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Robust Routing in Mobile Peer-to-Peer Systems

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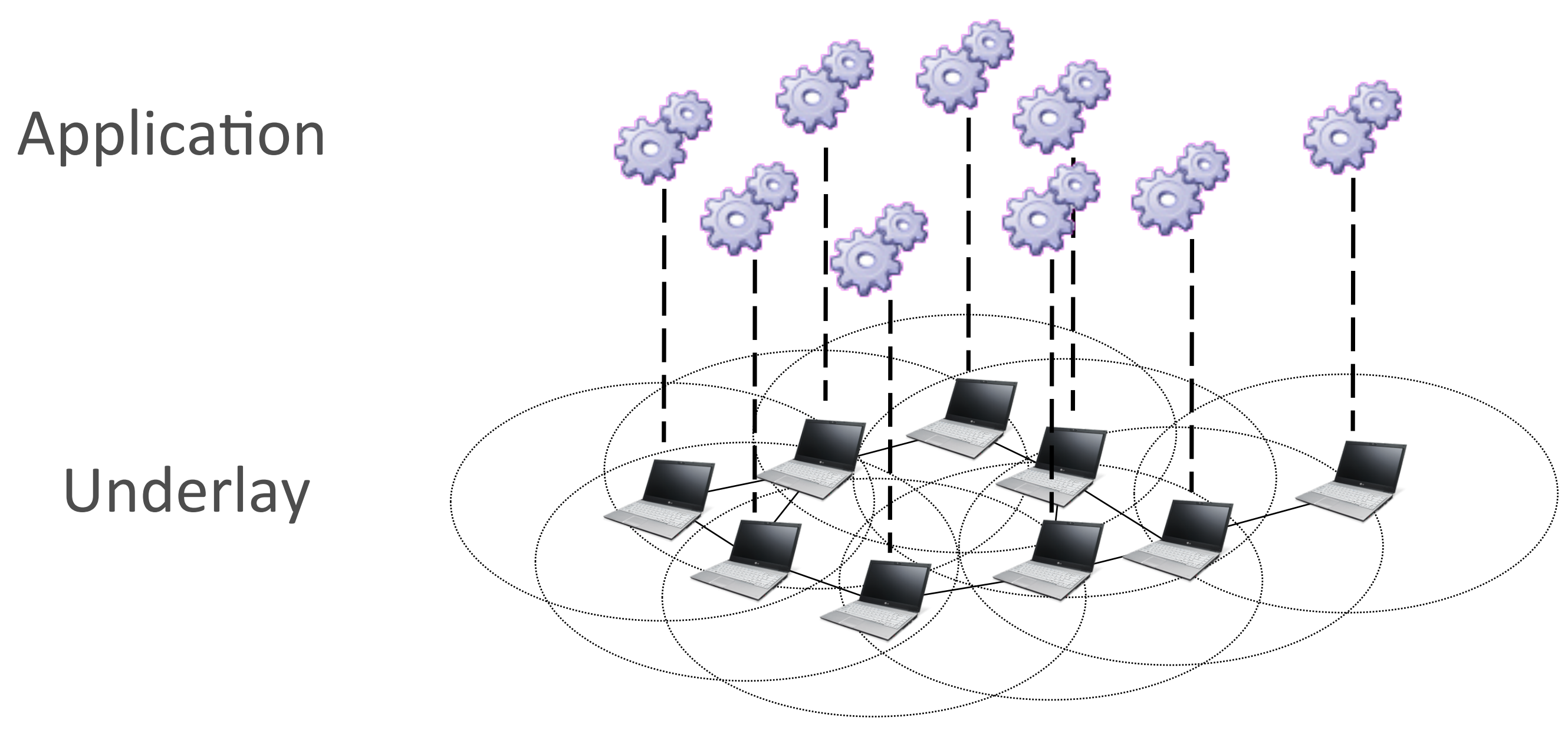
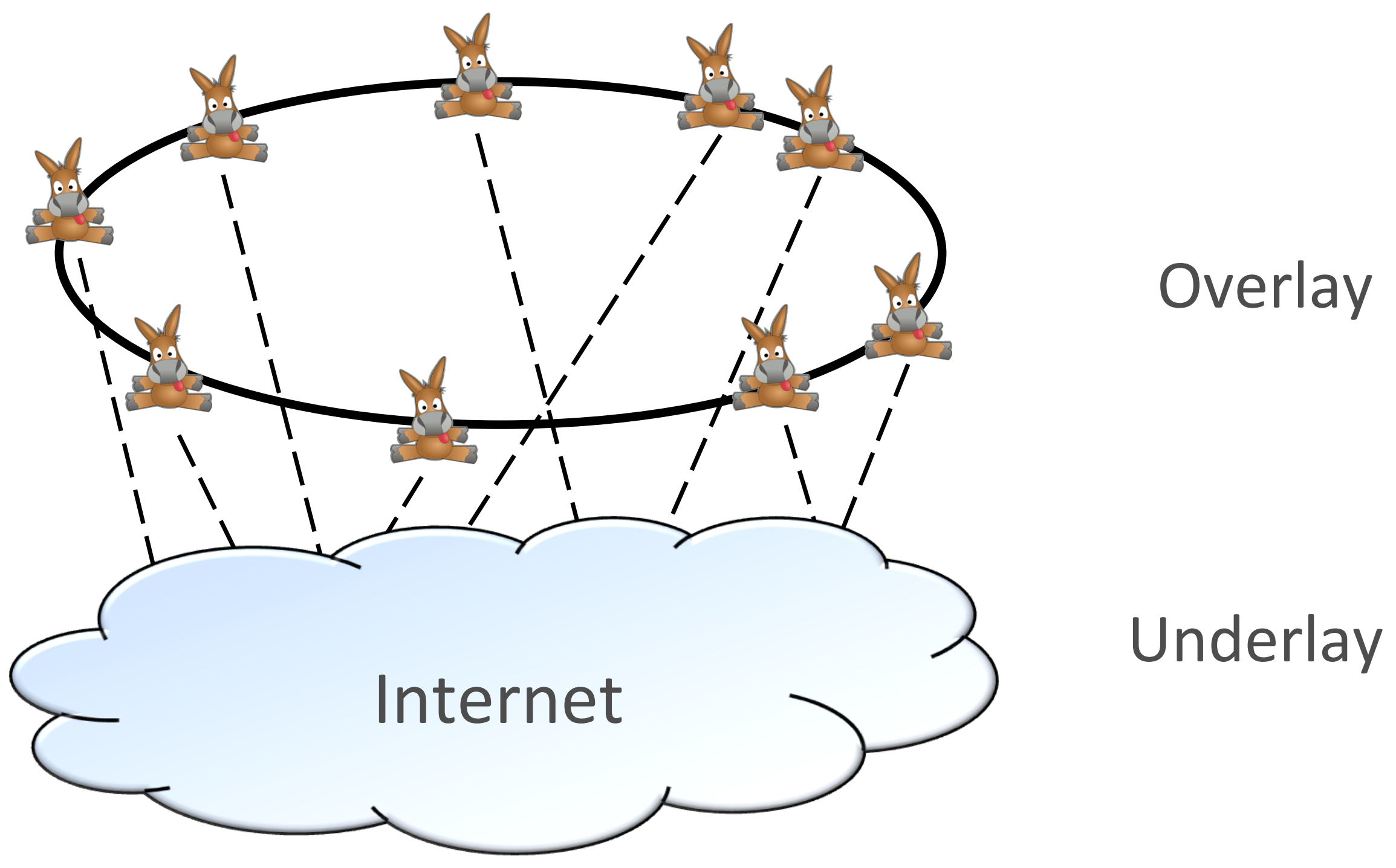
Mobile Ad hoc Networks

