

# Survey of Hybrid Wireless Mesh Networks



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EEL 6936

Advanced Topics in Wireless Communication Systems

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# Introduction



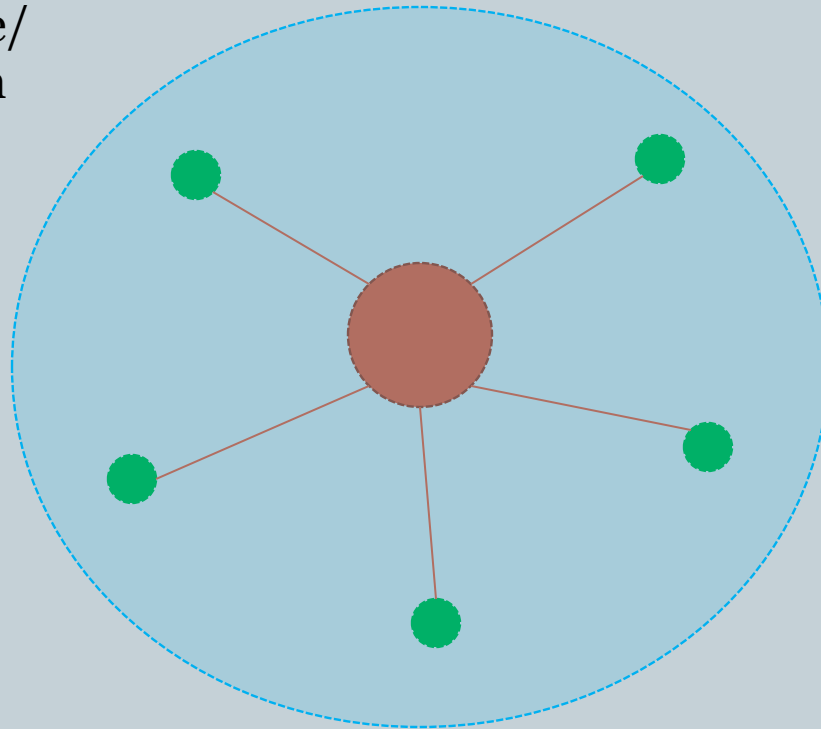
- Background
  - Mobility
  - Ad Hoc Wireless Networks
  - Hybrid Wireless Mesh Networks
- Mesh Networking Principles
- Advantages
- Disadvantages
- Considerations
- Current Research

# Stationary Wireless networks



 Client node

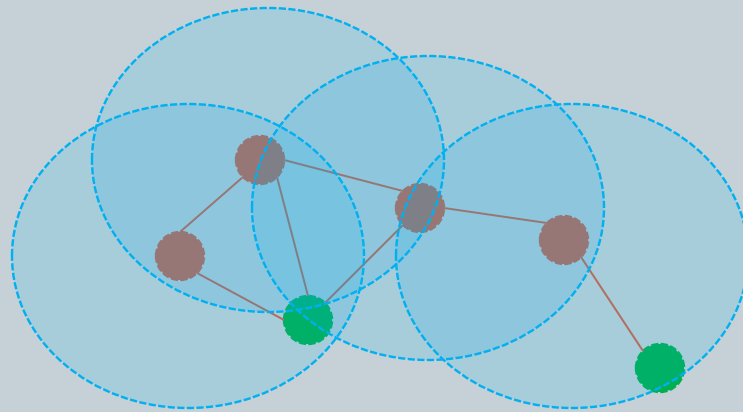
 Stationary  
Router node/  
Base Station



