

# Energy Efficient Authentication and Authorization for Multi-node Cooperative Connectivity and Reliability

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## Introduction

- Cooperative Wireless Communication (CWC)
- Opportunistic Large Arrays

## Key Issues

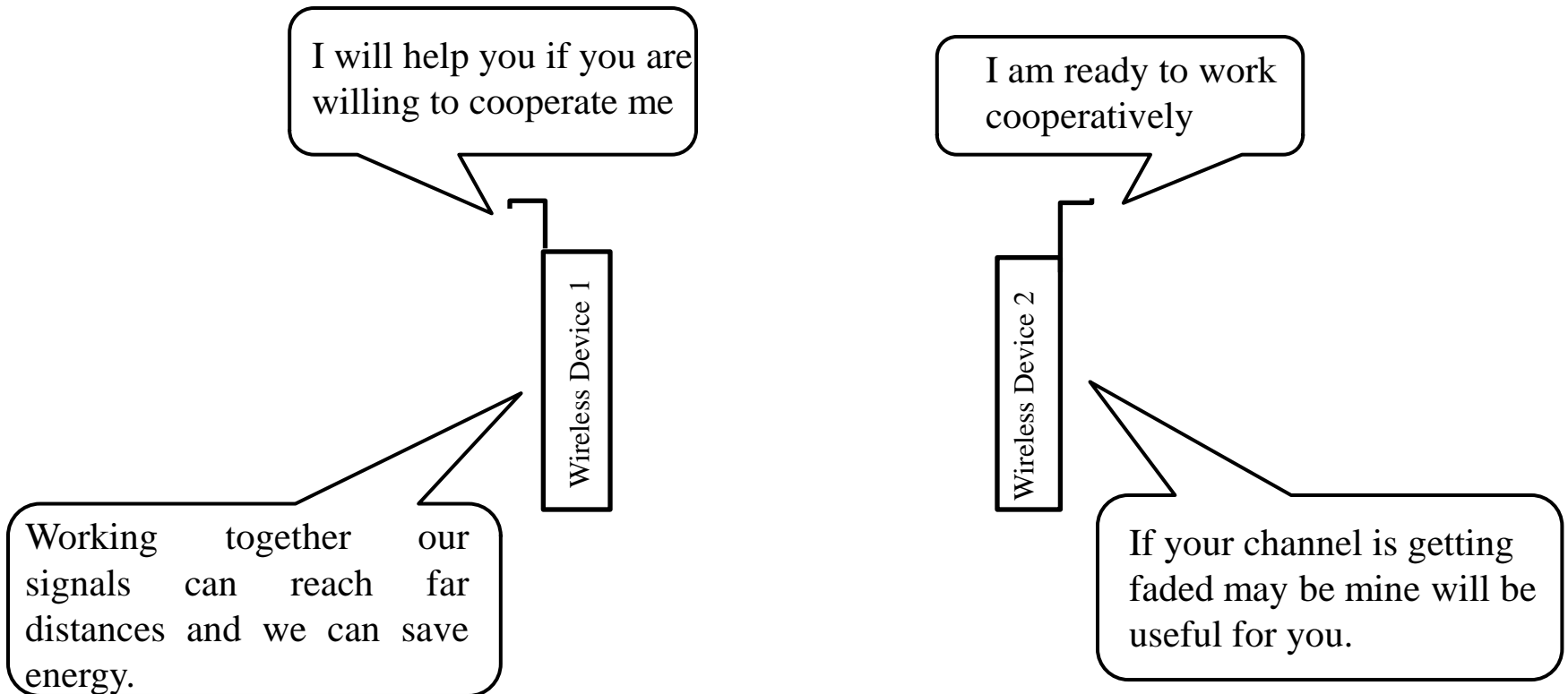
- Comparison of OLA algorithms
- Authentication and Authorization Issues

