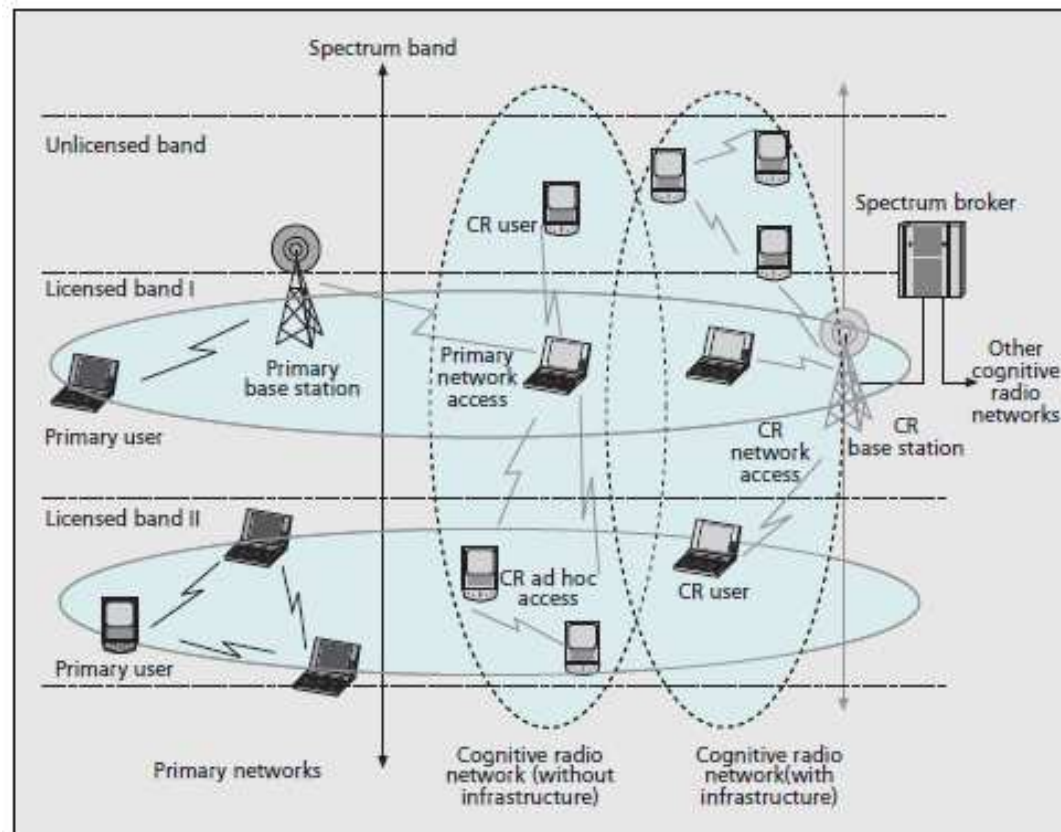


NATO IST-140 RTG-065

Cognitive Radio Networks - Efficient Solutions for Routing, Topology Control, Data Transport, and Network Management



Motivation

- **Individual Cognitive Radio Network aspects have been studied**
 - A holistic picture is still missing
 - Global networking goals should be achieved
- **Cognitive Radio Network will now optimize end-to-end connectivity**
- **WE GO BEYOND COGNITIVE RADIO**

Overview

- **What is IST-140?**
- **Our expectations**
- **What are Cognitive Radio Networks?**
- **Objectives**
- **Context of IST-140**
- **Topics**
- **Status of our work**
- **Summary**

What is IST-140? (1/2)

- **NATO**

- North Atlantic Treaty Organization
- Intergovernmental military alliance
- Collective / mutual defence



- **Science and Technology Organization (STO)**

- Aim: meet the collective needs of
 - NATO
 - NATO Nations and
 - partner Nations
- in the fields of Science and Technology



What is IST-140? (2/2)

- **Information Systems Technology (IST) Panel**

- advance and exchange appropriate technologies to provide

- timely,
 - affordable,
 - dependable,
 - secure and
 - relevant information



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- and to improve C3I systems

- including special focus on Interoperability and Cyber Security

- **IST-140**

- Research task group below IST panel

- Researchers from different nations

- Solve a particular research and technology problem

- ➔ Cognitive Radio Networks

How does the group work?

