

# Smart Networks Project

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## Team

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  - Jun Shu
  - Wilson So
  - Daniel Morato
  - Eduardo Magana
  - Undergraduate Students
- ◆ CISCO
  - ◆ David Jaffe
  - ◆ Anna Charny
- ◆ UIUC:
  - Jennifer Hou
- ◆ Georgia Tech:
  - Richard Fujimoto
  - George Riley

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## Outline

- ◆ Goals
- ◆ Approach
- ◆ Demo
- ◆ Future Work

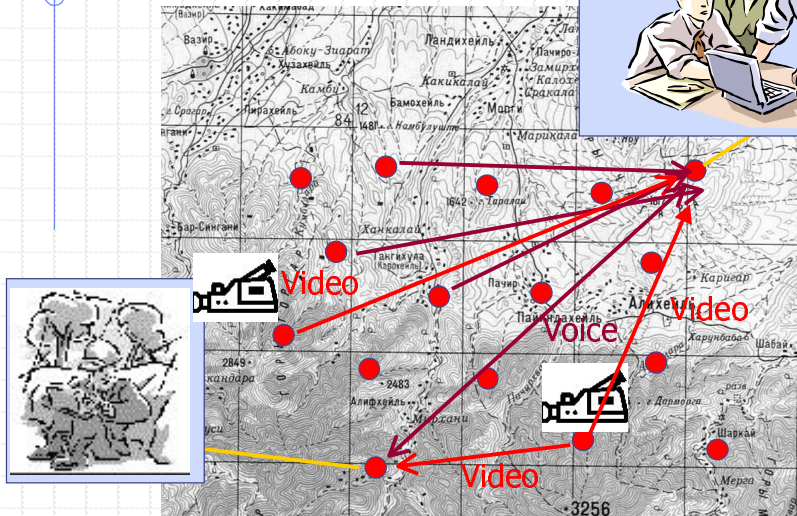
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## Goals

- ◆ Rapid Ad Hoc Network Deployment
- ◆ Improved QoS

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## Goals: Big Picture



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## Goals: Big Picture (cont)

- ◆ Requirements
  - Some applications need:
    - ◆ Low Delay
    - ◆ Guaranteed Bandwidth
  - Network changes:
    - ◆ Nodes disappear or appear
    - ◆ Channel quality varies (e.g., mobility)

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## Approach

- ◆ Combine Ad Hoc Routing with
  - Measurements
  - QoS Control
  - Simulation
- ◆ Motivation:
  - Standard protocols do not suffice

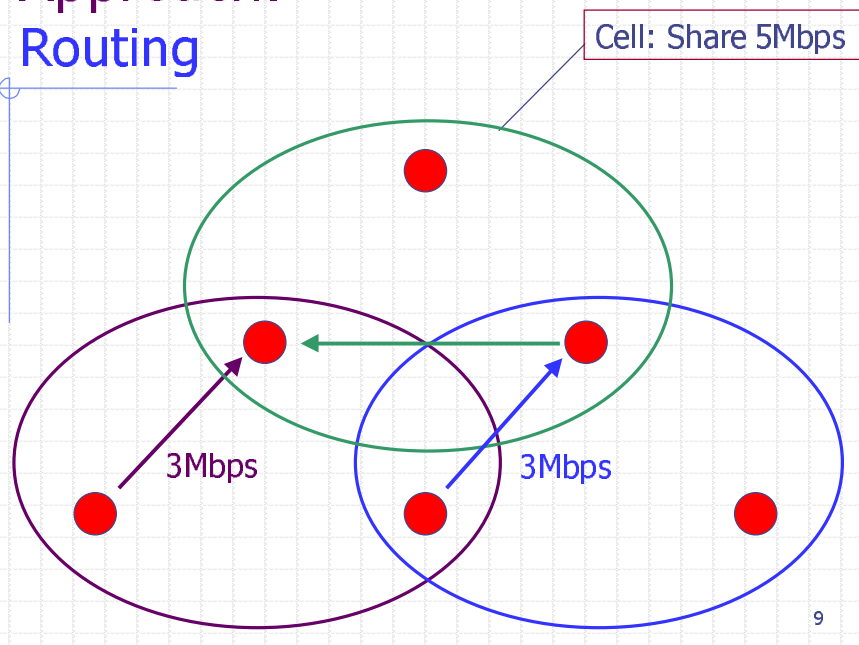
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## Approach (cont)