## Proposed Solutions

- Cross Layer Cooperation in OLAs

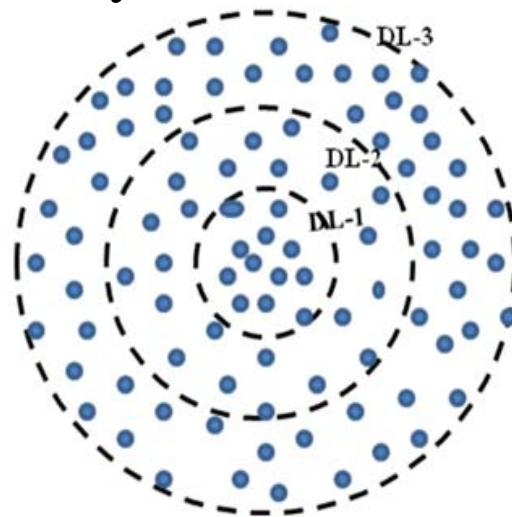
## Conclusions and Future Work

# Introduction: Cooperative Wireless Communication (CWC)



# Opportunistic Large Arrays (OLA)

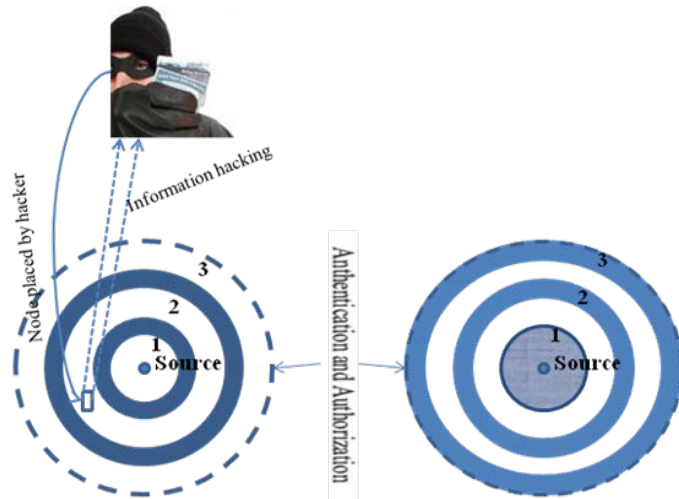
- Opportunistic Large Array (OLA) is nothing but a cluster of network nodes which use active scattering mechanism in response to the signal of the source called leader.
- The intermediate nodes opportunistically relay the messages from the leader to the sink.
- Due to signal enhancement in OLA,  $\text{SNR}_{\text{CT}}$  is much higher than  $\text{SNR}_{\text{P2P}}$ .
- OLAs are considerably flexible and scalable in nature.