# Mobile Ad Hoc Networks (MANETs)



- Client node
- Router node



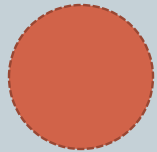
# Hybrid Wireless Mesh Networks



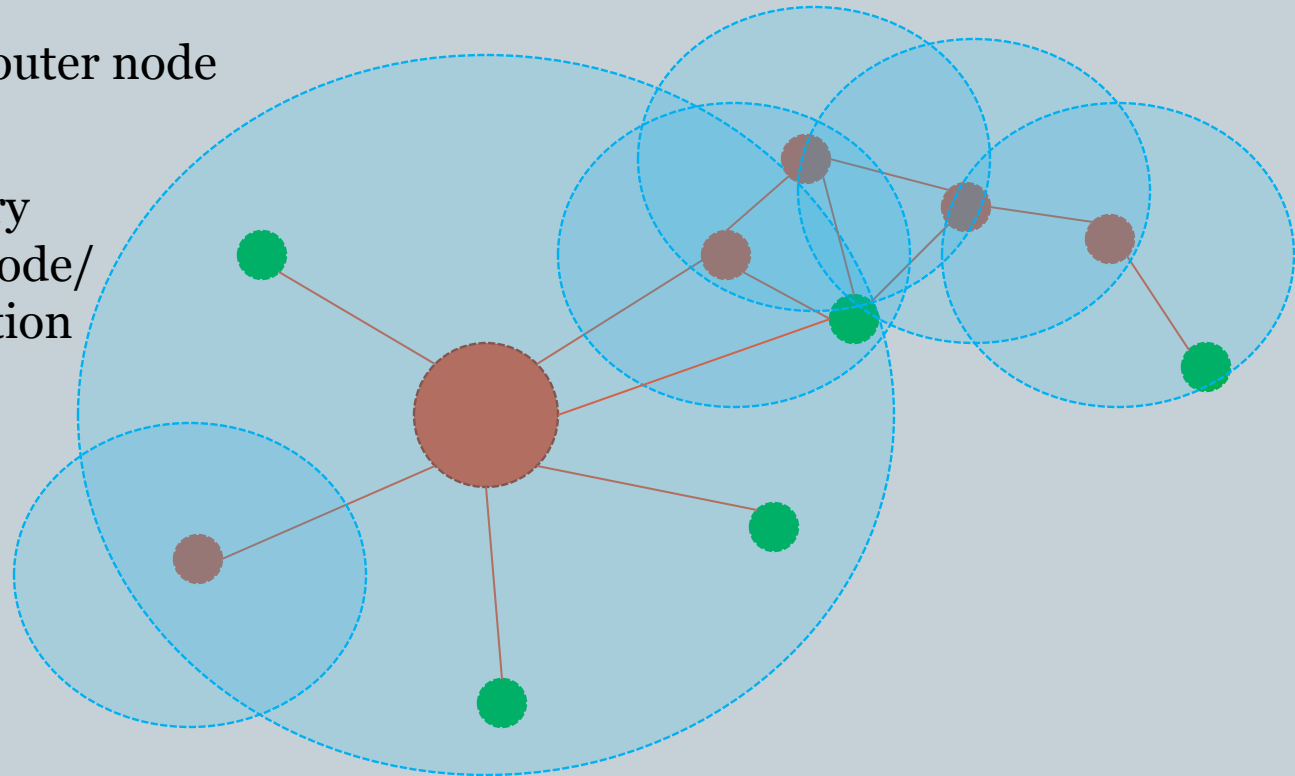
Client node



Mobile Router node





Stationary  
Router node/  
Base Station

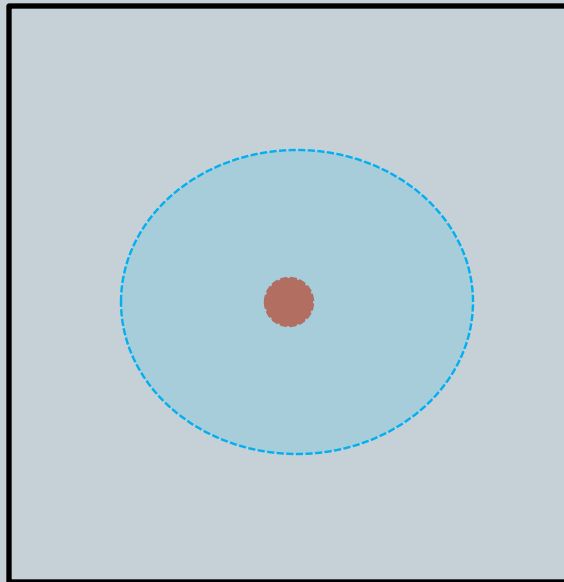


# Mesh Networking

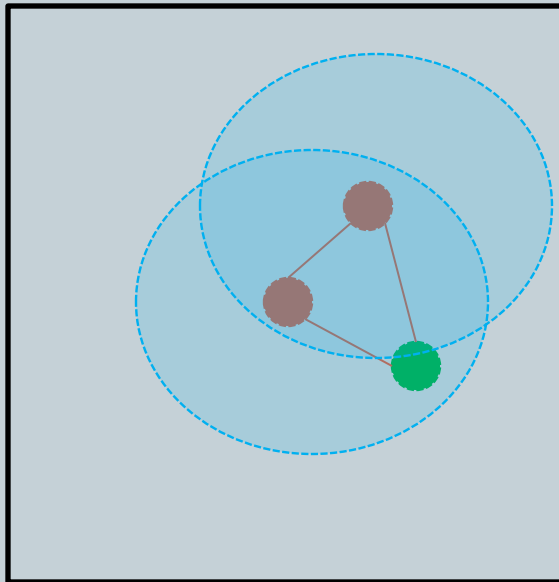


## Network Formation

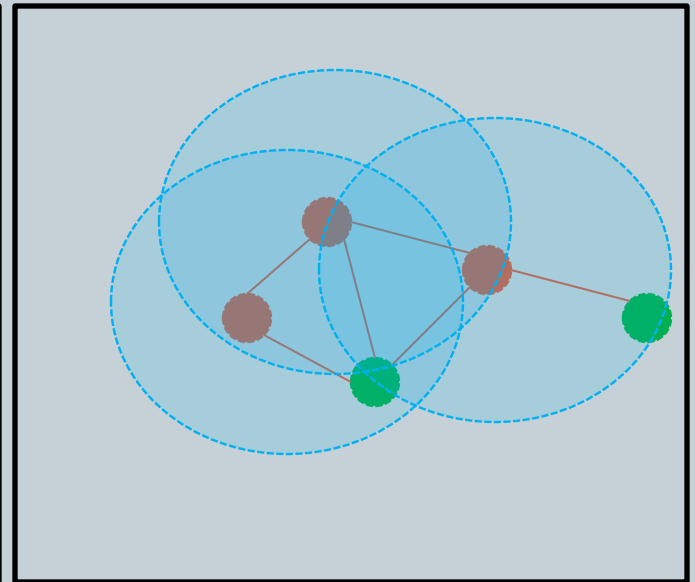
-  Client node
-  Router node



1



2



3

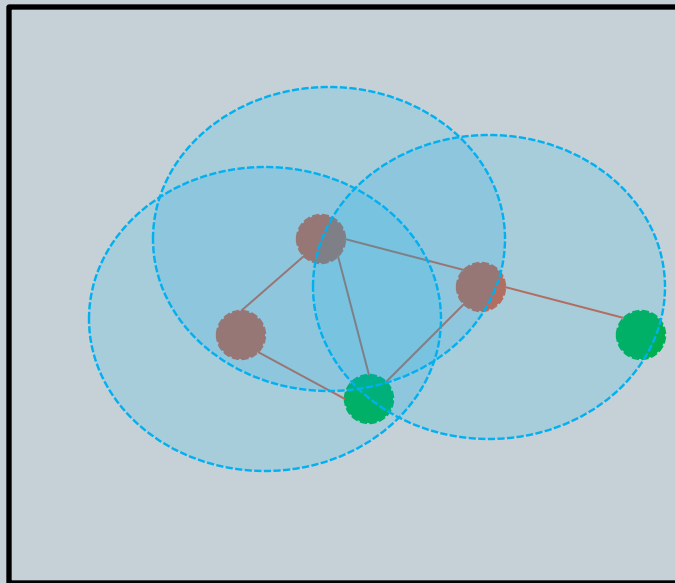
# Mesh Networking (cont'd)