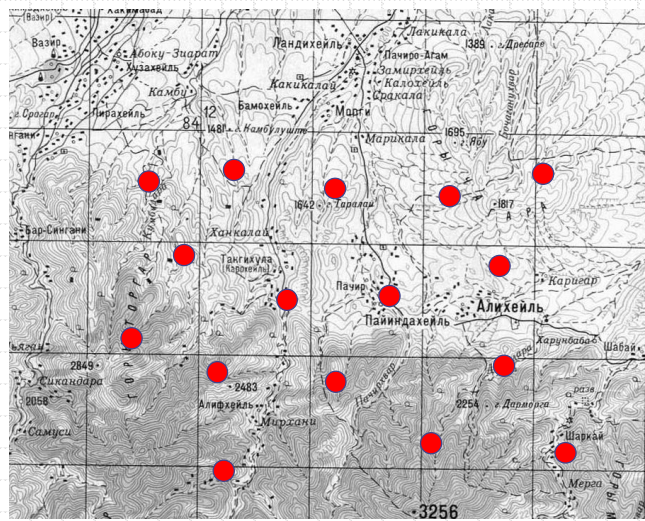
- ◆ Measurements:
  - Traffic Load
  - Quality of Links
  - Topology
  - Location
- ◆ Simulation:
  - Delay estimation before configuring the network
- ◆ QoS Control:
  - Requirements: current + anticipated
  - Actions:
    - ◆ Routing
    - ◆ Scheduling
    - ◆ Rate limiting

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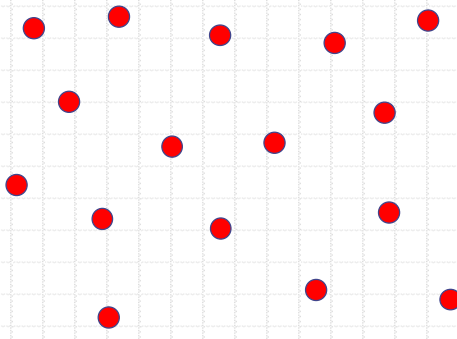
# Approach: Routing



# Approach: Routing (cont)

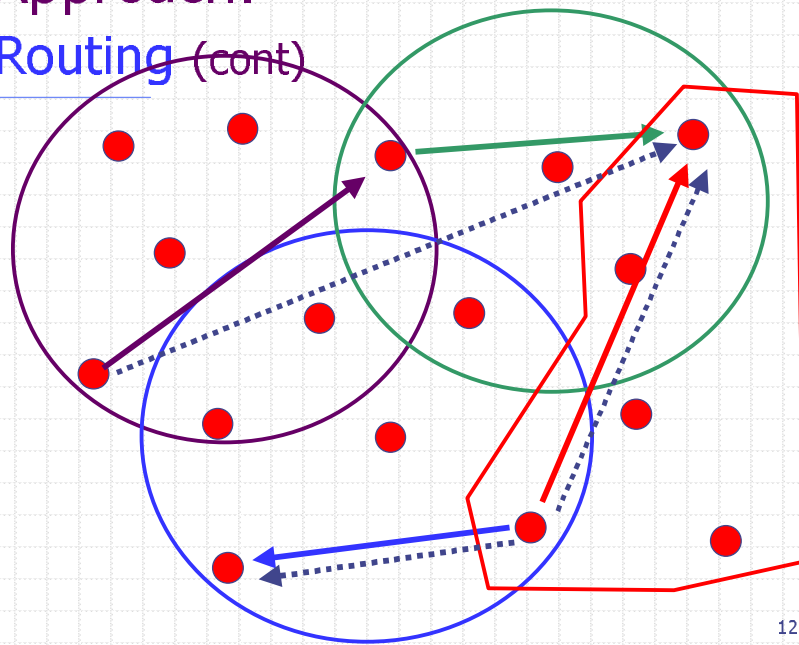


# Approach: Routing (cont)



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# Approach: Routing (cont)



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## Approach:

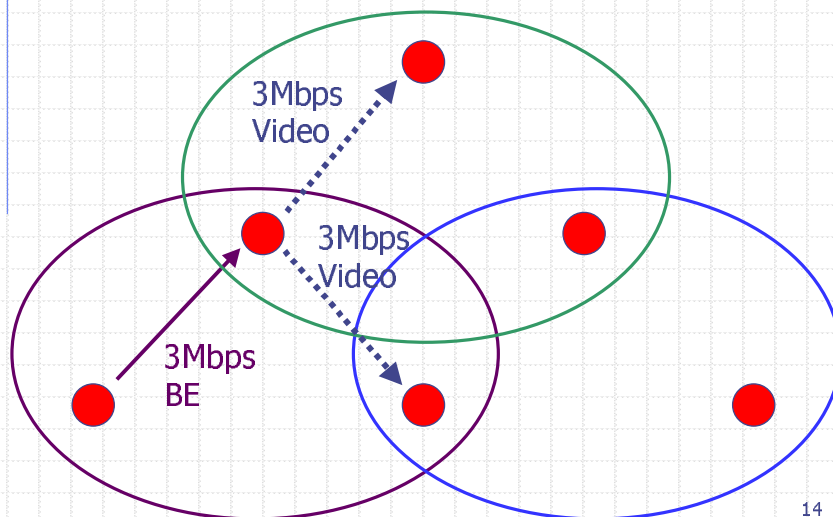
### Routing (cont)

