

Positioning in Ad-Hoc Networks

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Directions and Results

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August 10, 2002



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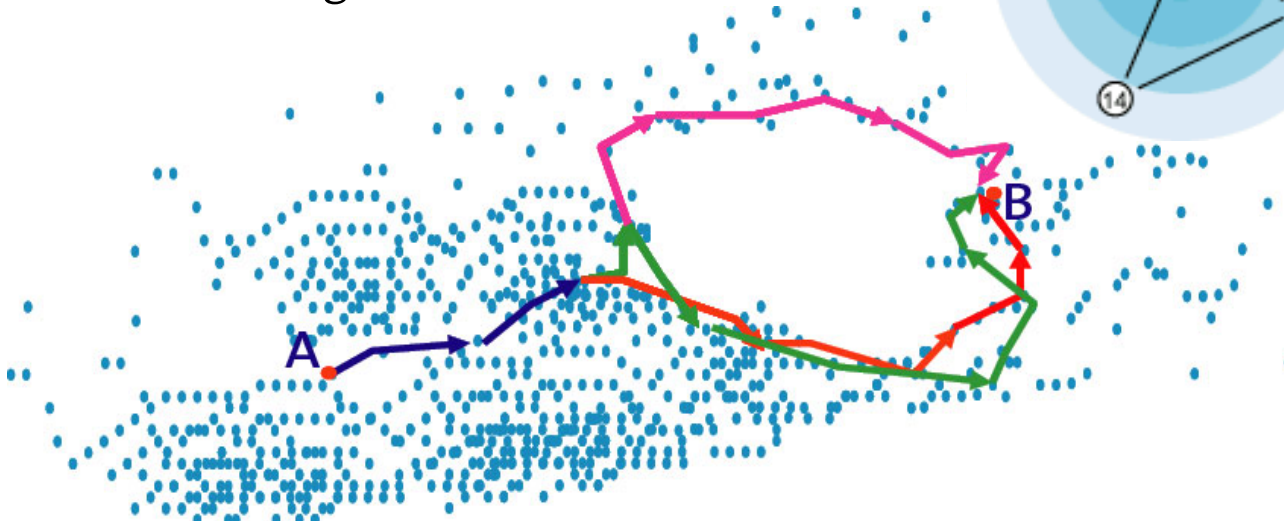
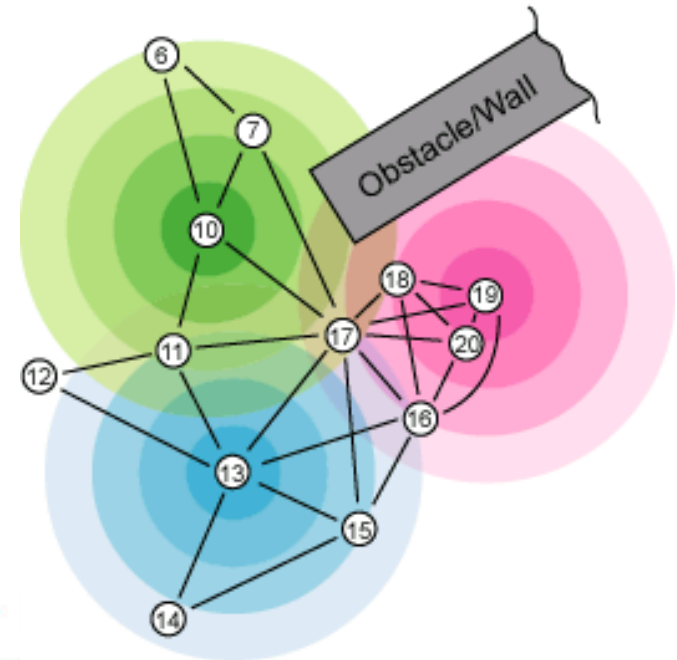
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Ad-Hoc Network Scenarios

- Low power
- Small size
- Very large population
- No infrastructure necessary
- Varying population density
- Multihop environment
- Partitioning