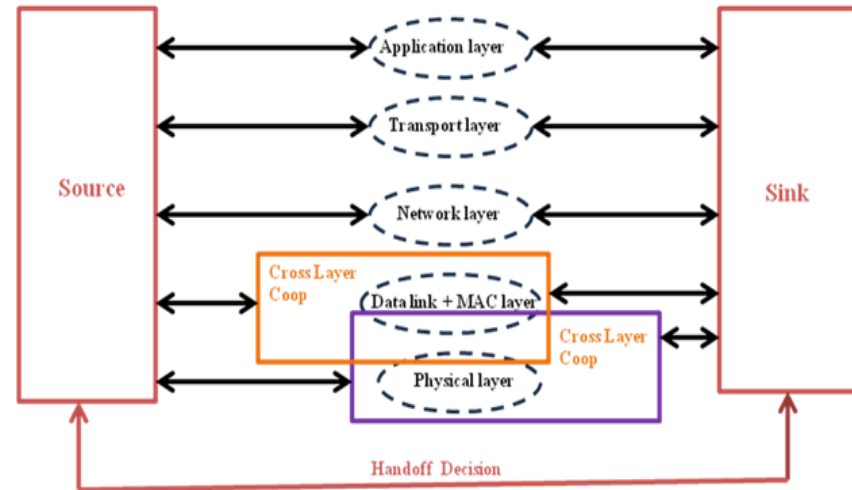
Basic OLA structure with decoding level

# Comparison of OLA algorithms

Parameter/Technique	Delay	Energy saving / life extension	Reliability	Node Density /Scalability	Authentication And Authorization	Merit/Demerit
<b>Basic OLA</b> [6] The avalanche of responses to the leader node is like the ola in a sports stadium.	Guaranteed to be constant	5 dB compared to DIB algorithm	With increased SNR values, BER reduces.	Reasonable node density with high scalability	<b>NOT ADRESSED UPTILL NOW</b>	With cooperative Tx, reach-back problem is solved
<b>OLA-T</b> [7] The node participation in each OLA is controlled by the power transmission threshold in Rx.	Constant delay	32% of the transmitted energy as compared to Basic OLA	Highly reliable coop communication	For constant $\epsilon$ values, $\rho=2.65$ nodes/m <sup>2</sup> with less scalability as compared to basic OLA		With full flooding approach, energy saving is 50%
<b>OLA-VT</b> [7] OLA with variable threshold, which optimizes thresholds as a function of level.	Can be slightly variable	25% of the transmitted energy as compared to Basic OLA	<b>NOT CONCENTRATED ON RELIABILITY ISSUES</b>	Slightly less scalable as compared to basic OLA		
<b>A-OLA-T</b> [8] Broadcast protocol alters between the sets of OLAs for each broadcast.	Variable delay	Can offer a 17% life extension as compared to Basic OLA and OLA-T		Highly scalable		Almost double power as compared to OLA is required.
<b>OLACRA</b> [8] It exploits the concentric ring shapes of broadcast OLAs to limit flooding on upstream connection.		75% as compared to full flooding approach		Possesses highest scalability		Level Ganging
<b>OLACRA-T</b> [9] The criteria to be met for OLACRA & their received power is less than a specified threshold.				Highly scalable		