- ◆ Procedure:
- ◆ Get requests
- ◆ Select **paths**
  - Relaxation → LP
  - Randomize; Check; Iterate
  - Run SIM to validate **paths**
- ◆ Configure **routing tables**

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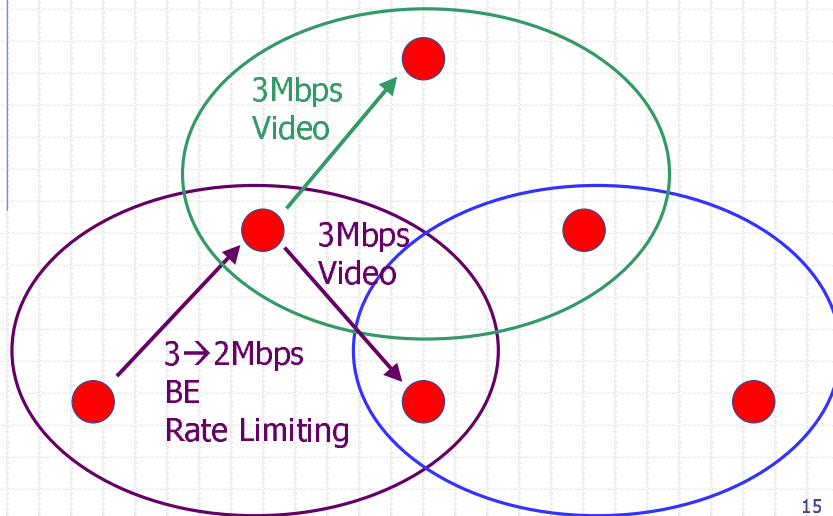
## Approach:

### Rate Limiting



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## Approach: Rate Limiting



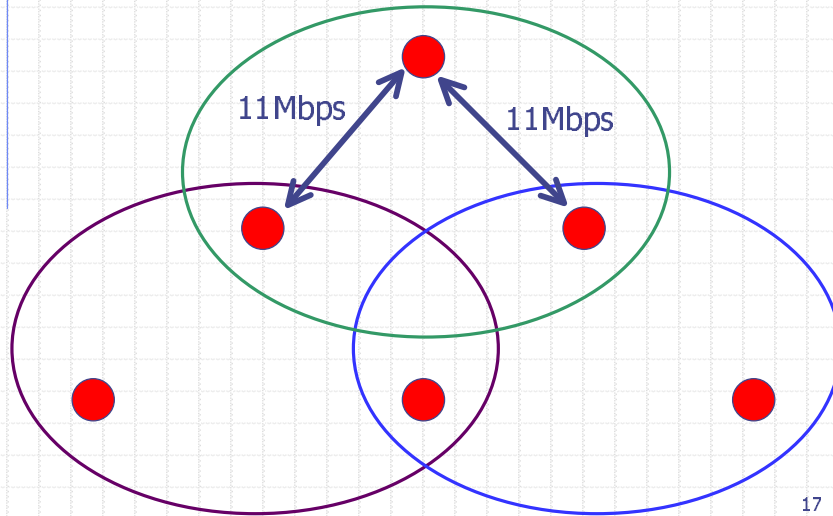
## Approach: Rate Limiting (cont)

- ◆ Procedure:
- ◆ Measure BE
- ◆ Get requests EF
- ◆ Calculate RL parameters for BE  
Note: Various implementations are possible. We use
  - EF rates → LP .... → Paths
  - Calculate available rate for BE/cell
  - Distribute fraction
  - Measure; iterate steps 3 and 4