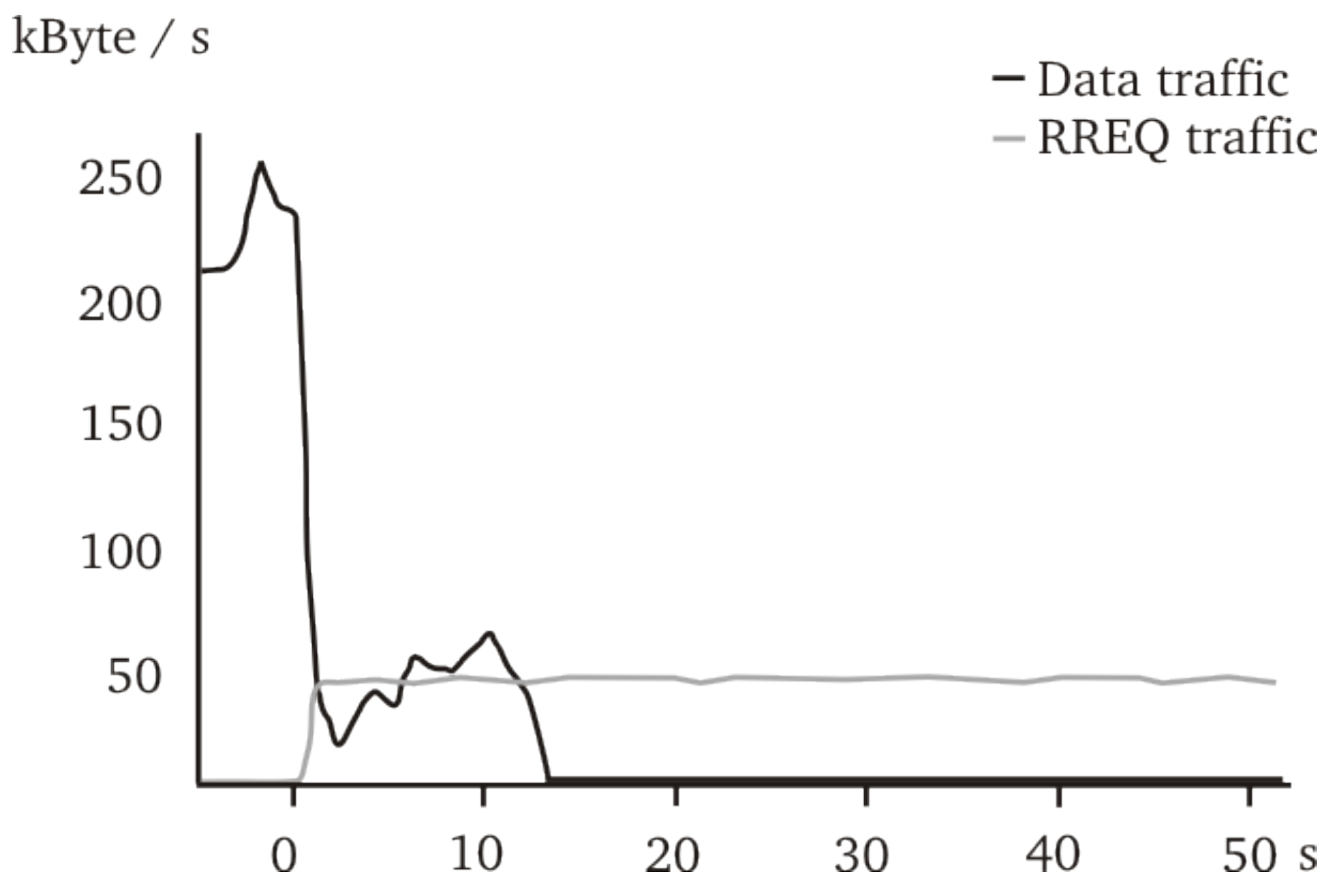
Peer-to-Peer Systems





Mobile Ad hoc Networks
- Establishing networks spontaneously
- Adapted routing algorithms required

