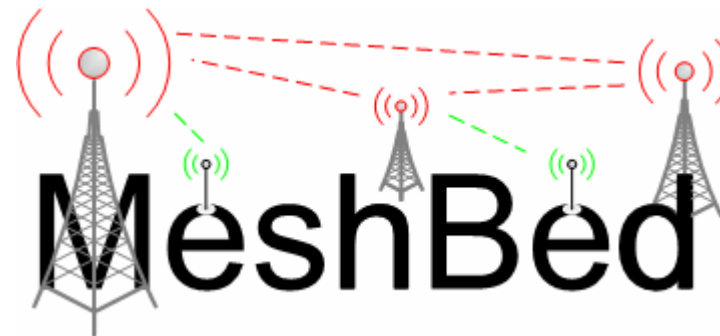


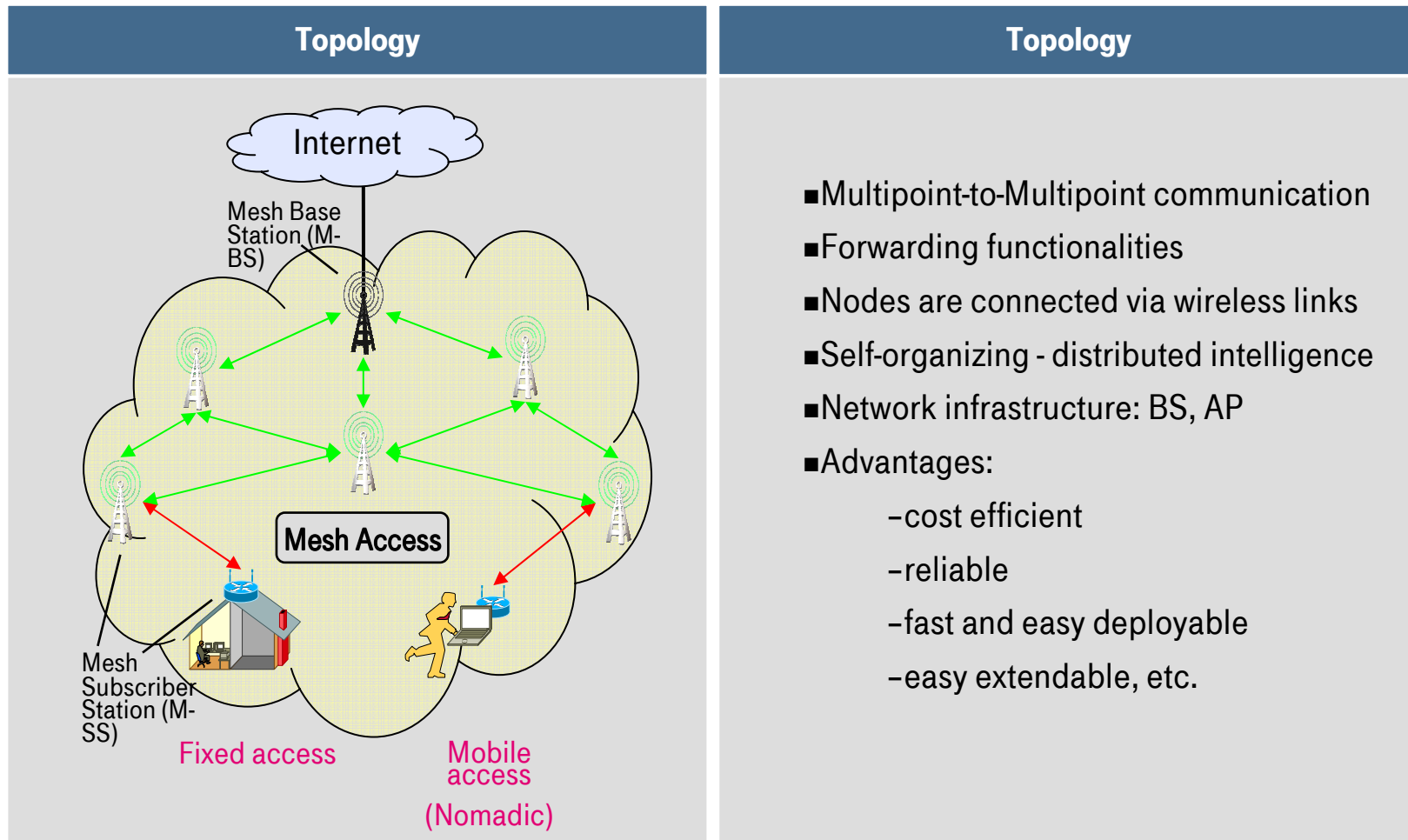
Mesh Multihop Testbed – MeshBed. VoIP over Mesh