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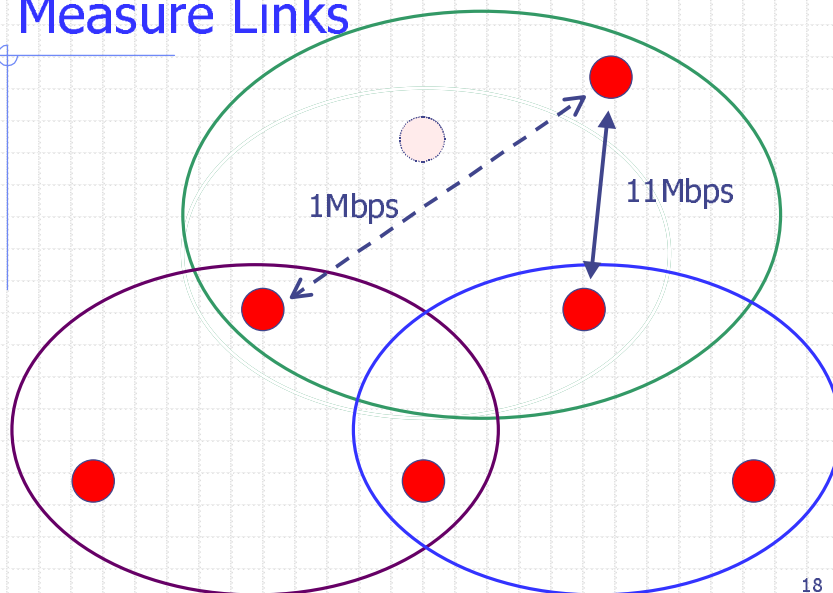


## Approach: Measure Links



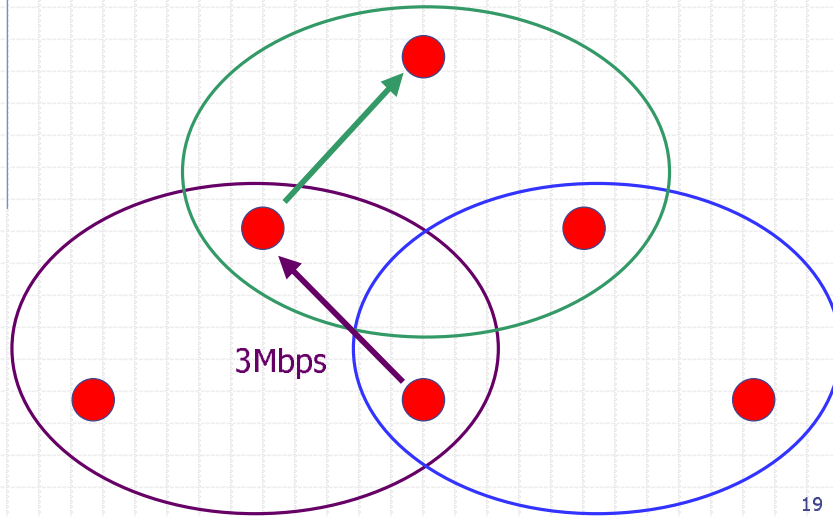
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## Approach: Measure Links