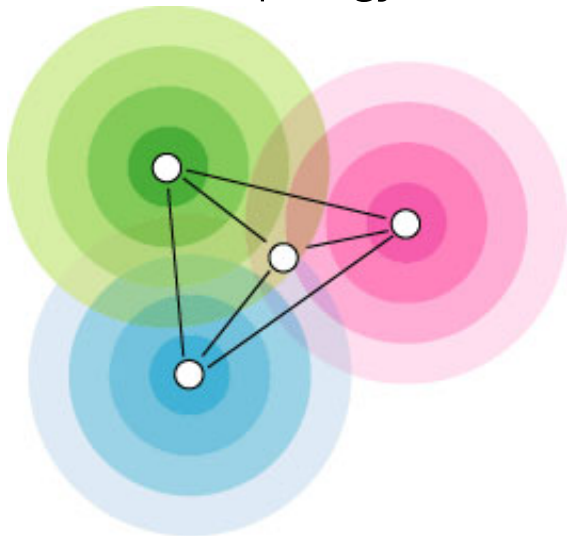


Positioning: The Problem

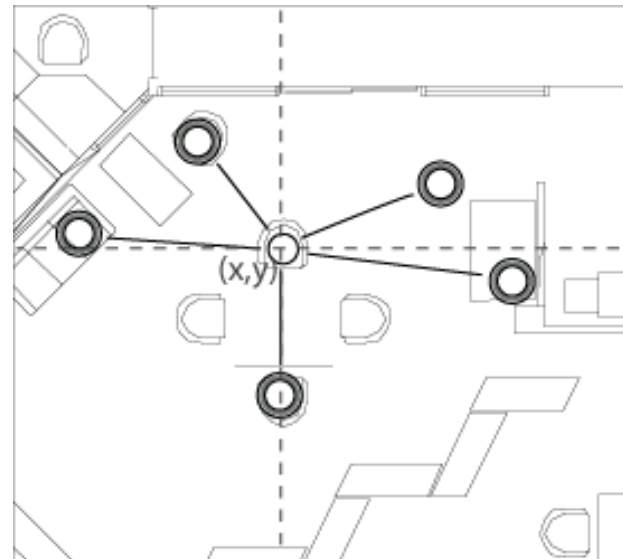
Finding the **position** of networking nodes