Nico Bayer, Andreas Roos,
Paul Arnold, et al.



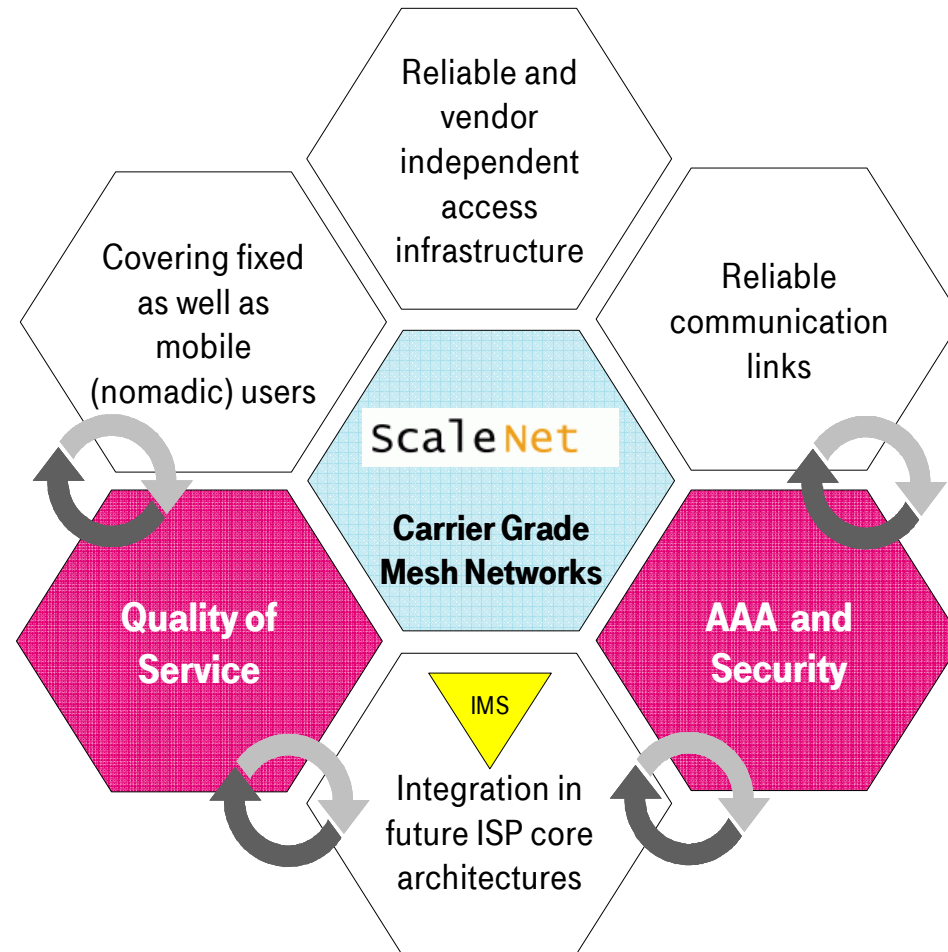
MeshBed

Scenario: Broadband Wireless Access



Mesh for Broadband Wireless Access.