Challenges
- Wireless communication
- Dynamic network topology
- Limited resources



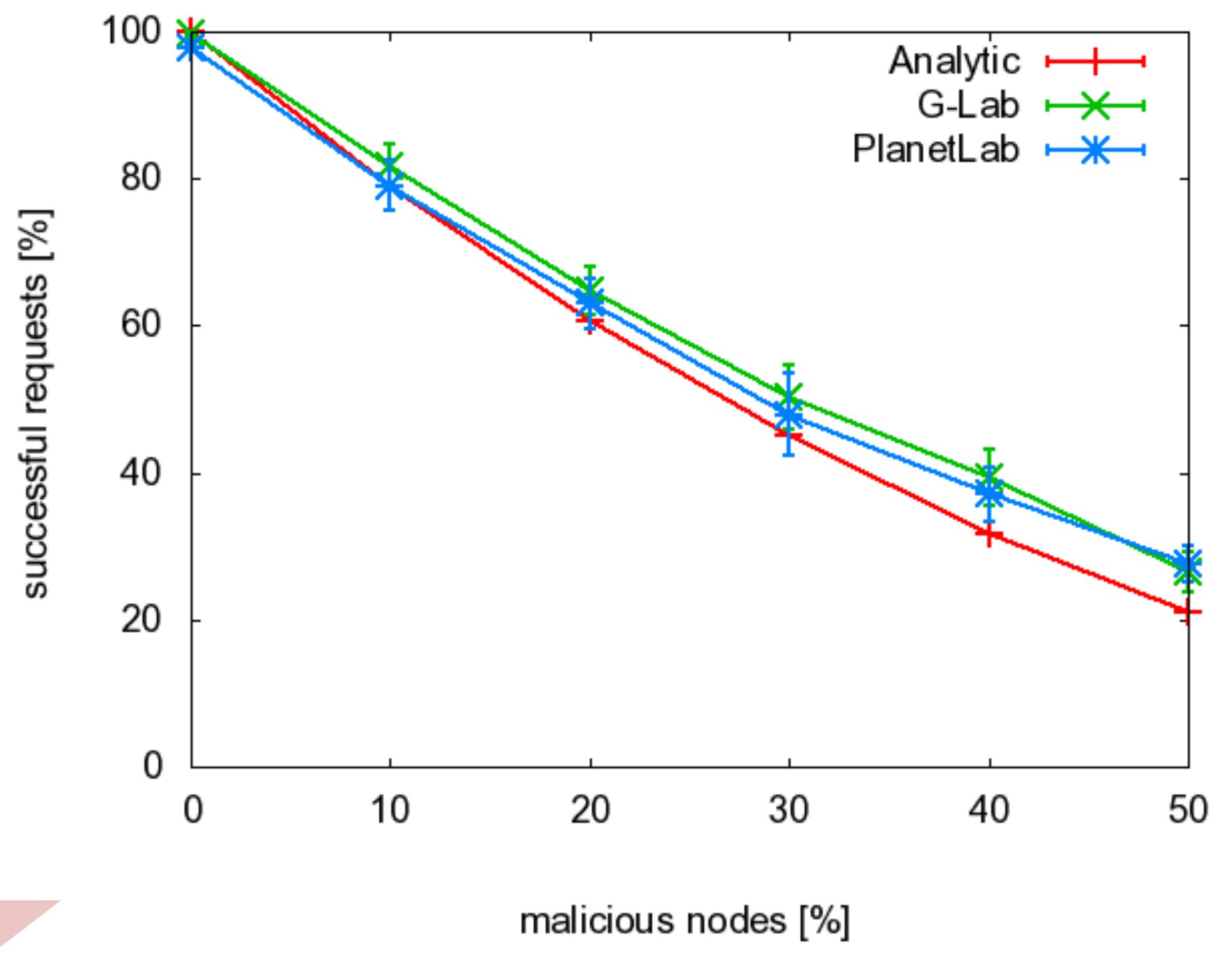
Route Request Flooding attack on a MANET

Vulnerable to multiple attacks
- Flooding attacks
- Loop Forming attacks
- Blackhole attacks
- ...