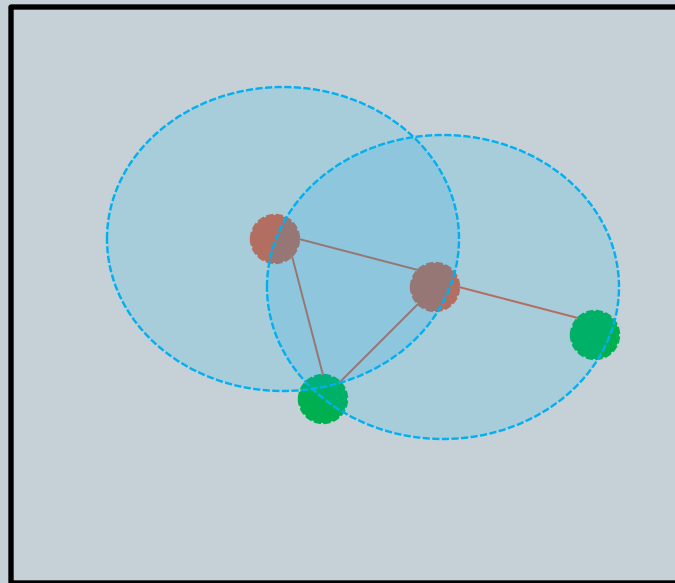
 Client node

 Router node

## Node Loss



**1**



**2**

# Client Access & Backhaul



One Radio Two Radios Three Radios



1<sup>st</sup> Gen



2<sup>nd</sup> Gen



3<sup>rd</sup> Gen

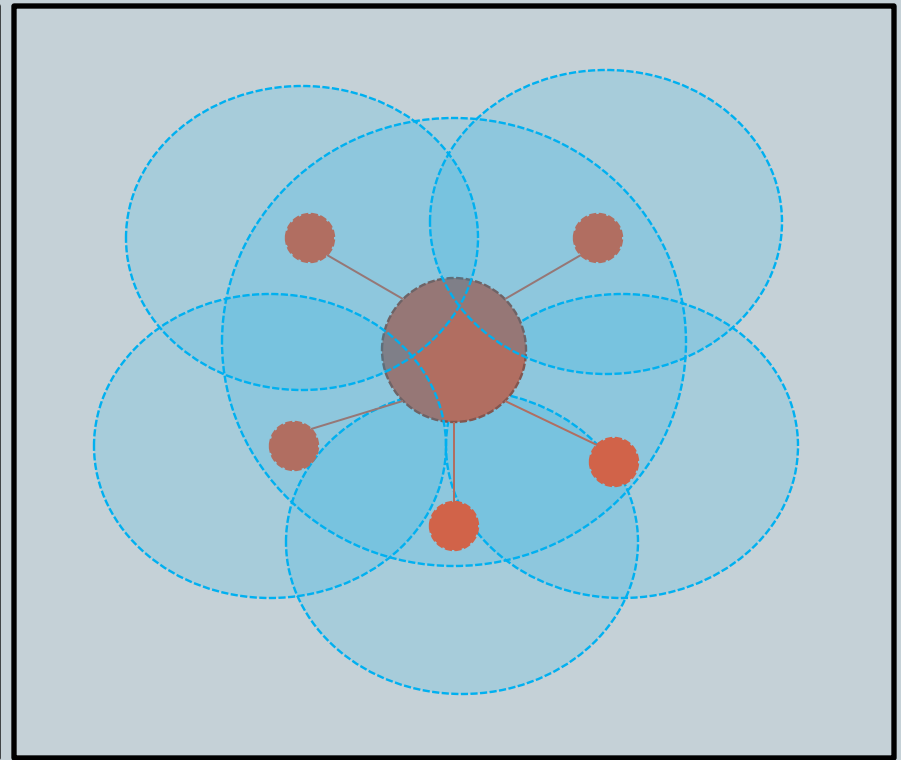
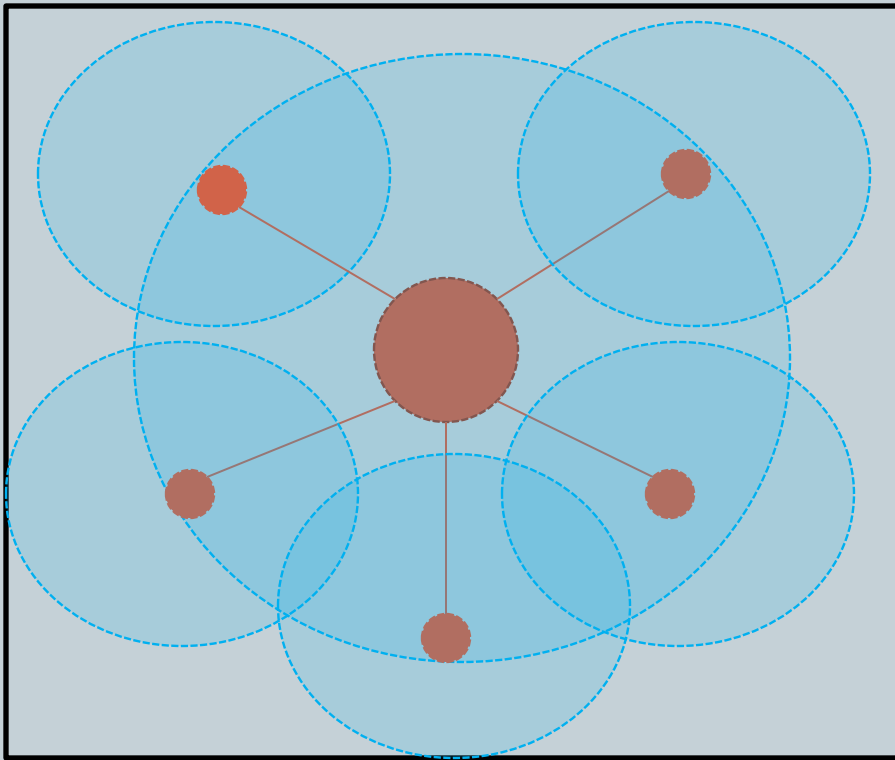
# Advantages: Range and Power