- **TTL: Jan. 2015 to Dec. 2017**
- **3 to 4 meetings per year**
- **Participating nations:**
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- **Build upon the results of other groups (e.g. IST-104 CR in NATO II)**
- **Investigate**
 - challenges and solutions
 - for Cognitive Radio Networks
 - in a military context
- **Main output is a report with recommendations**

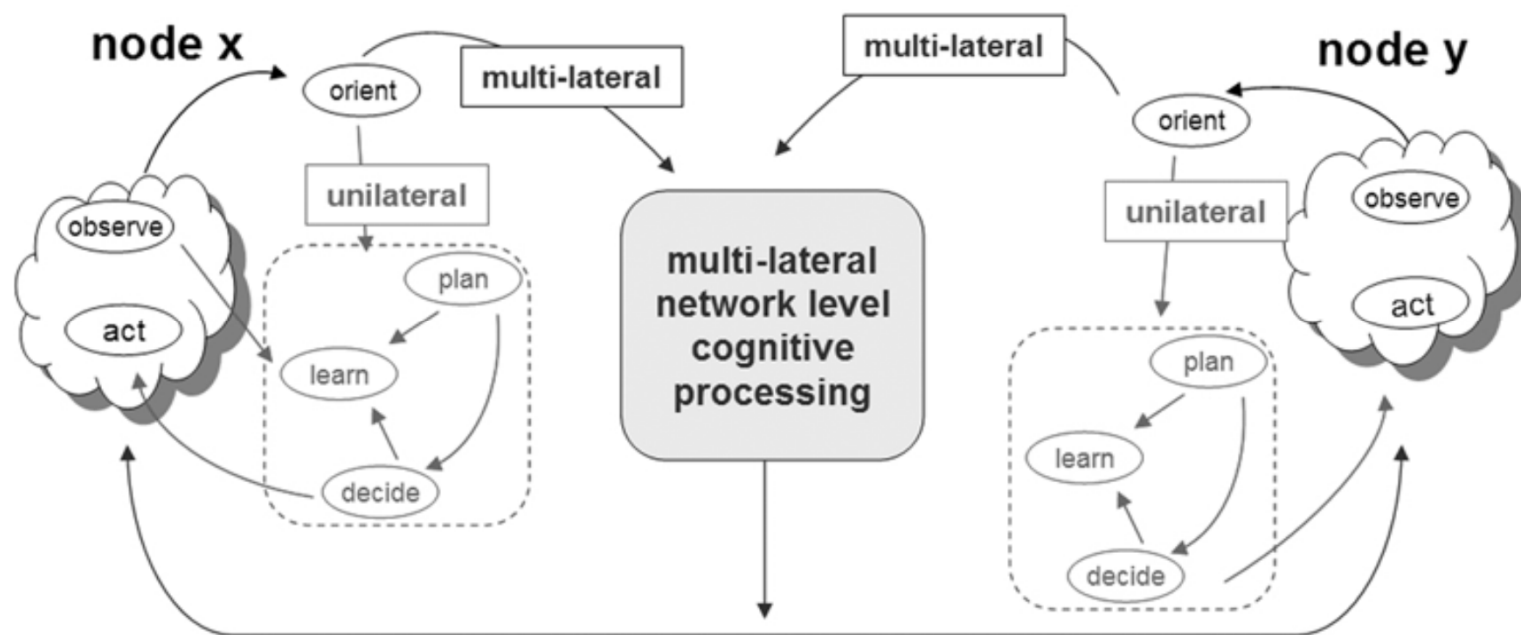
Our expectations

- **Get known to the public**
- **Raise interest in the topic**
- **Get**
 - Comments
 - Inputs
- **And perhaps welcome new members**



What are Cognitive Radio Networks?