Relative vs. Absolute Positioning Mode

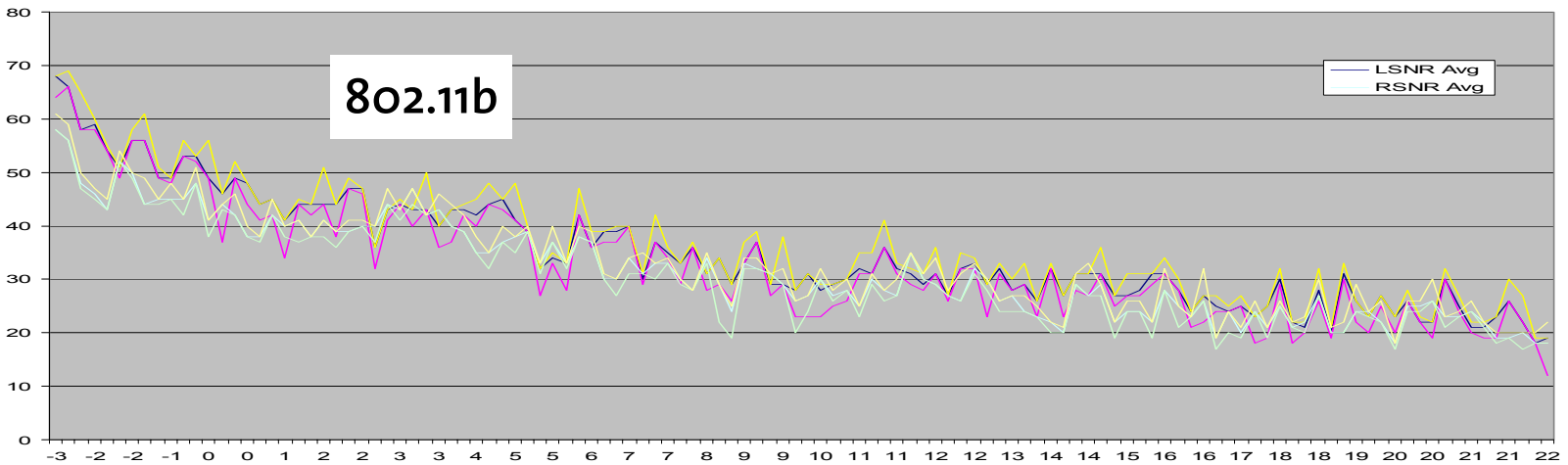
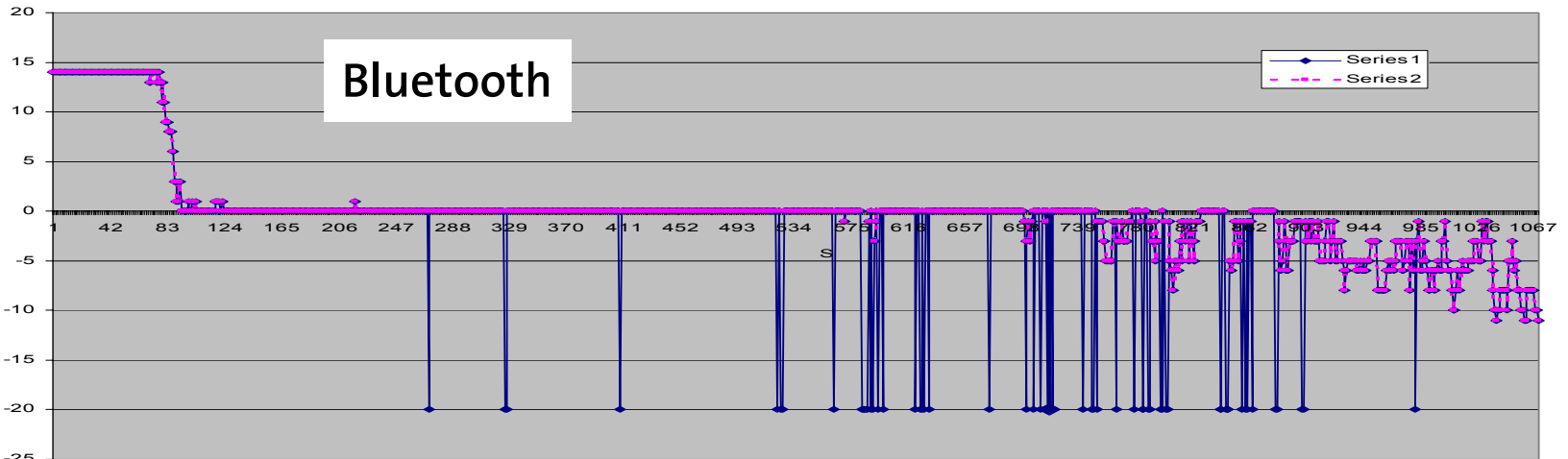
Other Networking Nodes,
Distance and Geometric
Topology