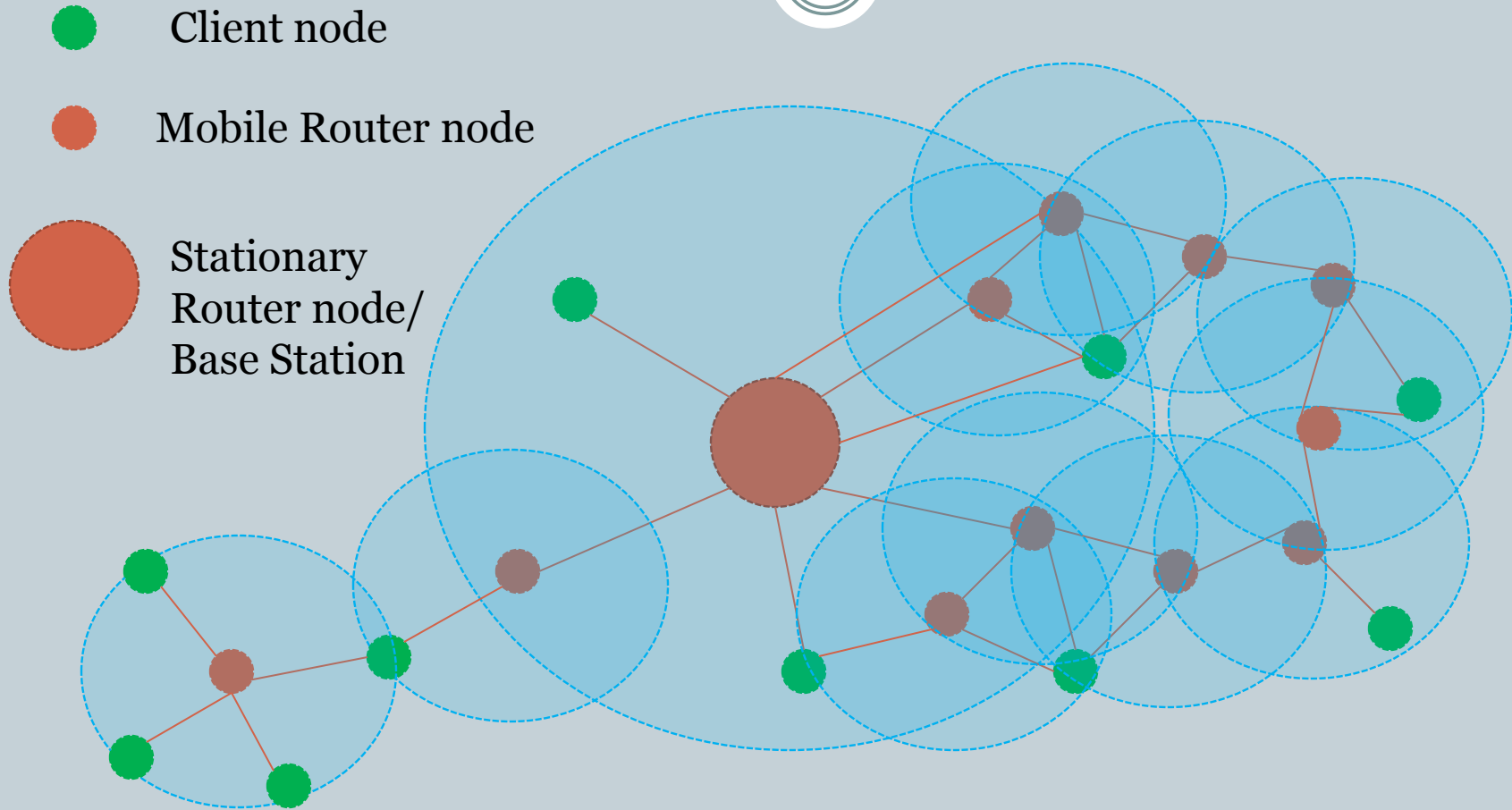
Router node



Stationary  
Router node/  
Base Station





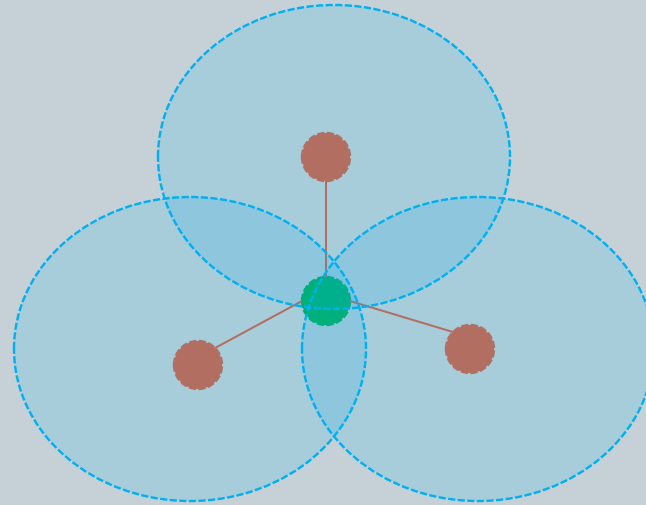
# Advantages: Scalability



# Advantages: Throughput



-  Client node
-  Mobile Router node

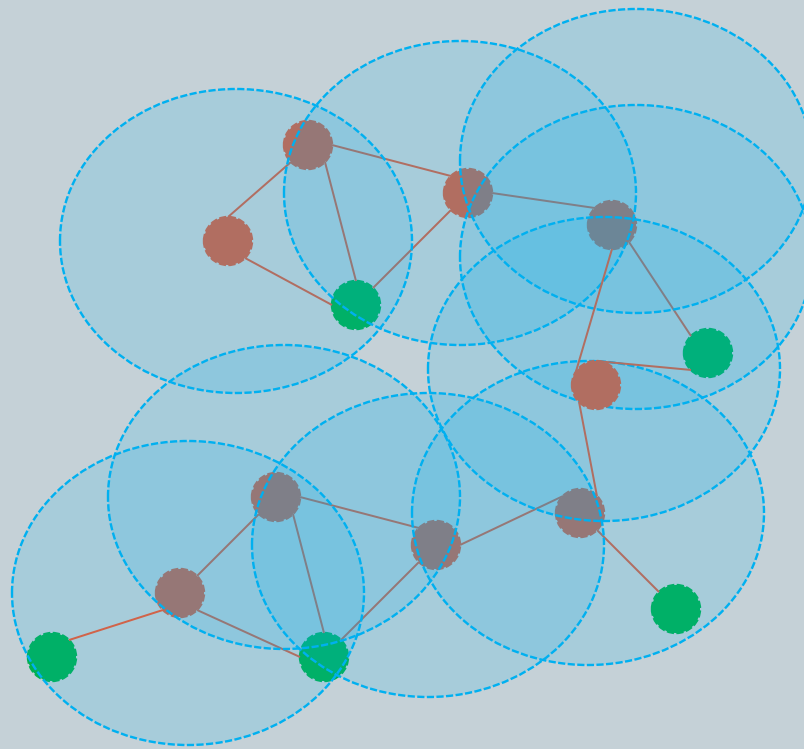


# Disadvantages: Throughput



● Client node