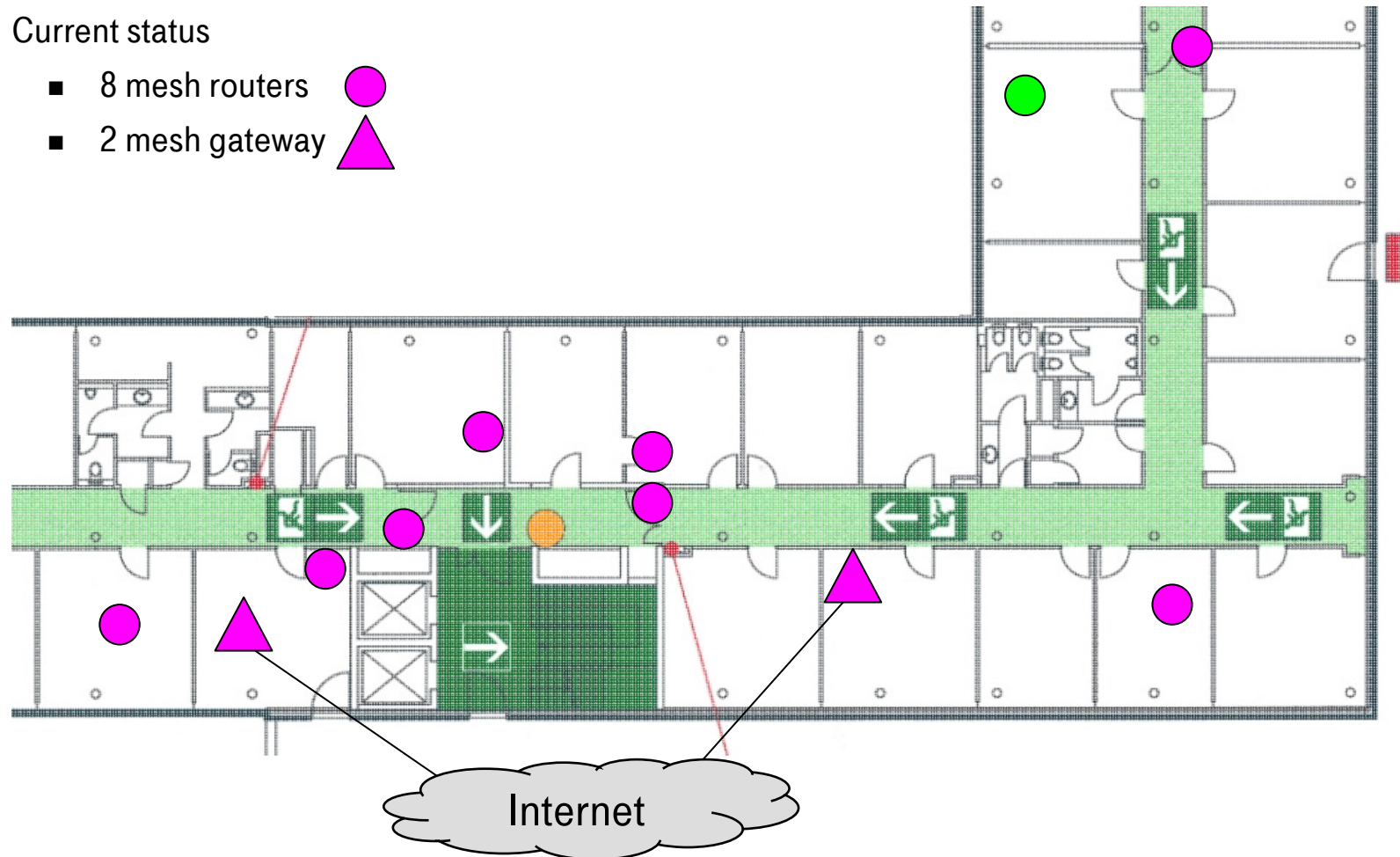
Challenges to achieve “carrier grade” services.



MeshBed. Infrastructure.