Reference Positions,
Map Database

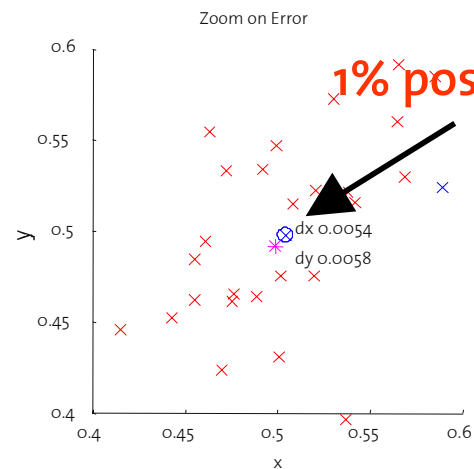
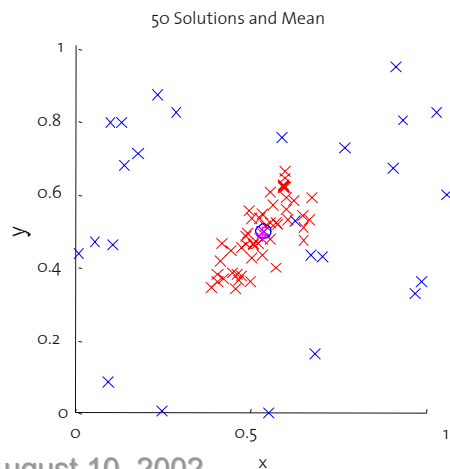
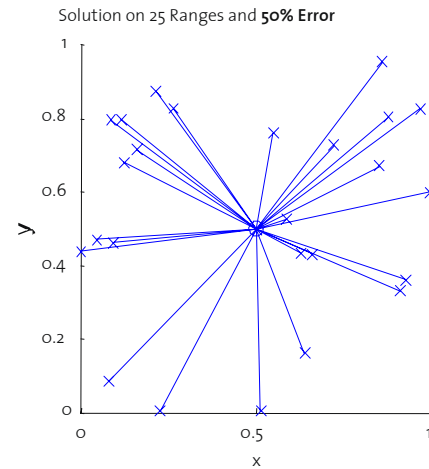
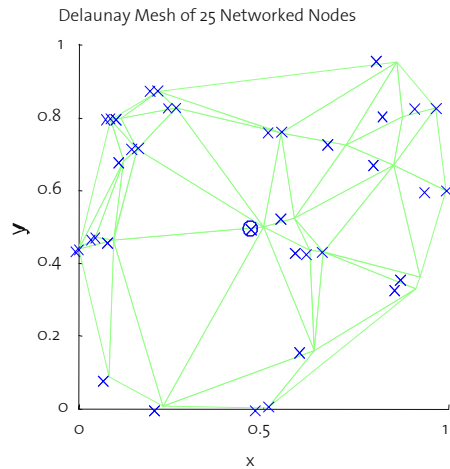