Authentication and Authorization issues in the OLAs



Cross Layer Cooperation in OLAs

# System Model

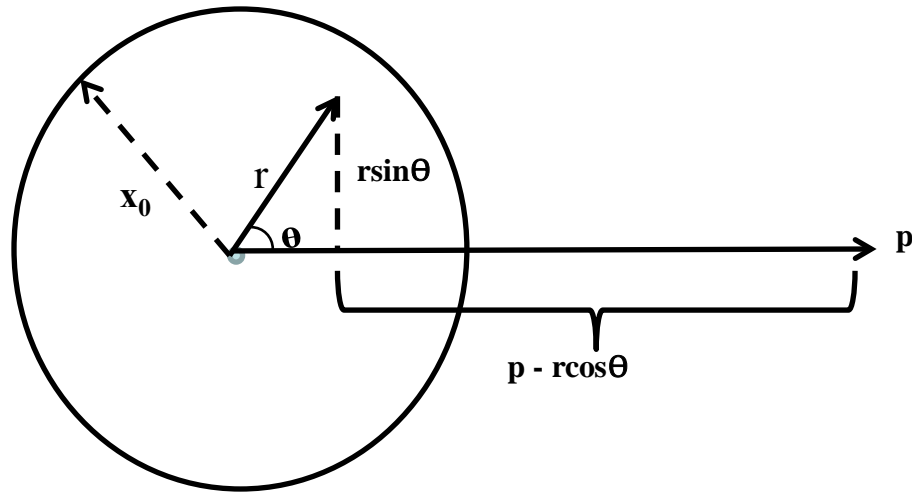
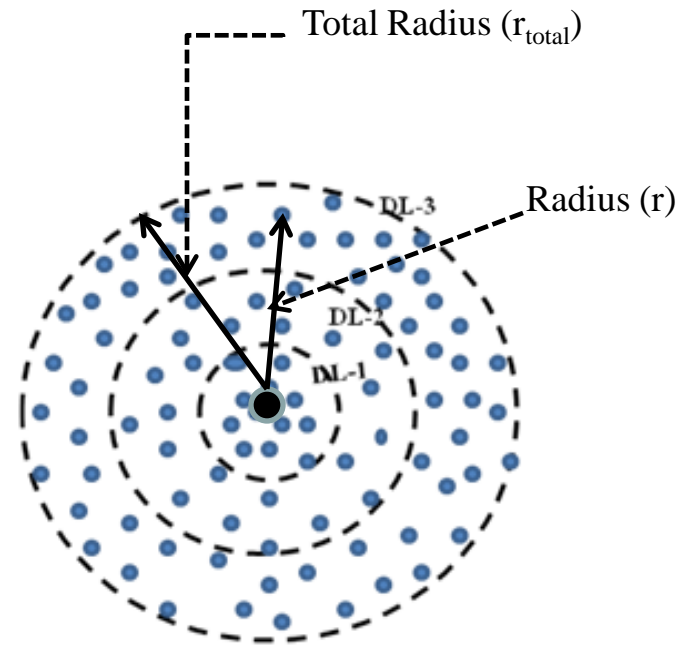
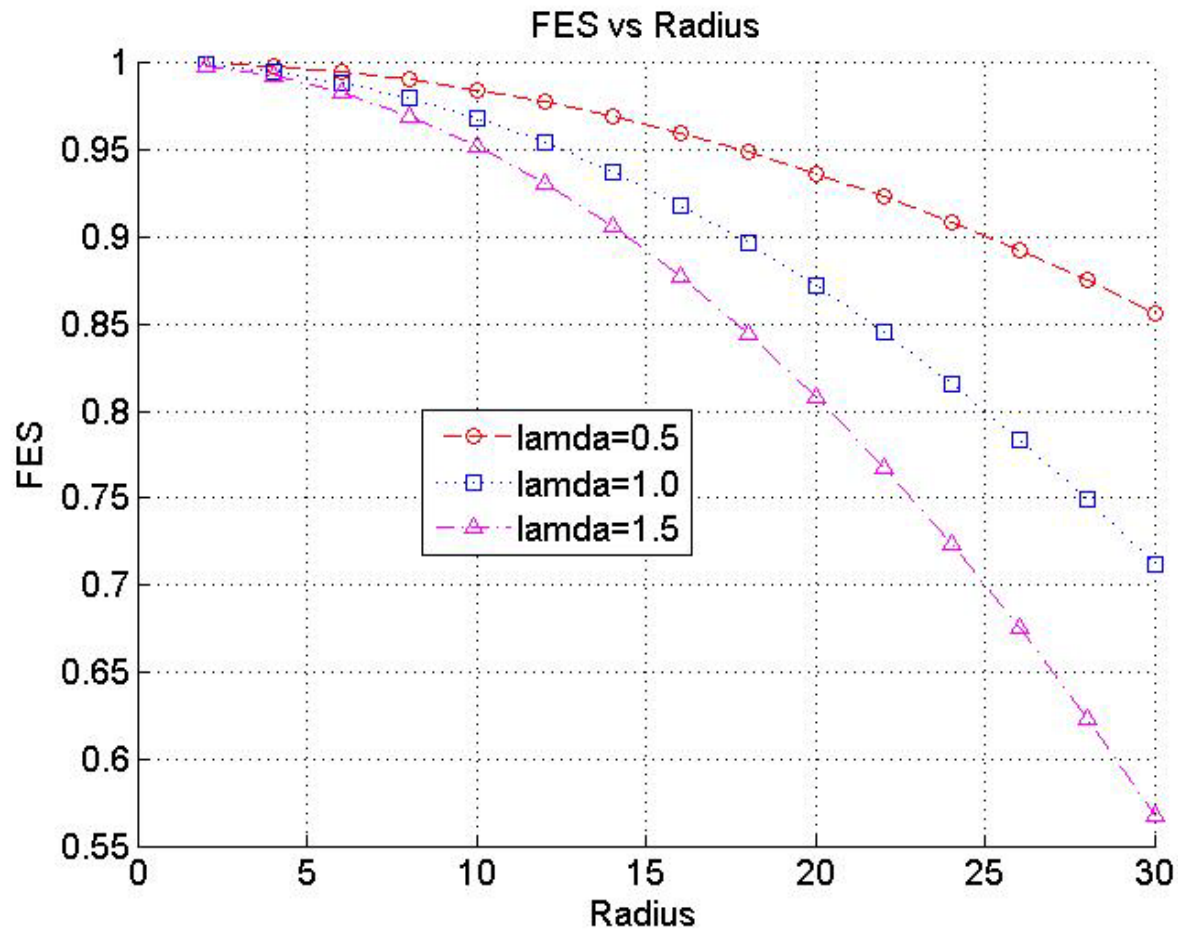


