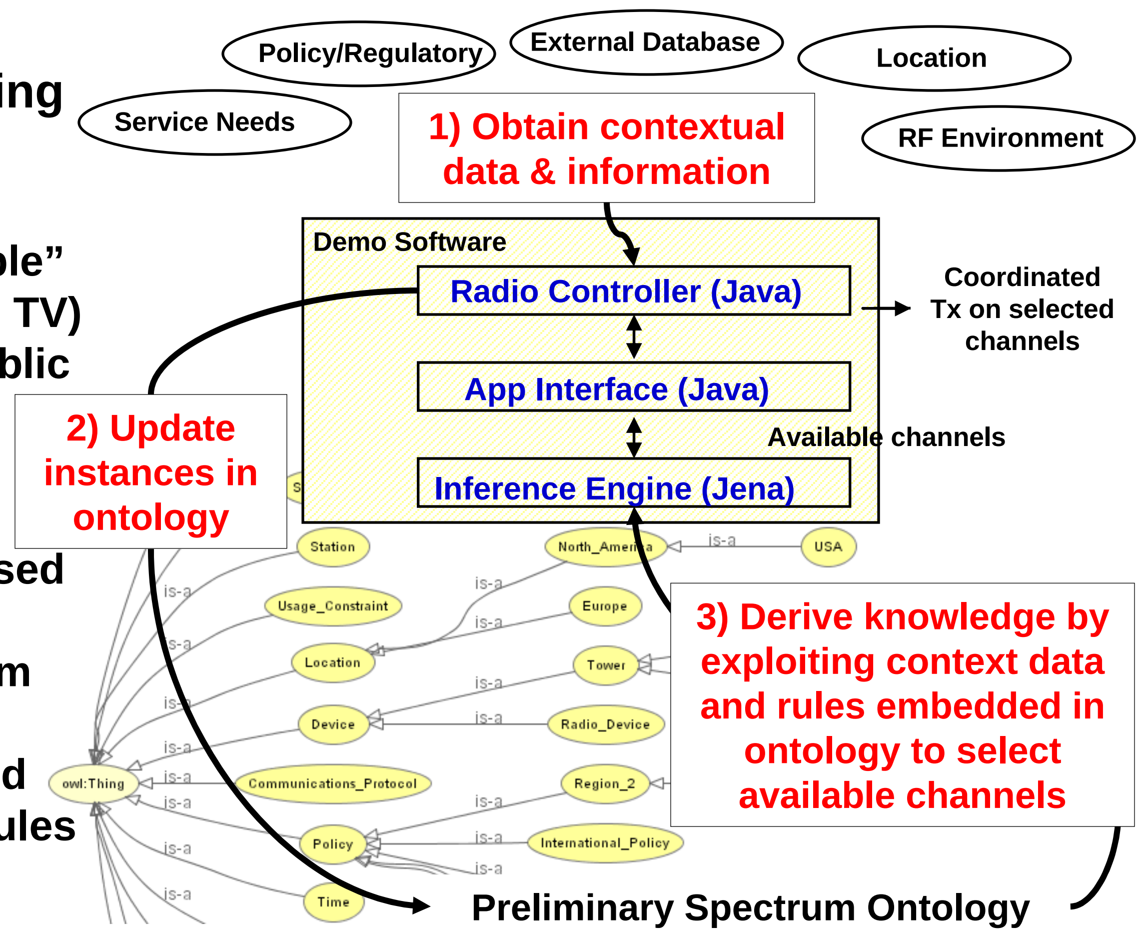
- XML isn’t enough, because there are many ways to describe the spectrum; what is the meaning of a “channel” here?
- Database-oriented spectrum allocation strategies do not provide the inferencing needed for new situations.





Demonstration

- Channel Selection Using Ontology Inferencing
  - Select "available" channels (e.g., TV) for tactical, public safety, or commercial networking
  - Availability based on derived knowledge from contextual information and policy/usage rules



Impacts

- Develop system and radio device architectures and techniques:
  - Military Applications: Tactical & Sensor Networks
  - Public Safety
  - Aviation
- Help MITRE maintain leadership and be a recognized source in developing "smart" radios
- Influence development of this emerging technology through participation in standards and technology organizations such as IEEE 802.22

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Future Plans