RSSI Samples Over Distance - Free Space

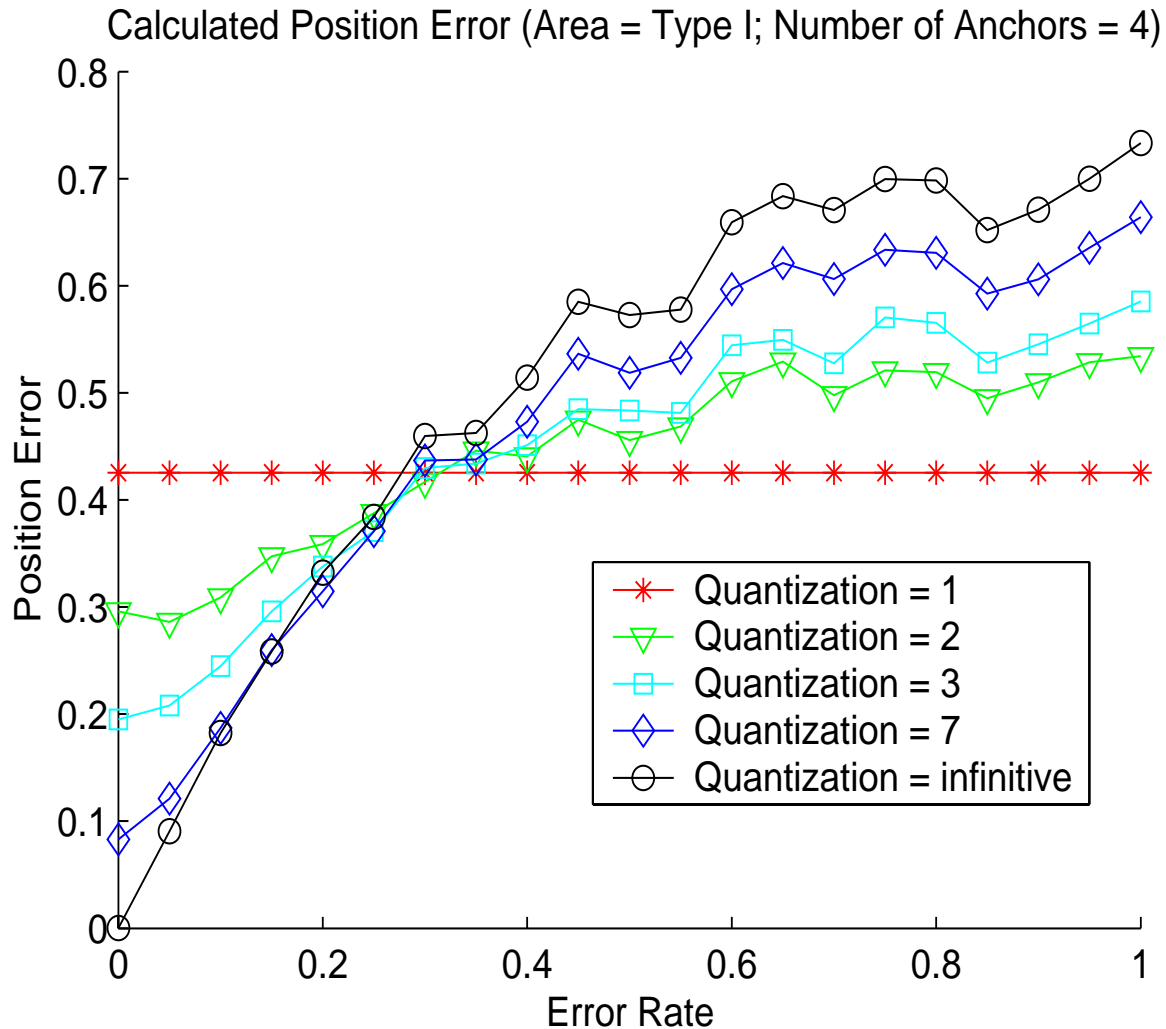


Redundant Triangulation and Filtering

Average over 25 individual triangulations with 50% range error

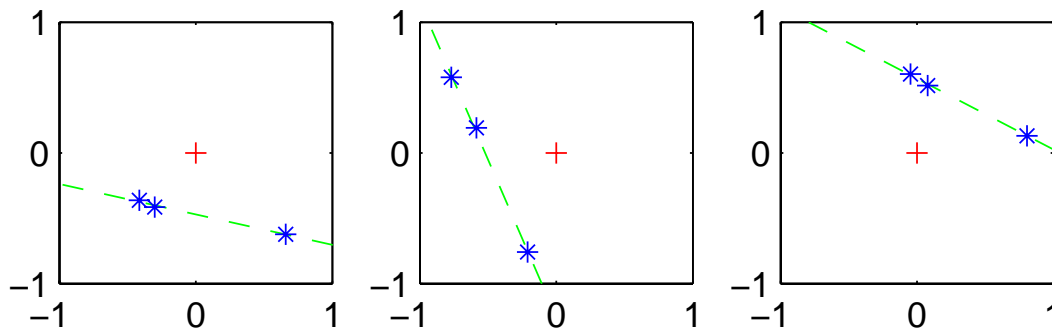


Influence of Range Quantization

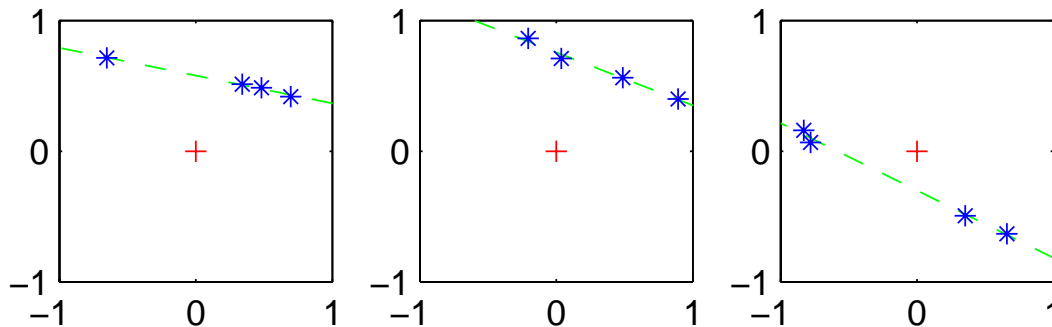


