

Martina Umlauf



- PhD student at WIT, Technical Head, WP 4, EU Project Track & Trade
- Telecommunications Research Center Vienna (ftw)
- Master: Computer Science, Specialization: Computer Engineering
- **Research Interests:**
 - Wireless Computing and Telecommunications
 - Ad-Hoc Networks
 - Mobile Human-Computer Interaction and Usability for Mobile Devices.
- Thesis (working title): „Routing in Wireless Mesh Networks“



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EU Project Track & Trade



Idea:

- Taxis and fleet cars float among traffic like corks in a stream
- They use GPS and send their position to fleet management
- This already existing data can be used
- Data from several fleets can be combined

-> accurate picture of traffic situation

Project goal:

- Platform to collect, trade & publish this data

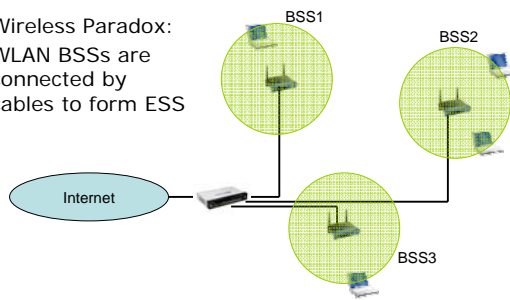


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Wireless Mesh Networks – Intro / 1



- Wireless Paradox:
- WLAN BSSs are connected by cables to form ESS

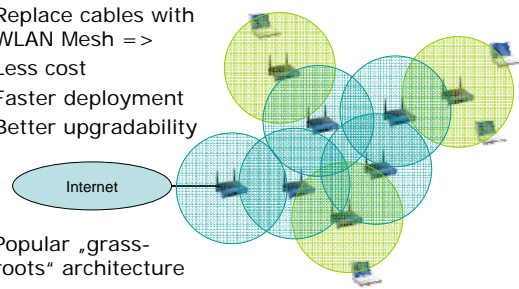


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Wireless Mesh Networks – Intro / 2



- Replace cables with WLAN Mesh =>
- Less cost
- Faster deployment
- Better upgradability



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Research Questions



But: many questions not answered yet:

- Influence on Internet protocols & applications?
- Wireless aware routing
- Cross-layer interactions / optimizations
- Metric for user perceived performance

Approach:

- Ant-based Routing Algorithm /w cross-layer opt.

Method:

- Simulation /w ns-2 Network Simulator



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Ant-based Algorithms / 1



- Inspired by nature: behavior of ants
- Single ants are quite stupid, but the whole system exhibits „intelligent“ behavior
- Ant Colony Routing (ACR) – distributed version of Ant-based Algorithm, eg.: **AntNet** by Di Caro and Dorigo, 1998
- **AntHocNet** for MANETs by Di Caro, Ducatelle, Gambardella, 2004:
 - AntNet concept + Extensions
 - Hybrid routing approach: reactive/proactive



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Ant-based Algorithms / 2



1. Whenever an ant moves, it lays a pheromone trail
2. To find its way, an ant:
 - Follows existing trails if there are any. Probability for choosing a trail is proportional to amount of pheromone on the trail.
 - Walks randomly if there are no trails.
3. Pheromone evaporates over time -> unused trails vanish.

- **Trail following (state transition rule)** determines how the ant chooses its way depending on link cost and amount of pheromone found on the trails
- **Trail laying (pheromone update rule)** determines how the pheromone is updated
- **Evaporation (evaporation rule)** determines how fast pheromone evaporates



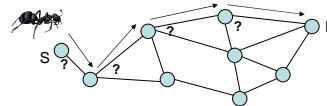
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AntNet / 1



- Forward ants: regularly created, choose next link based on transition rule:

$$P = \text{Trans}(\text{pheromone}, \text{link cost})$$

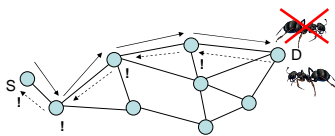


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AntNet / 2



- Backward ants: created when forward ant reaches destination node, travels back to from where it came, updates pheromone amounts and measured links costs at all nodes on way back



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Proposed Algorithm



- Based on AntNet concept
- Probably proactive routing approach, maybe hybrid but proactive/reactive
- Use cross-layer info to determine link costs
- Reduce number of ants by observing TCP traffic in the network (possible?)



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Publications



- Martina Umlauf: **Relay Devices in UMTS Networks - Effects on Application Performance** (Poster). Proceedings of the IFIP Fifth Annual Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net 2006), June 2006, Lipari, Italy.
- Martina Umlauf: **Web Performance in a Hybrid Ad hoc Network based on UMTS** (short paper). Proceedings of the 14th International Conference on Telecommunication Systems - Modeling and Analysis (ICTSM 2006), October 2006, Reading, PA, USA.



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