Evaluating 5G/NextG Wireless

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Overview

**Goal:** Research O-RAN and develop: (1) Open source 5G system implementation, and (2) Network management applications and framework for resiliency, security, and spectrum management.

**Implementation:**
- Set up demo 5G network (OAI/Amarisoft)
- Develop Python rApp applications.
- Develop O-RAN SMO Framework Services for Topology and Visualization and Message Generation.

![Figure 1: Block Diagram of O-RAN Hierarchy](image1)

![Figure 2: OAI/Amarisoft Architecture](image2)

![Figure 3: SMO Applications and Framework Services](image3)

![Figure 4: Sequence Diagram for Security rApp](image4)

![Figure 5: OAI iperf test with OAI nrUE + gNB, COTS UE](image5)

![Figure 6: Topology Visualization](image6)

![Figure 7: Spectrum Energy and Occupancy](image7)

**Security:** (1) Receives security related RAN alarms (2) Assesses severity of alarms and outputs commands (3) Isolates compromised components and their connections

**Resilience:** (1) Maintains updated topology (2) Calculates optimal distribution of data across multiple network paths (3) Ensures constant connectivity

**Spectrum Management:** (1) Analyzes frequency band occupancy (2) Allocates available frequency band to RUs

rApp Framework/Methodology

**Components:**
- 5G Network through Amarisoft and Open-Source Openairinterface (OAI) code.
- 5G CU/DU/RU through SDR (USRP B210) and 5G Core on Docker.

**Accomplishment:**
- End-to-End Connectivity from 2 nrUEs to the Internet.
- Demo 5G SA Monolithic Network for future testing.

**Implementations**
- Set up demo 5G network (OAI/Amarisoft)
- Develop Python rApp applications.
- Develop O-RAN SMO Framework Services for Topology and Visualization and Message Generation.

![Figure 8: Spectrum Management Diagram](image8)

Future Work

- Integration onto SDRs and physical hardware
- Test/refine applications design and daily performance

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