Very Large Errors and Topology

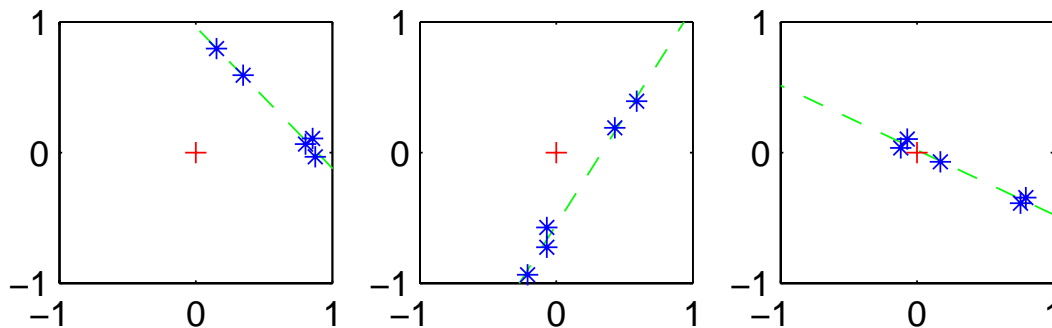
3 anchors ~ 94%



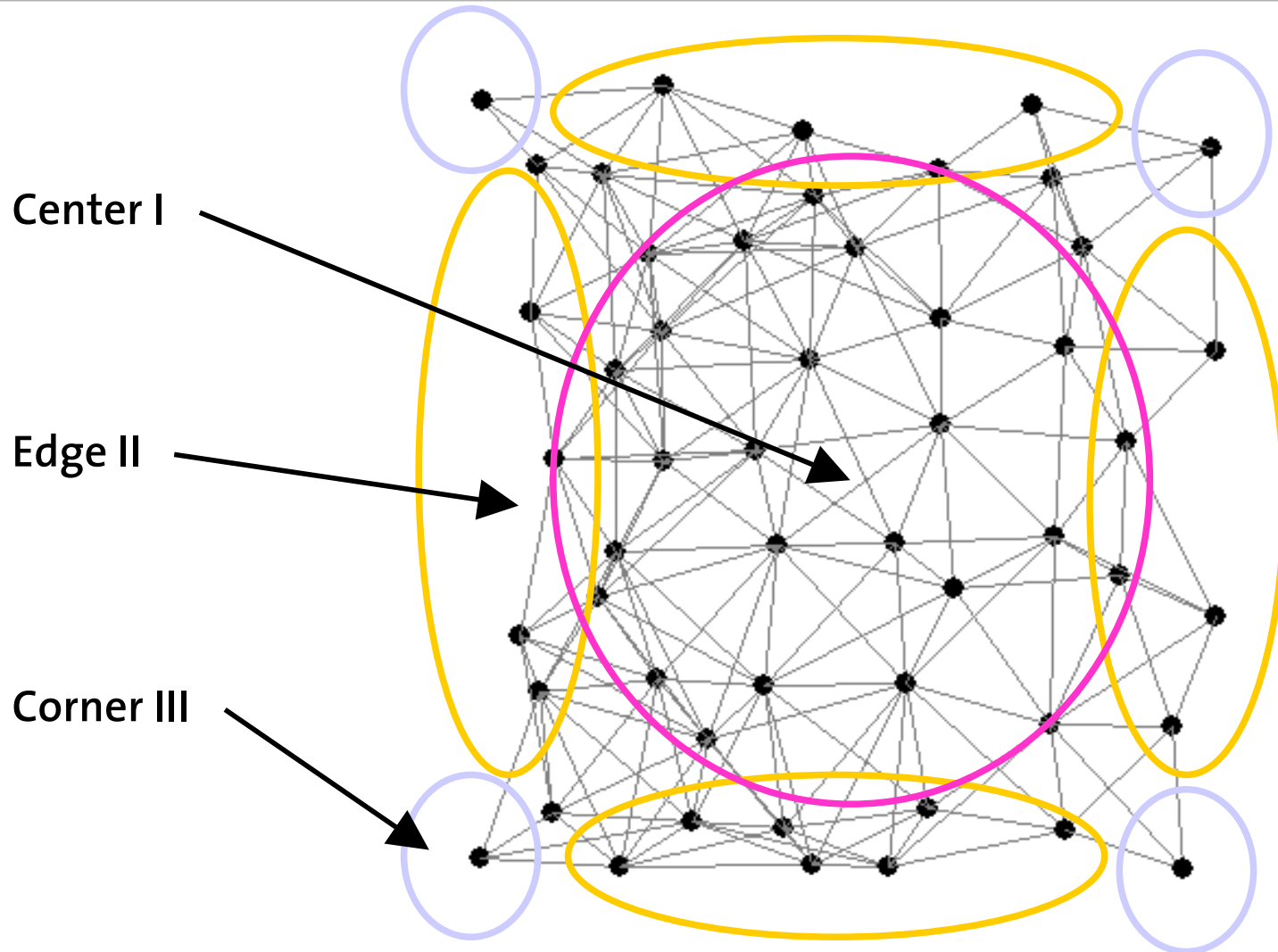
4 anchors ~ 6%



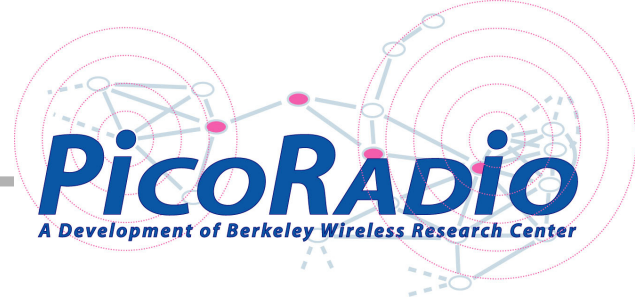
5 anchors >1%



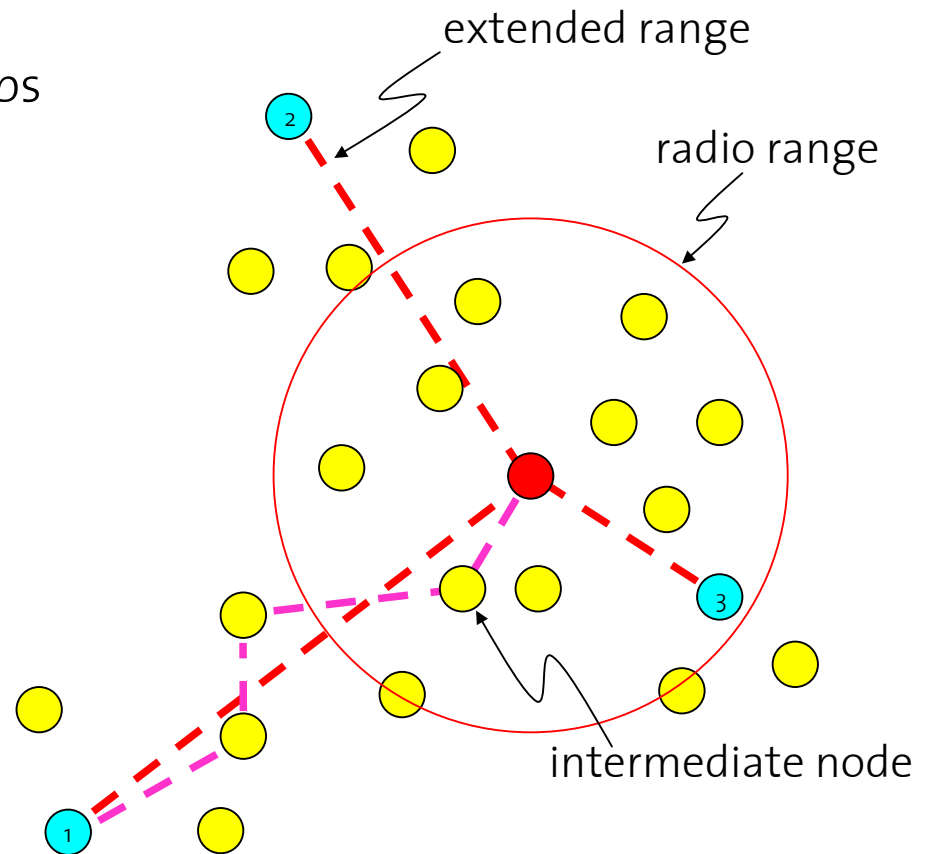
Influence of Border Regions



The TERRAIN Algorithm



- Triangulation via Extended Range and Redundant Association of Intermediate Nodes
- Algorithm creates local maps
- Every node waits to be included in ≥ 3 maps
- Extended ranges calculated from respective maps
- Triangulation node based on extended ranges
- Network-wide iterations



Ad-hoc Network Simulation Environment