Illustration of  $f(x_0, p)$

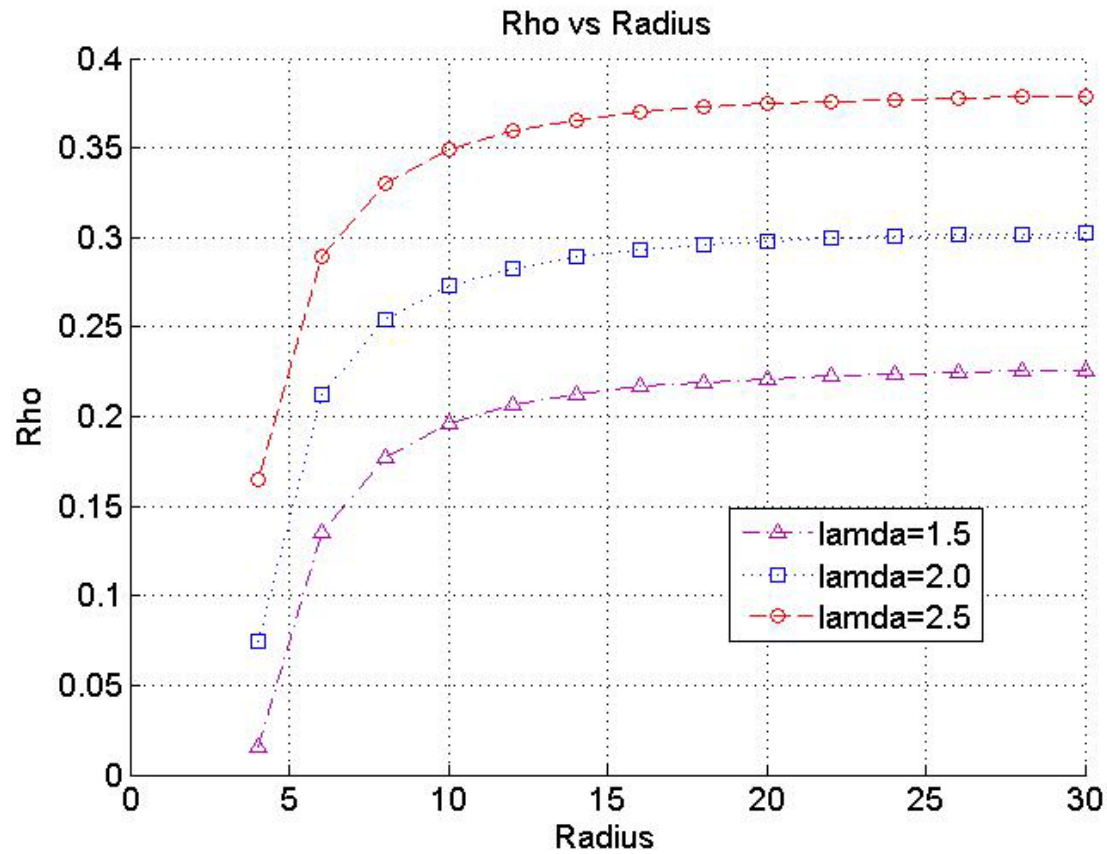


Proposed OLA structure for Numerical Analysis

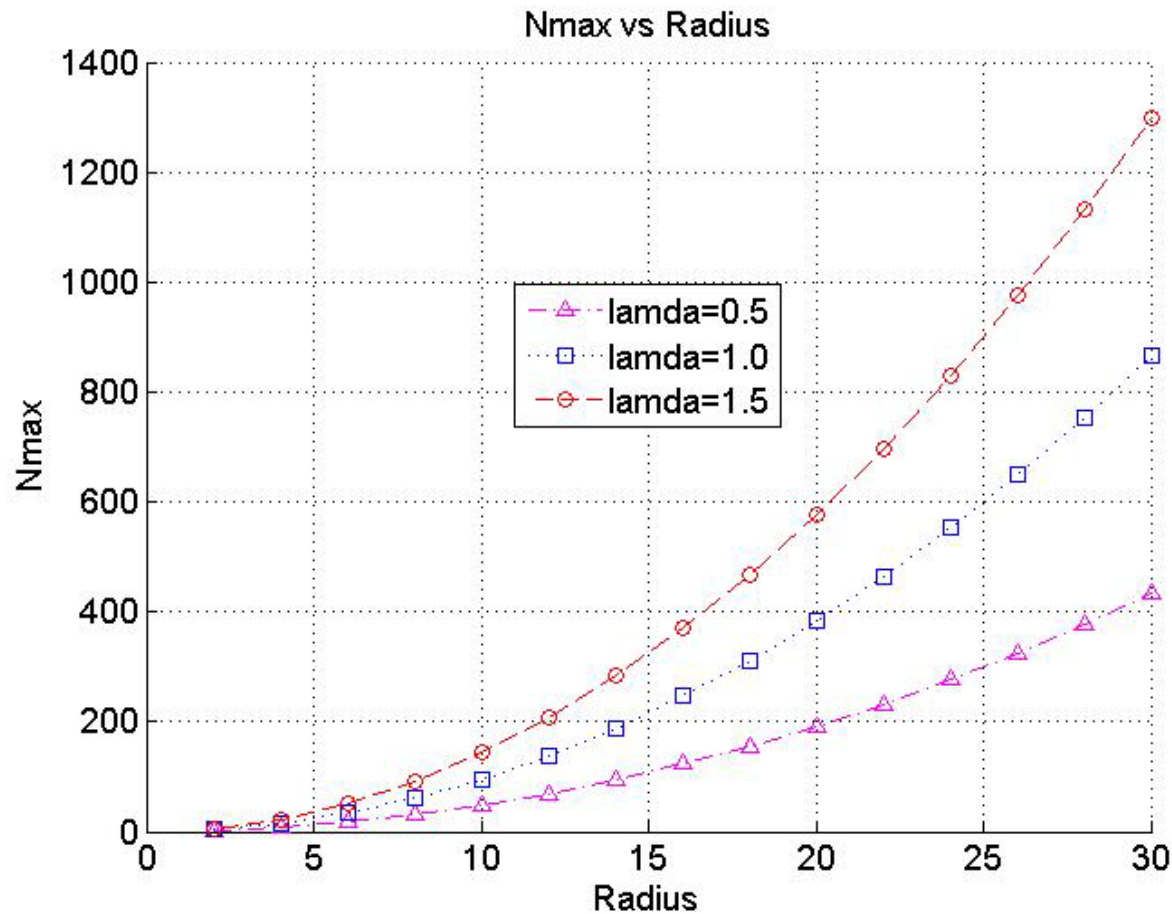


Fraction of Energy Saving (FES) as a function of Radius and SNR threshold