Security mechanisms
- Intrusion Prevention Systems
- Intrusion Detection Systems
- Intrusion Response Systems

Peer-to-Peer distributed hash tables (DHT)
- Decentralized and self-organized
- Scales well to the network size

Challenges
- Operation requires cooperation
- Decentralized nature, no coordinating instances



Incorrect Lookup Routing attack on a DHT

Vulnerable to multiple attacks
- Incorrect Lookup Routing
- Sybil Attack
- File Poisoning
- ...

Security mechanisms
- Robust routing based on redundancy
- Distribute replicas of stored objects

Mobile Peer-to-Peer

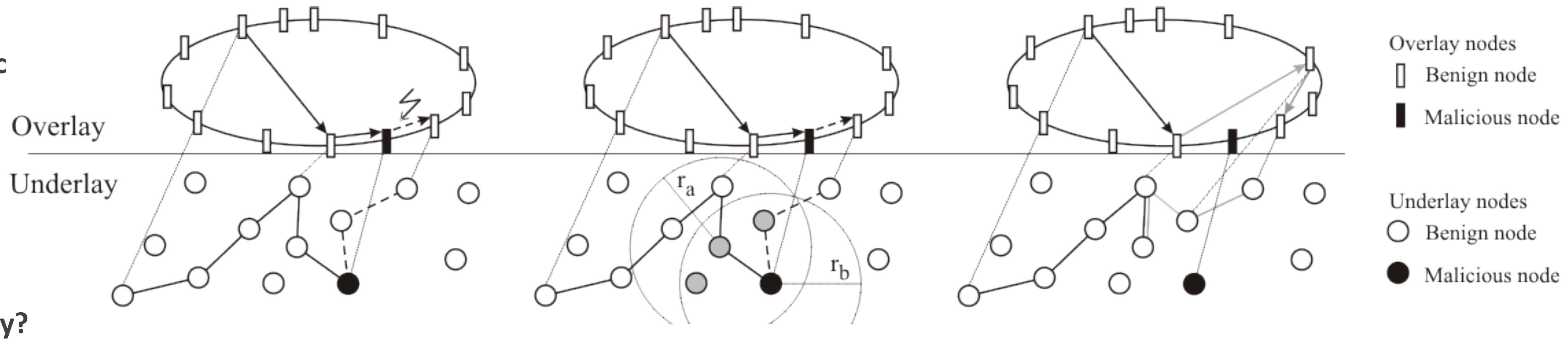
Mobile Peer-to-Peer Network
- Combining Peer-to-Peer and Mobile Ad hoc Networks

New challenges for the Overlay
- Strongly limited resources
- Dynamic topology

How to secure the Mobile Peer-to-Peer overlay?

Example: Incorrect Lookup Routing attack
- Traditional security mechanisms:
  - Iterative Routing
  - Redundant Routing
  - ...
- Based on redundancy
- Not applicable in Mobile Peer-to-Peer
  - Due to limited bandwidth