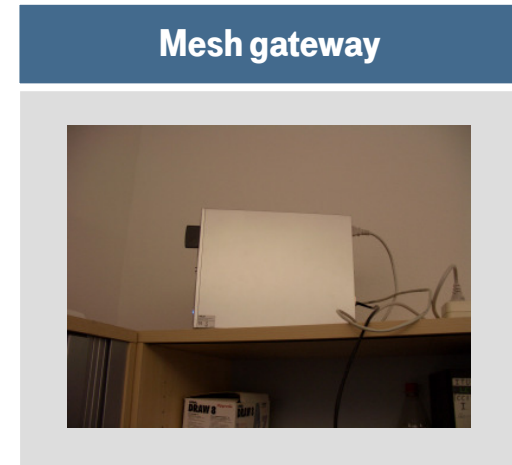
Current status

- 8 mesh routers ●
- 2 mesh gateway ▲



MeshBed.

Used Hardware.



- Embedded AMD Geode SC1100 266MHz System
 - 2 Mini-PCI Atheros WLAN interfaces incl. diversity
 - Indoor and Outdoor version
- Voyage Linux 06/06 (Debian based)
 - Adabted Linux distribution (about 64 MB)
 - Fully compatible with Debian Linux 3.1 (.deb)



- ASUS Barebones:
 - Atheros WLAN interfaces
- Debian GNU Linux 3.1 (Sarge) and SuSE 9.1