● Mobile Router node



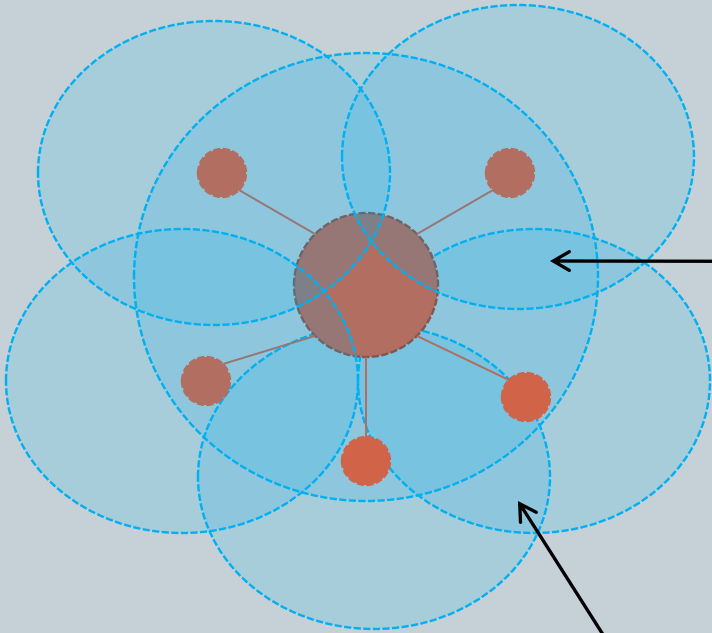
# Disadvantages: Interference



Router node



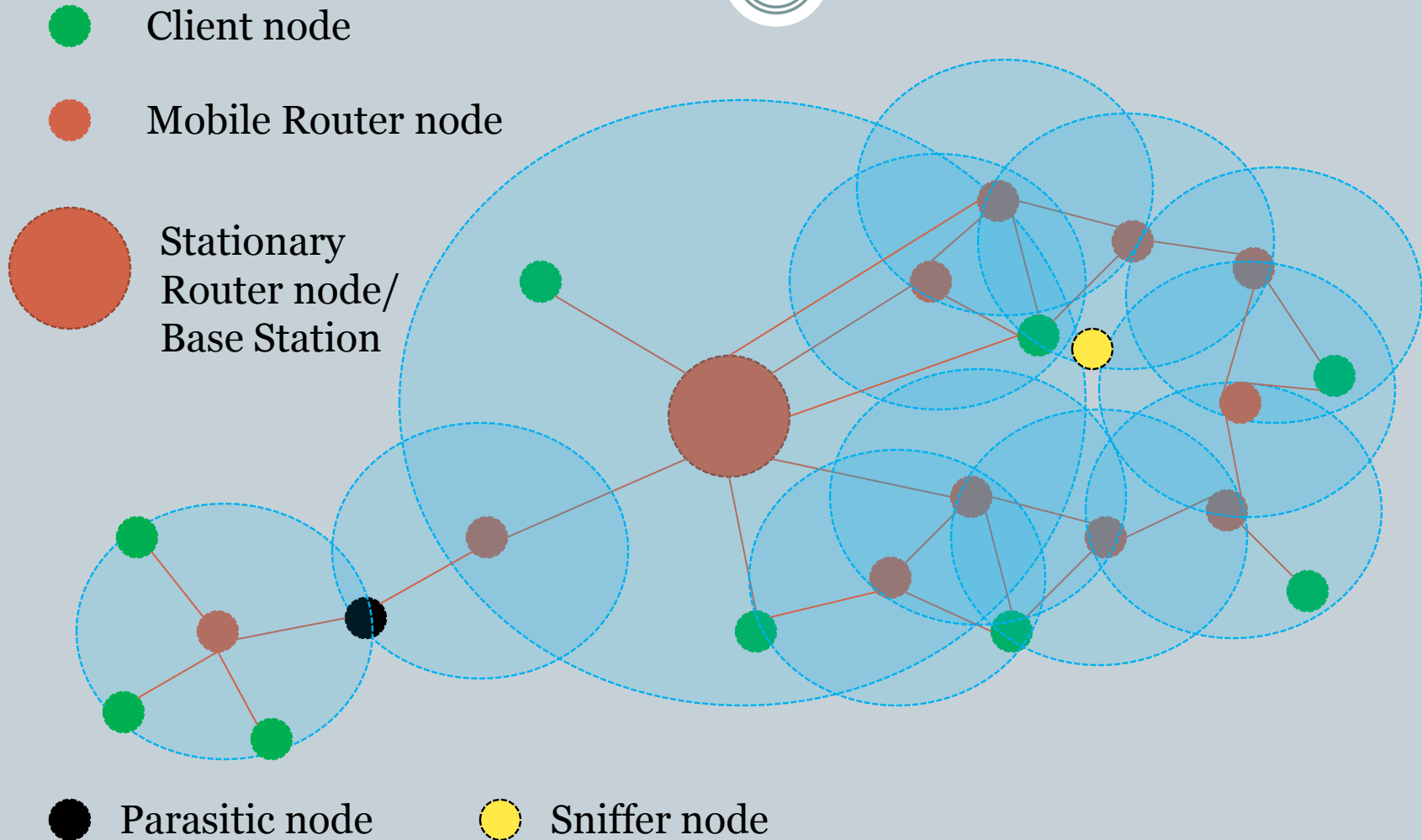
Stationary  
Router node/  
Base Station



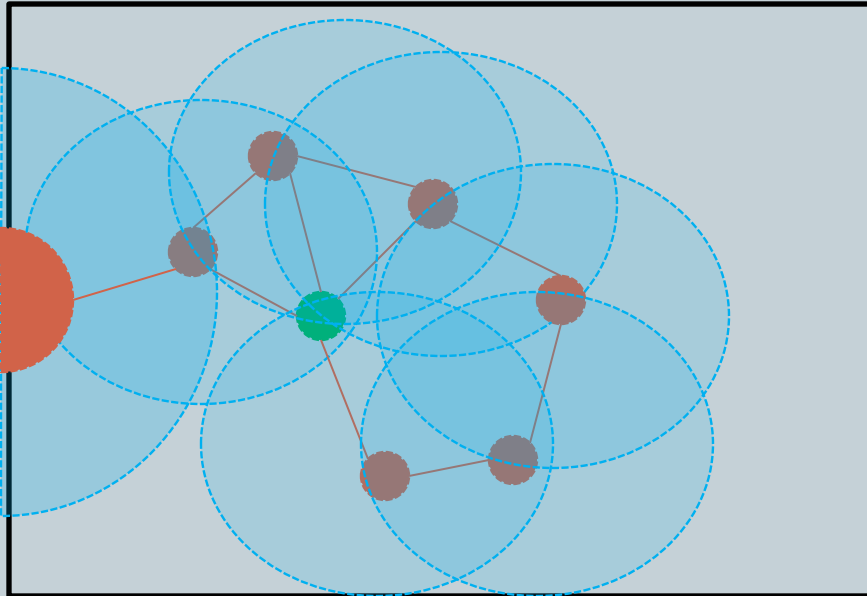
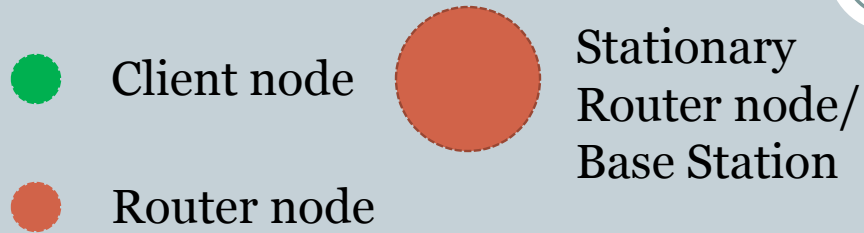
Heavy Co-Channel  
Interference