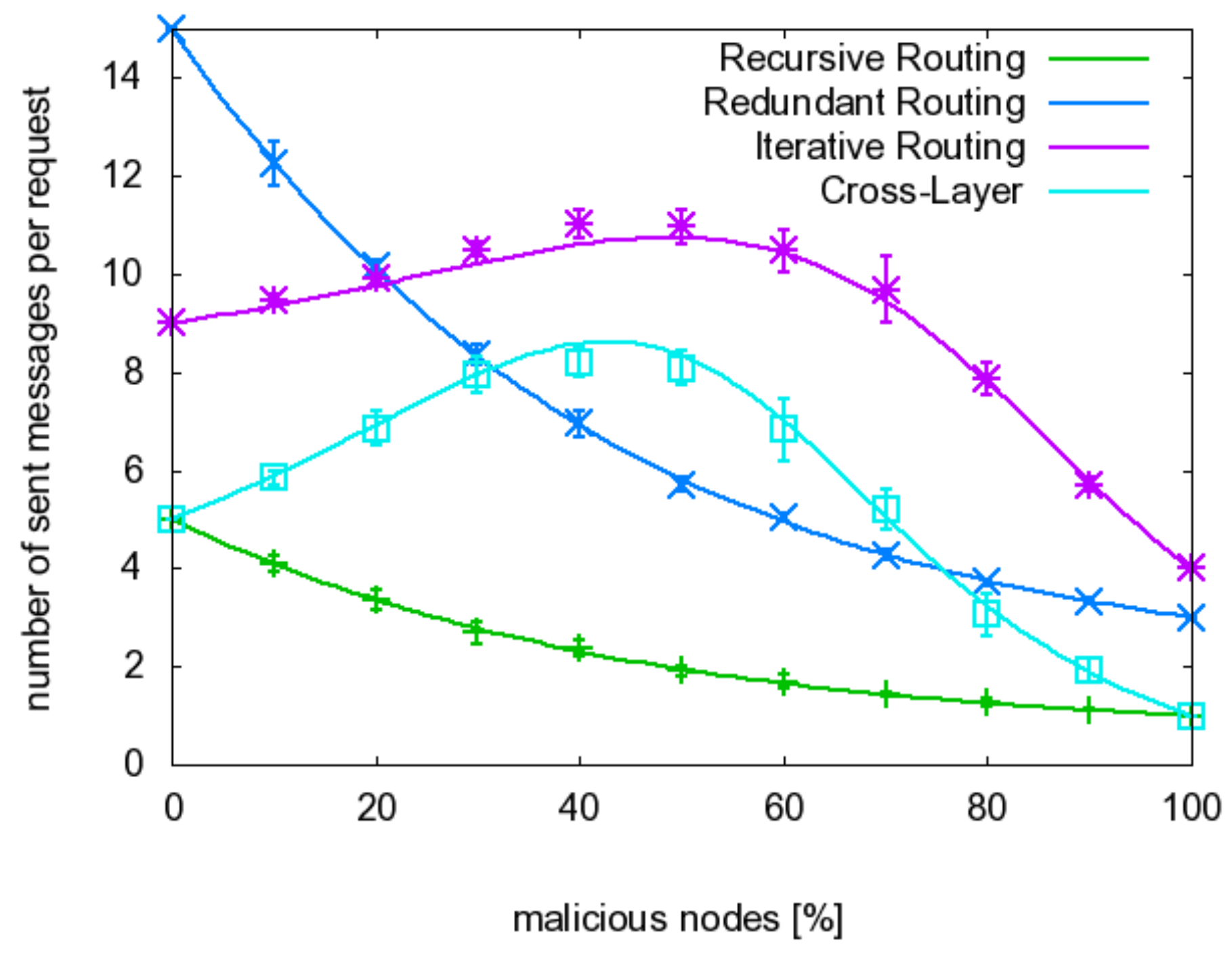
Cross layer approach
- Harness underlay information to detect malicious behavior
- Adapted underlay security mechanisms

