

Cognitive Radios: Experiences and Challenges

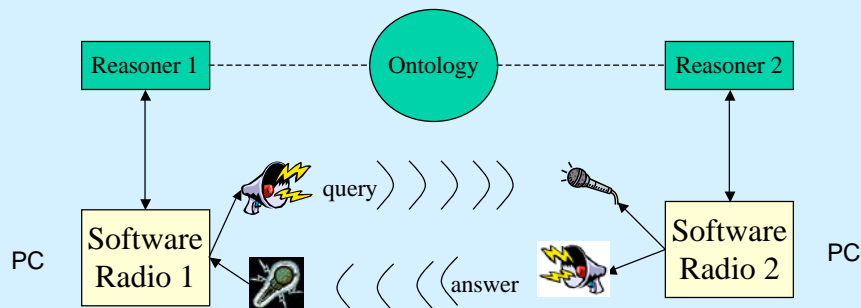
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Proof-of-concept scenario (NSF Grant)

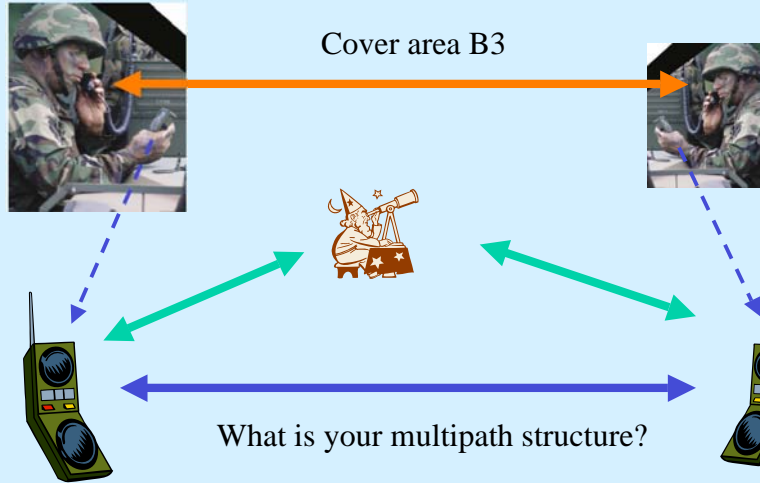


query: What is the rmsDelay, excessDelay and equalizerError in your last Buffer?

answer: rmsDelay = 1.0078370372505556; excessDelay = 1.062759005498691;
equalizerError = 851.5498431539809

Depending on these values, the transmitter can: select the size of the alphabet,
e.g., QAM2 or QAM4 or QAM16, increase equalizer length, increase power ...

Two Conversations

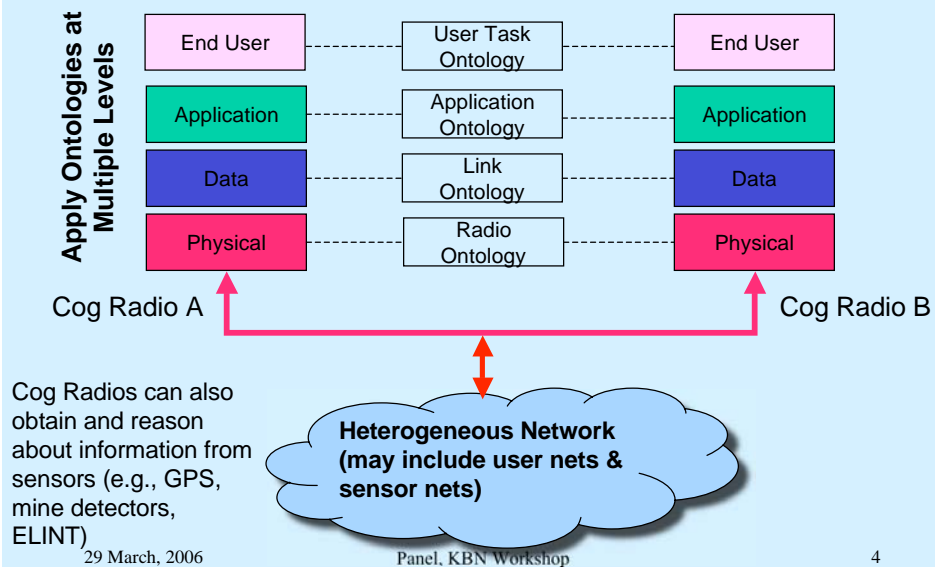


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A Framework for Use of Ontologies in Cognitive Radios



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Solution

- If the “multipath” question is the only question, then we can hard-code it into the process. But then the capabilities are limited to the encoded question!
- How can we add more flexibility for questions/answers?

Ingredients exist:

- Ontologies to define a description-and-query language
- Ontology description language (OWL) for computer processing
- OWL-QL – Query Language
- Formal reasoner (theorem prover) to derive answers to queries, e.g., Racer, Pellet, JTP, Prolog, ...
- Reflection capability – a feature of the Java programming language
- Situation awareness and information fusion – active research field

More research needed!

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Challenges

- Inference in real time
 - Can't use theorem provers for reasoning
- Knowledge base constantly varying
 - Can't use theorem provers for reasoning
- “Facts” are not part of the Knowledge Base but part of internal data structures of the communication software
 - Need access to the software internals
 - We use the *reflection* feature of programming languages.
 - Not integrated with a reasoner

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Unsolved Problems (yet)

- Limits of expressiveness (only binary predicates) of OWL vs. complexity of reasoning
- Ontology mapping and integration (combine ontologies consistently)
- Query language – no standard
- Efficiency of Human-Display interface
- Reasoning with uncertain information
- Reflection combined with reasoning