Co-Channel Interference

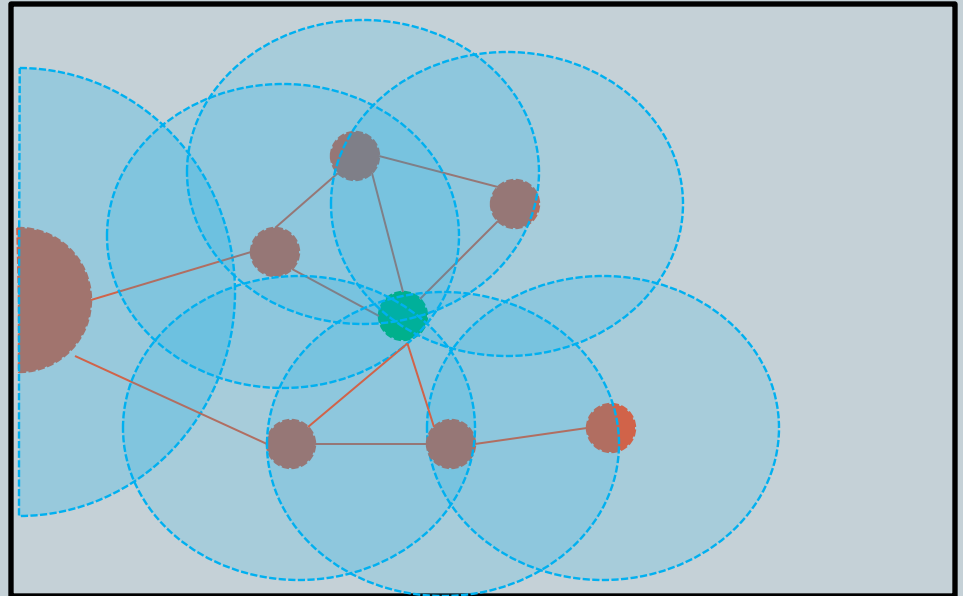
# Disadvantages: Security



# Considerations: Mobility Management



Bad

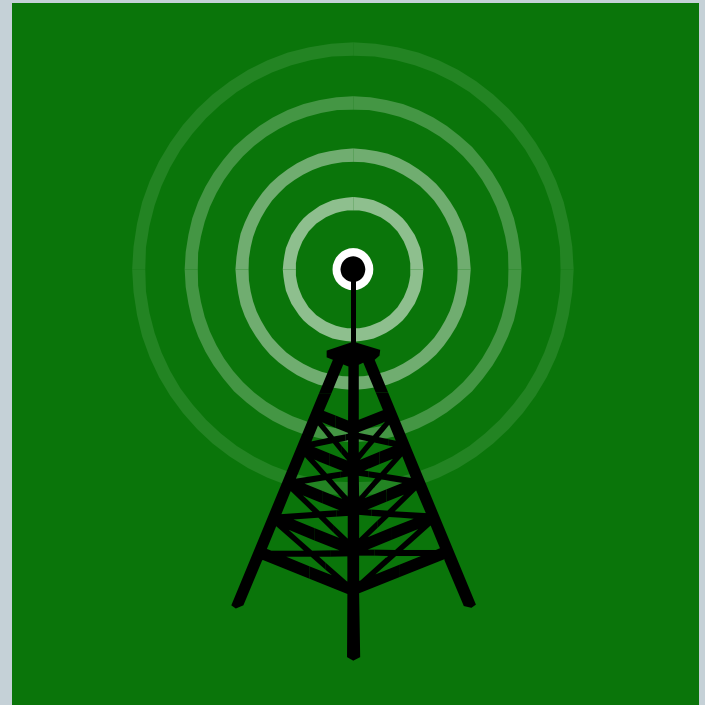


Good

# Considerations: Device Power



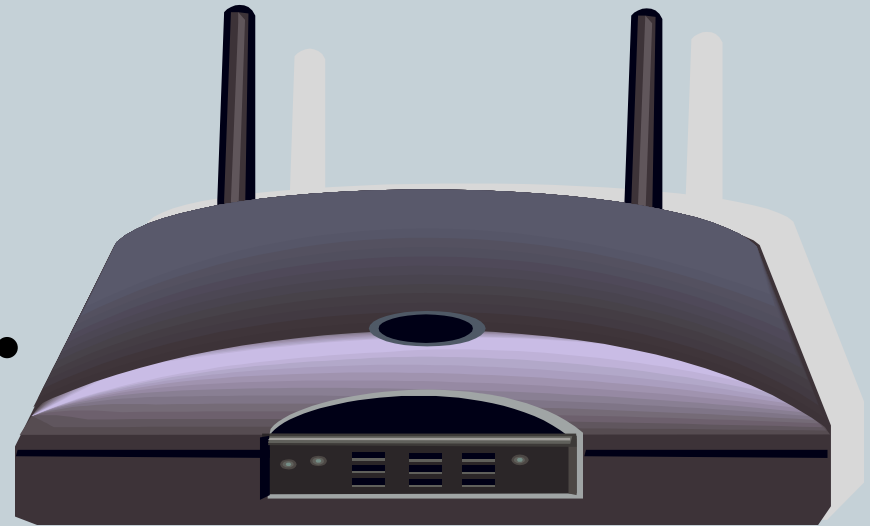
**Vs.**



# Considerations: Device Complexity



**Vs.**

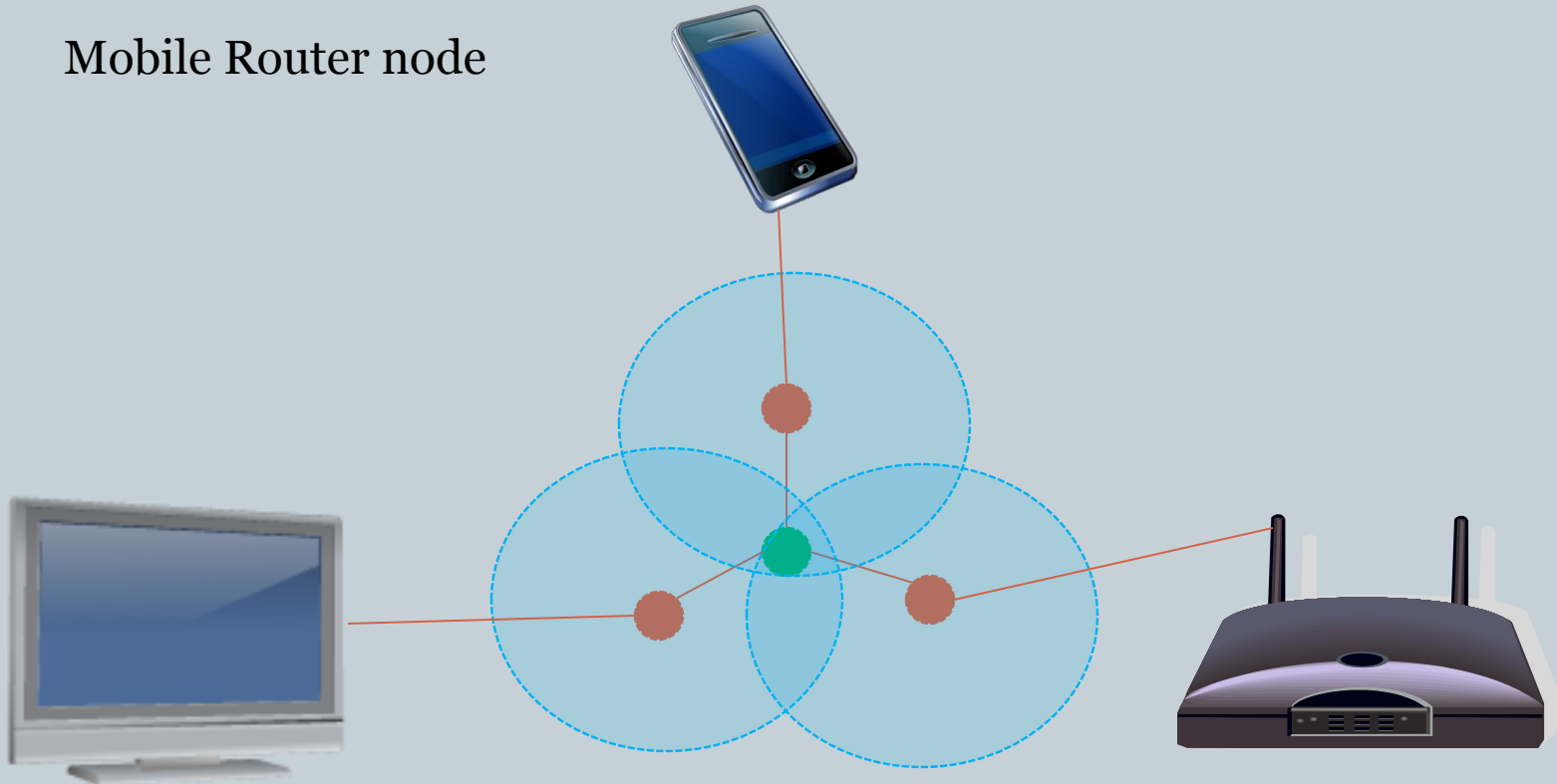


# Considerations: Gateways

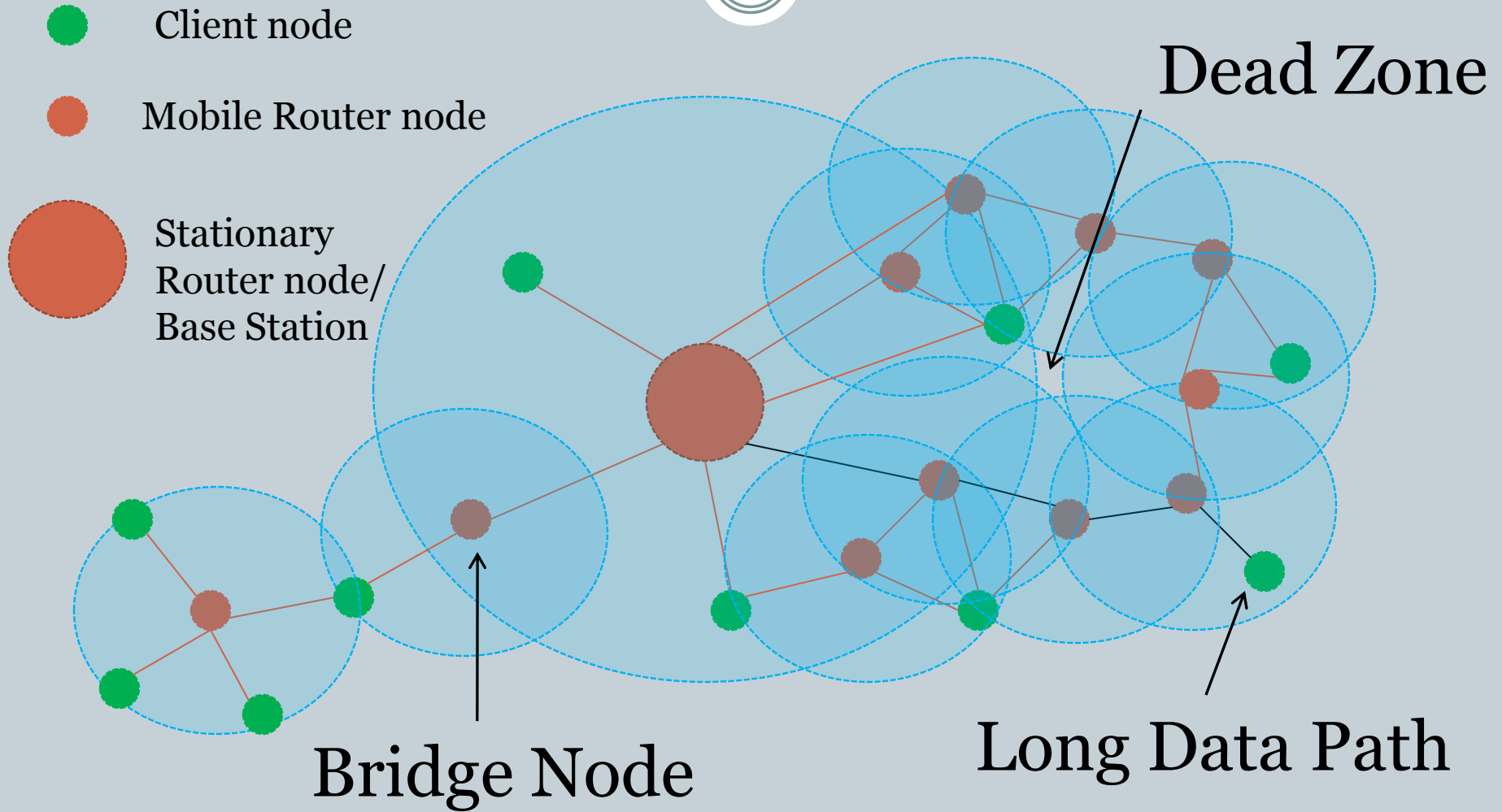


 Client node

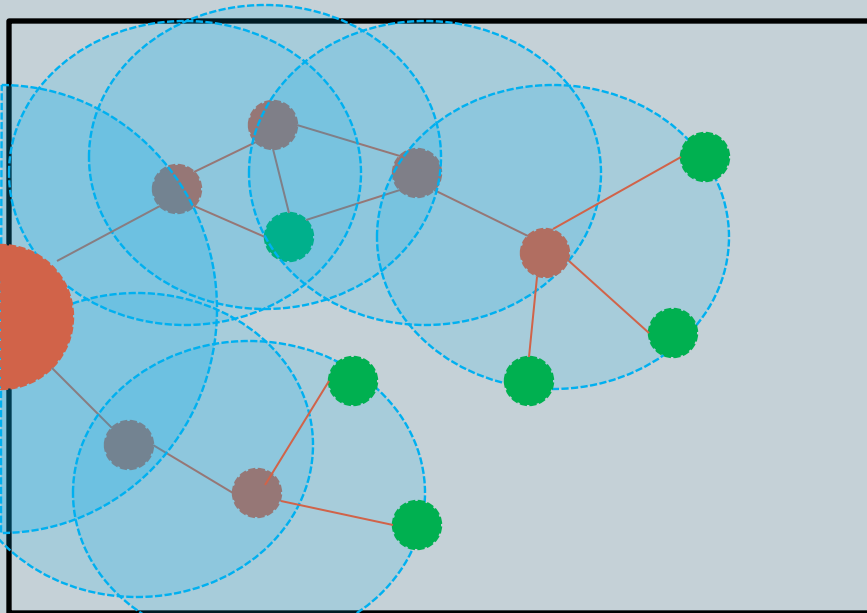