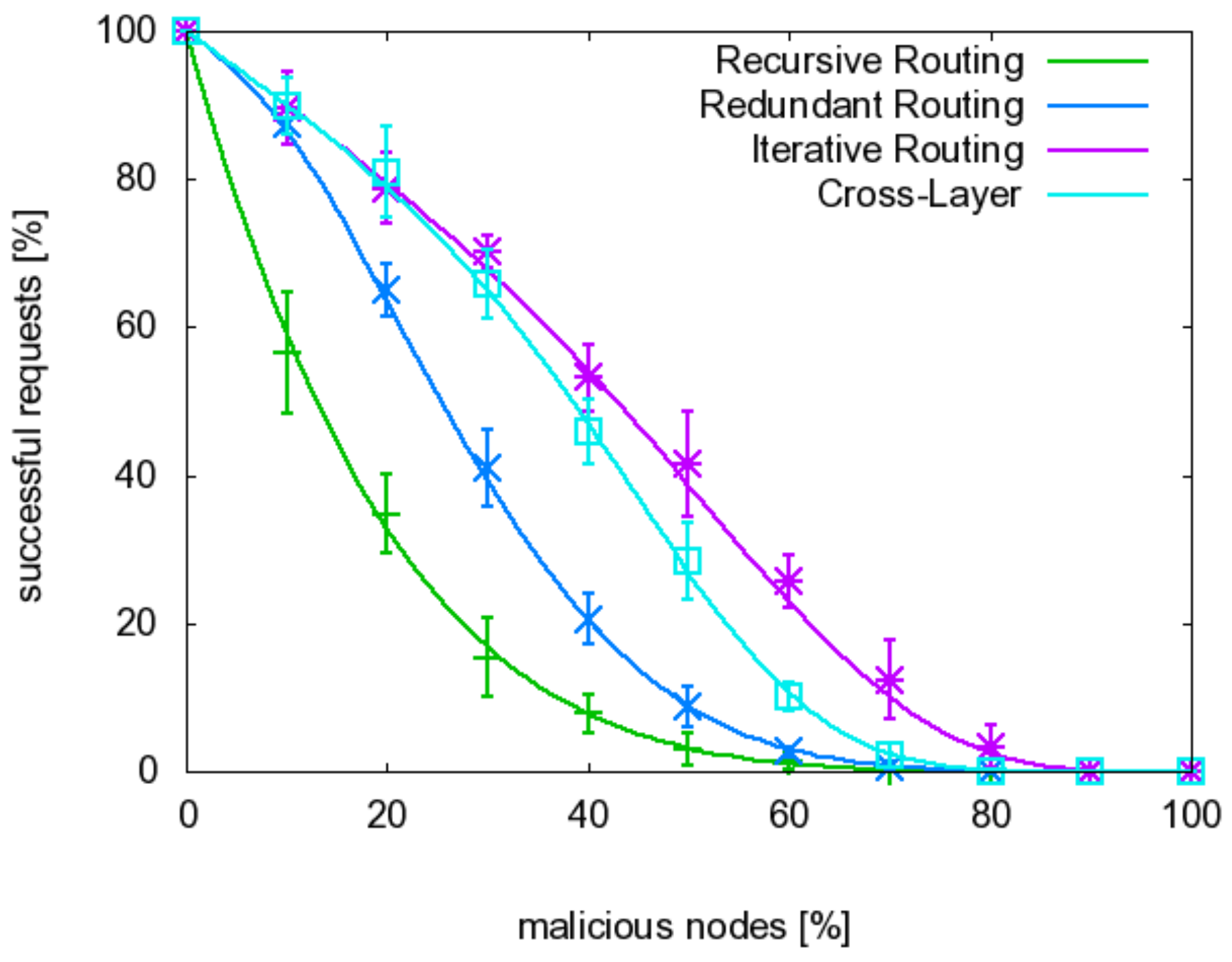


Malicious overlay node drops lookup request

Underlay neighbor nodes detect dropped lookup request

Underlay neighbor node informs previous intermediate overlay node


Recursive Routing
Redundant Routing
Iterative Routing
Cross-Layer
number of sent messages per request
malicious nodes [%]


Recursive Routing
Redundant Routing
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Cross-Layer
successful requests [%]
malicious nodes [%]