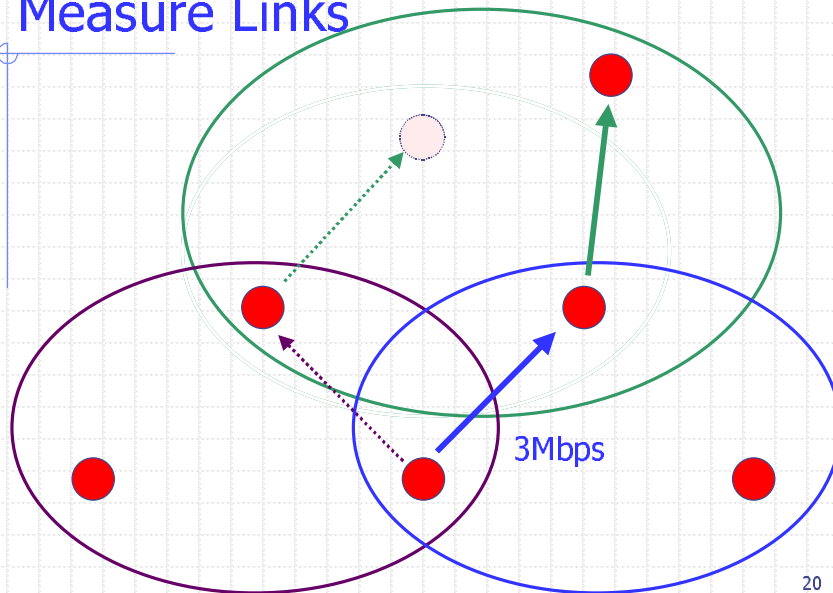


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# Approach: Measure Links



# Approach: Measure Links



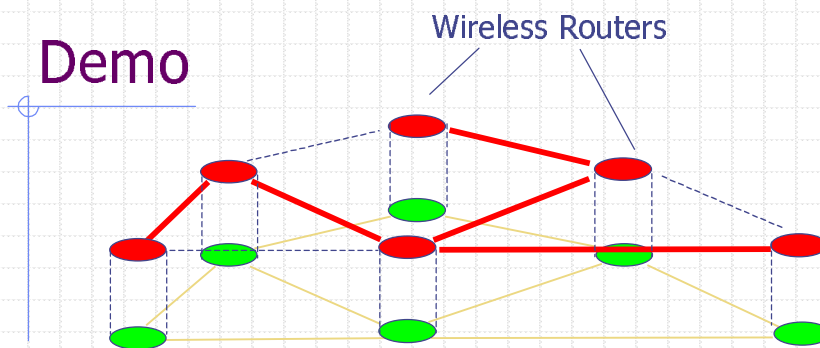
## Approach:

### Measure Links (cont)

- ◆ Procedure:
- ◆ Get link states
- ◆ Select **paths**
  - Relaxation → LP
  - Randomize; Check; Iterate
  - Run SIM to validate **paths**
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## Demo

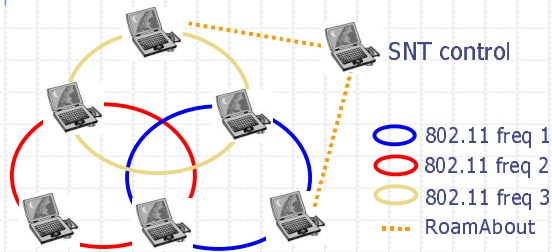


- ◆ Ad-hoc routing protocol ensures the connectivity among wireless routers, regardless of node arrival and departure.
- ◆ Control hosts monitor, measure, and control the traffic in the wireless ad-hoc network.
- ◆ **Data** packets follow **overlay** routes. **Network management** packets follow **ad-hoc** routes.

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## Demo Setup

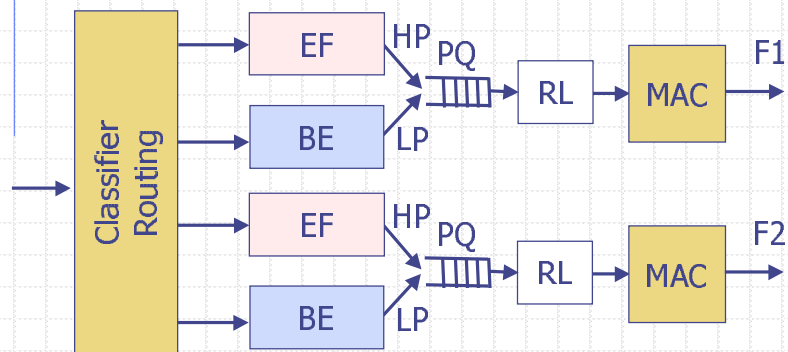
- ◆ Six Laptops running RedHat Linux 7.1 act as wireless routers
- ◆ 1 laptop runs SNT and QoS routing application
- ◆ Each laptop has 1 to 2 wireless interfaces
- ◆ each interface speaks 1 out of 3 possible frequencies to emulate several cells in a small room



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## Demo Setup

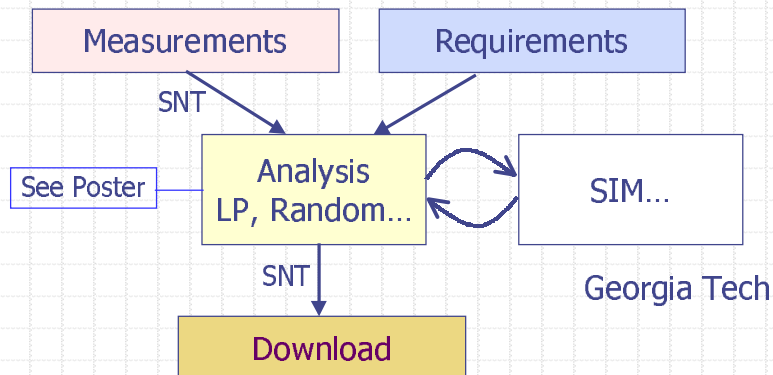
- ◆ Logical View of Node



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## Demo Setup

- ◆ Logical View of Management



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## Demo: Demonstrate Value of

- ◆ QoS Routing
- ◆ Rate Limiting

### Additional Demo

- ◆ Adaptive Red (w. Jennifer Hou)

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## Future Work

- ◆ Scalability
  - Clusters
  - Distributed Algorithms
- ◆ Implementation of
  - AQM
  - End-to-end QoS on Demand  
[Using modified IOS]