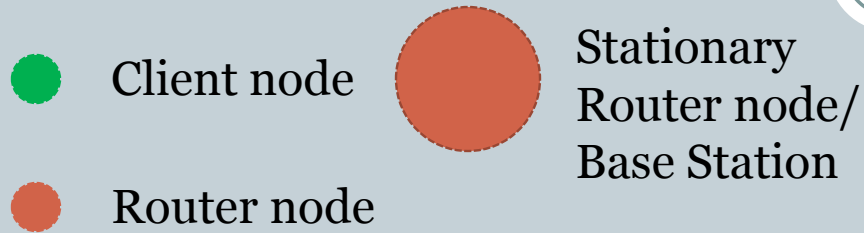
 Mobile Router node



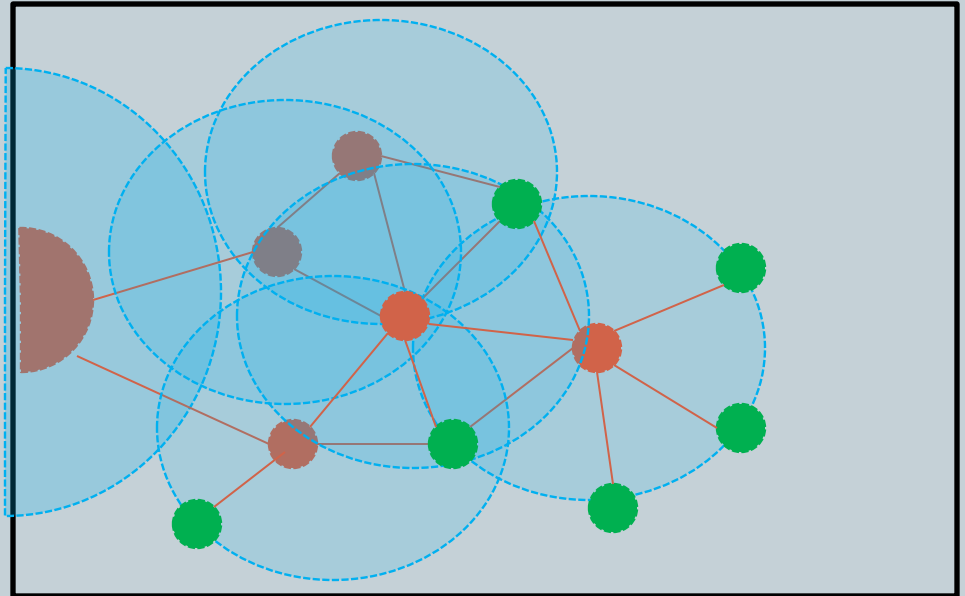
# Considerations: Network Topology & Routing



# Considerations: Network Topology (cont'd)



Simple



Complex

# Current Research: Access Schemes



## Carrier Sense Multiple Access (CSMA)

Sense

Buffer

Transmit



1<sup>st</sup> Step

2<sup>nd</sup> Step

3<sup>rd</sup> Step

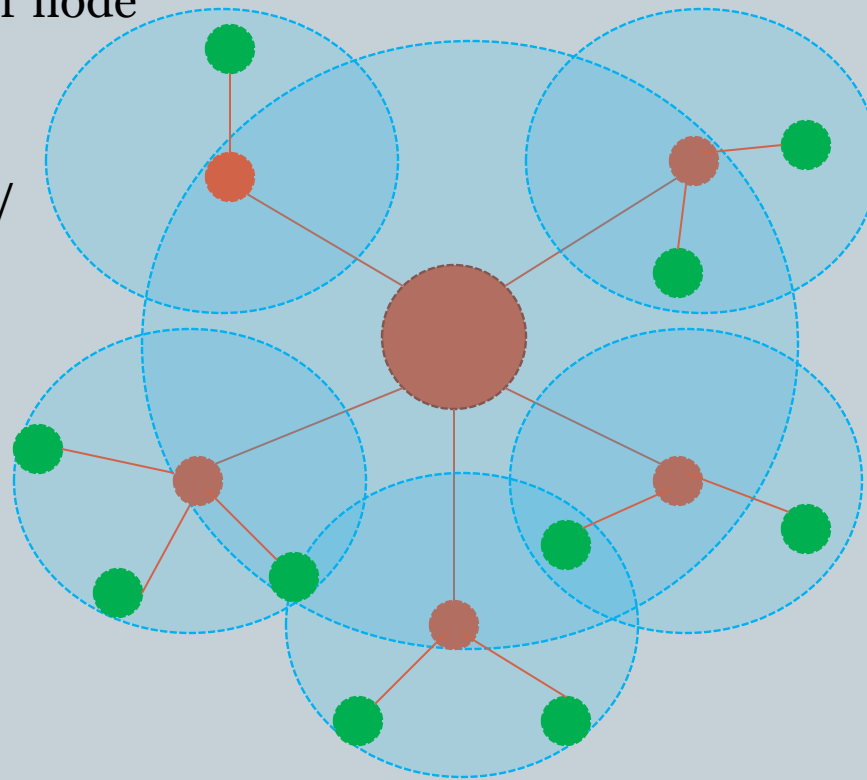
# Current Research: Topology Schemes



● Client node

● Mobile Router node

● Stationary Router node/  
Base Station



## Clustering Approach

# Current Research: Capacity



**It depends.**

# Current Research: Capacity (cont'd)



## **FACTORS**

- Number of channels per node
- Number of nodes
- Throughput

## **Rule of Thumb:**

As nodes are added to a hybrid wireless network, the capacity will increase until you exceed the optimum number of nodes.

# Recap



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# Questions