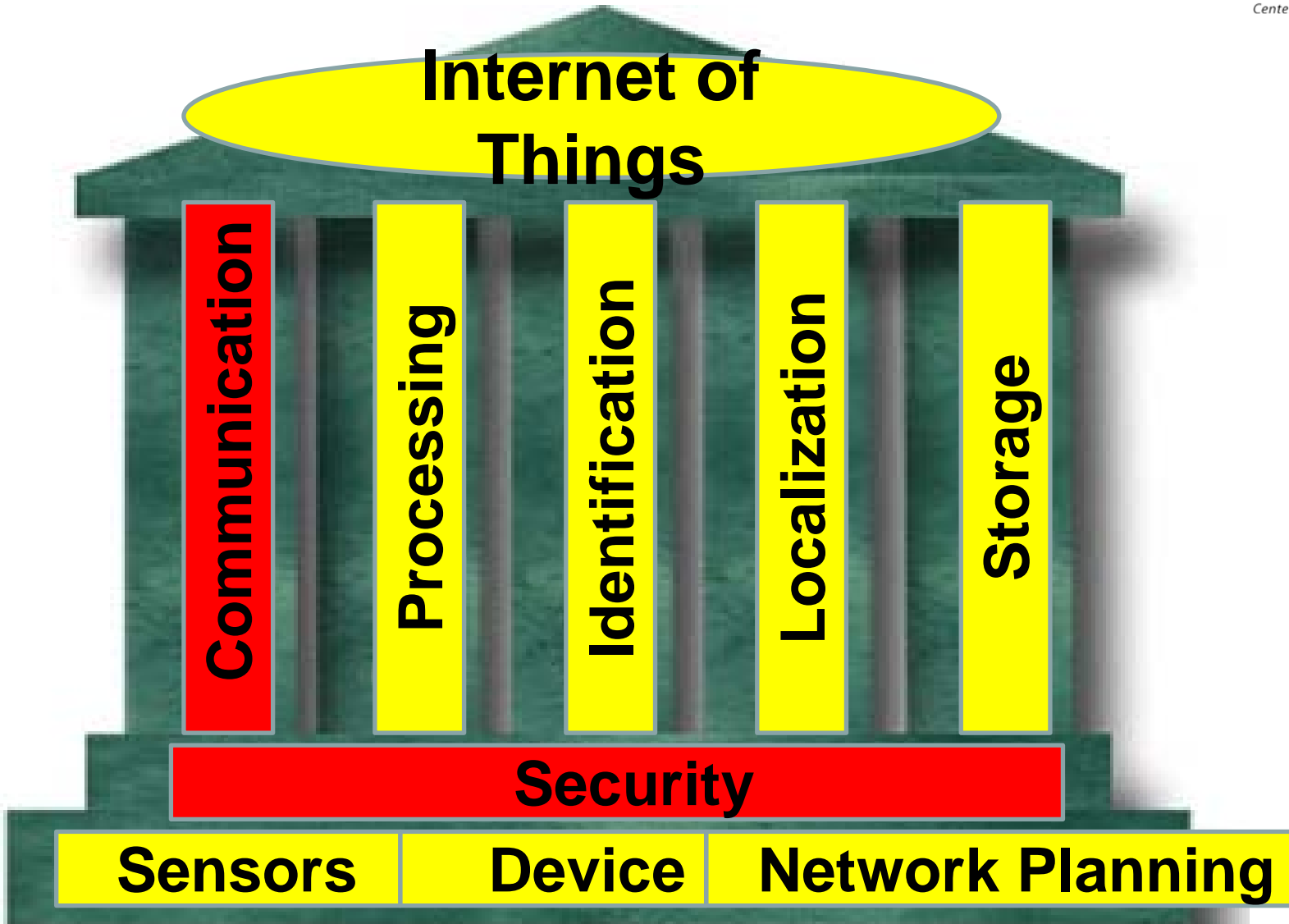


Radio node density as a function of Radius and SNR threshold



Nodes participated in cooperative communication as a function of Radius  
and SNR threshold

# House of IoT



- Design Cooperative and Reliable MAC protocol.
- Design efficient methodology for authentication.
- Develop an energy efficient novel approach with security mechanism for trustworthy transmission of the information.

**Thank you!!**