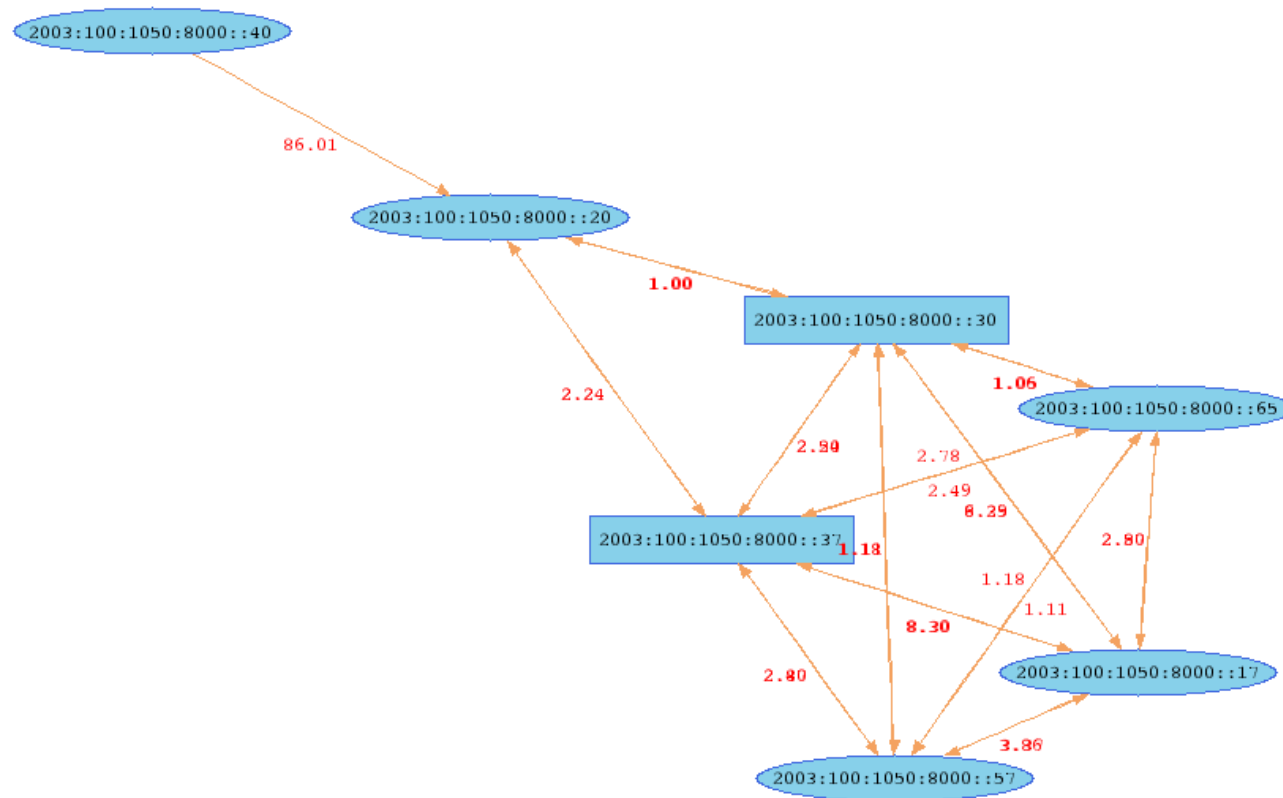


OLSR (Optimized Link State Routing protocol)

MeshBed. Monitoring tool.