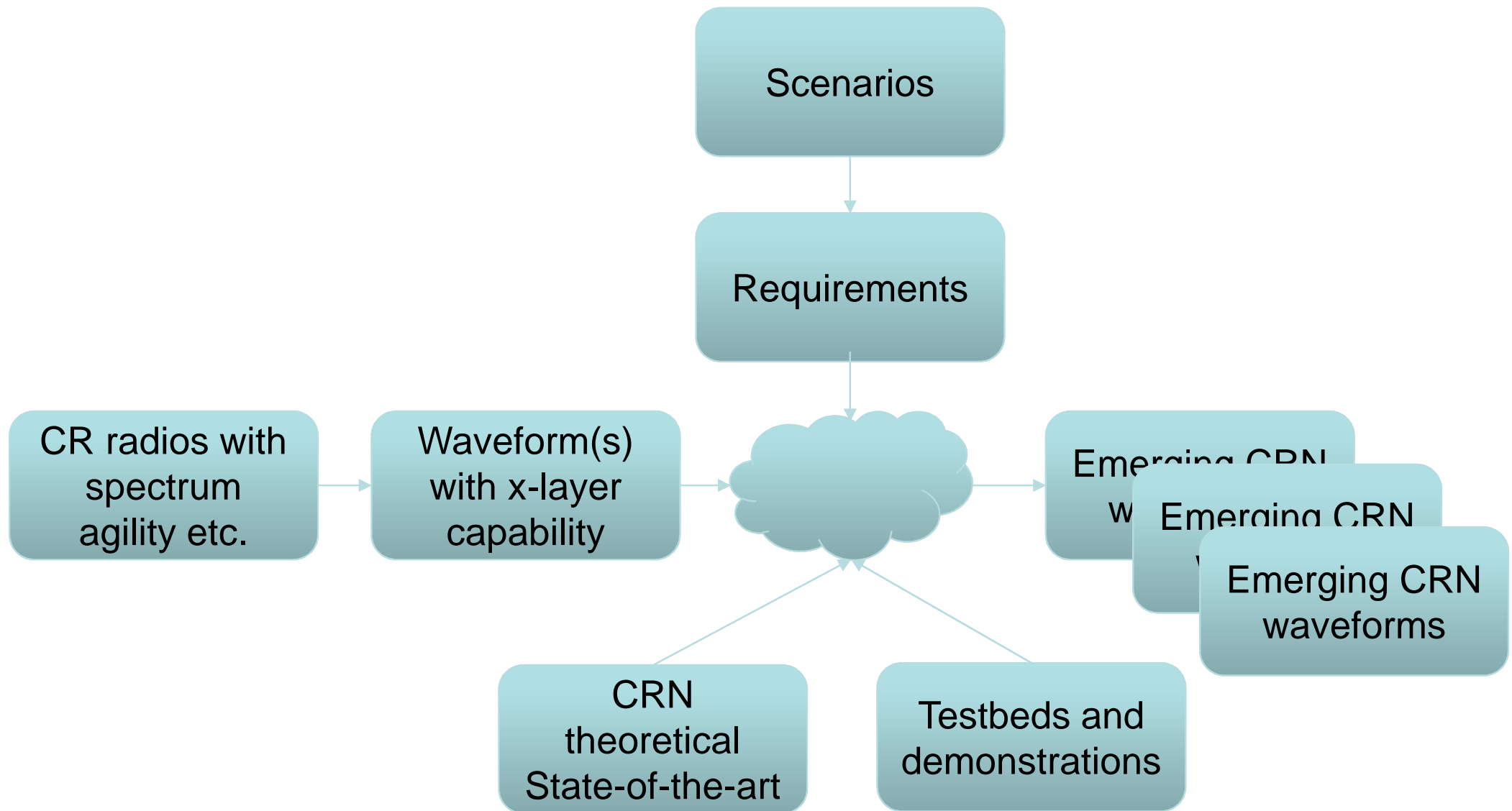
- **Cognitive Radio:** dynamic spectrum access
- **Networks of Cognitive Radios:** legacy network of CR devices
- **Cognitive Radio Networks:** end-to-end optimization



Objectives

- **Identify**
 - military requirements for CRN usage in joint and combined operations
 - potential capabilities of military CRN as compared to legacy networking
 - networking challenges in CR operation in infrastructure-based and ad-hoc military networks
- **Explore**
 - networking solutions for infrastructure-based and ad-hoc CRN
 - solutions to exchange control information taking into account military requirements
 - technologies for further enhancements
 - system architectures for CRN
- **Propose recommendations for specifications, implementations and/or further researches**

Context of IST-140



Topics

- **Technologies studied in the context of CRN**
 - Routing: take into account metrics from CR entities
 - Topology Control: take into account frequency information
 - Data Transport: TCP and UDP not designed for wireless networks
 - Clustering: part of DLL, but closely related to networking
 - Management: trade-off human control \Leftrightarrow automatization
 - Reliable Exchange of Control Information: information from both networking and CR
 - Trust Management: analyse neighbour trustworthiness
- **CRN System Architecture**

Status of our work

- Scenarios have been selected
- State of the art has been described
- Challenges are being identified
- Still a long way to go...



Summary

- **Go beyond Cognitive Radio**
 - Cognitive Radio has a local perspective
 - End-to-end networking perspective is added
- **Two nested cognition cycles**
- **We focus on adapting networking techniques**



Thank you!

Any questions?