Monitoring tool is based on information obtained by the routing protocol

- Displays links and link qualities

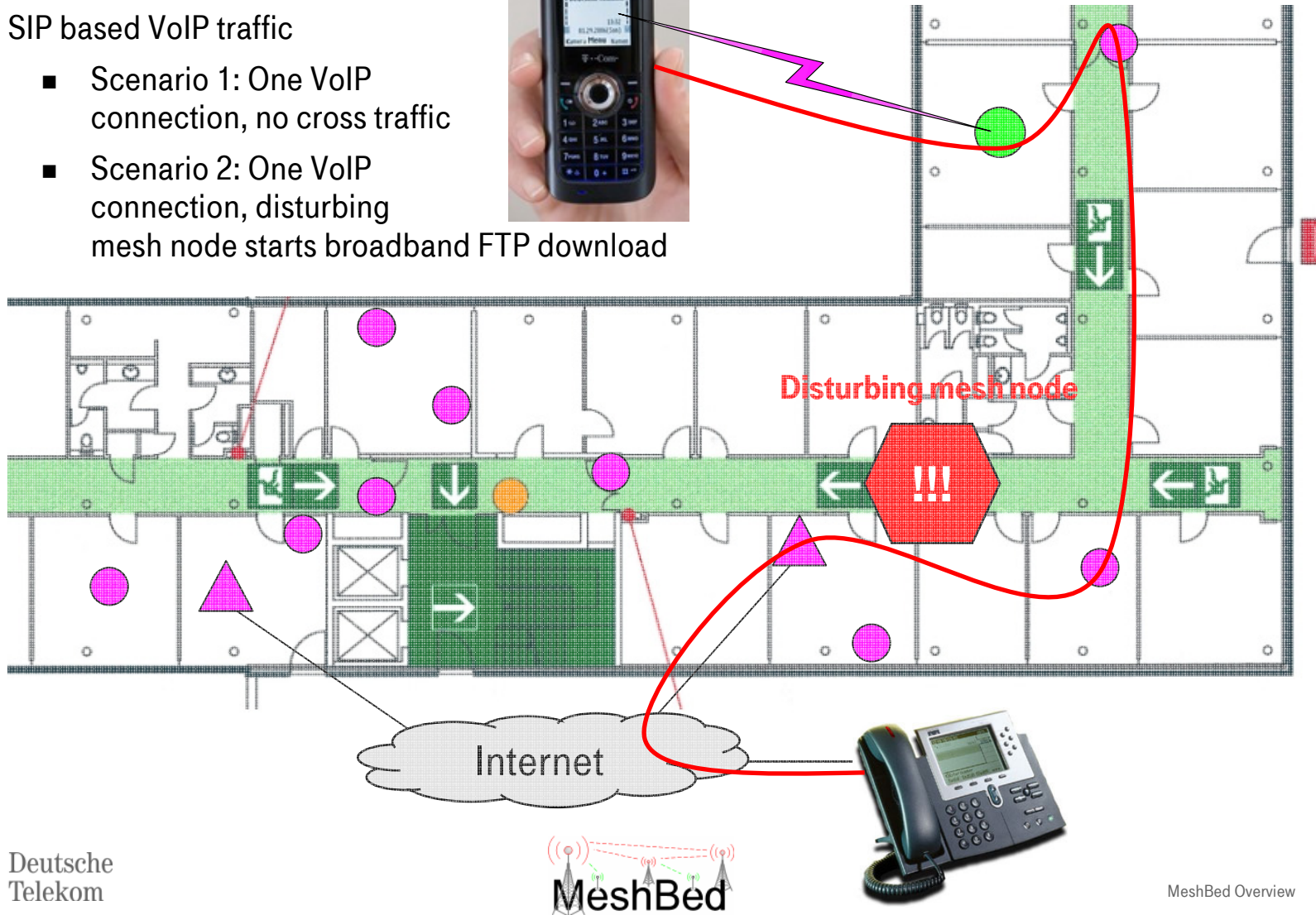


MeshBed.

VoIP performance.

SIP based VoIP traffic

- Scenario 1: One VoIP connection, no cross traffic
- Scenario 2: One VoIP connection, disturbing mesh node starts broadband FTP download



MeshBed.

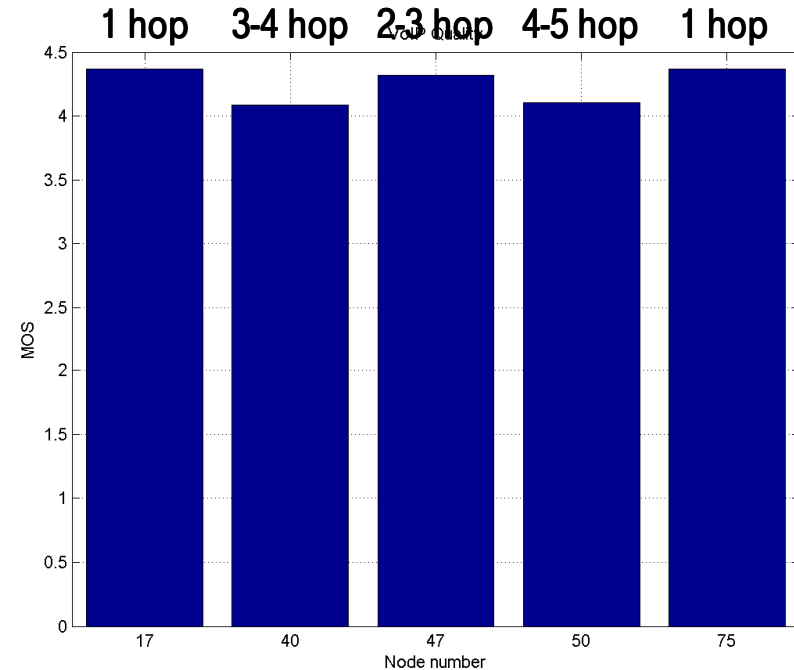
VoIP experience also reflected by measurements.

Quality meter: Mean Opinion Score (MOS)

- MOS ranges from 1 to 5

MOS (lower limit)	User satisfaction
4.34	Very satisfied
4.03	Satisfied
3.60	Some users satisfied
3.10	Many users dissatisfied
2.58	Nearly all users dissatisfied

- MOS calculation based on
 - One-way (network) delay, end-to-end delay, packetisation delay, jitter buffer delay, data loss



Application scenario – VoIP over Mesh.

State-of-the-art can not meet “carrier grade” requirements.

Mesh networks are able to provide VoIP communication with good quality

- Performance of mesh networks provides VoIP with good quality
- Unsolved issues:
 - QoS support → VoIP session can be interrupted by broadband data connections
 - Security issues → Wireless medium eases malicious attacks

Quality of Service provisioning

- Quality of service support in the mesh
 - MAC and routing layer investigations
- End-to-End QoS support
 - Integration with the overarching QoS control function
 - Enhancements of the Resource and Admission Control Subsystem (RACS)

AAA & Security

- Avoiding of malicious users
 - Mesh access control mechanisms
 - Integration in Network Attachment Subsystem (NASS)
- Mutual authentication between mesh stations