

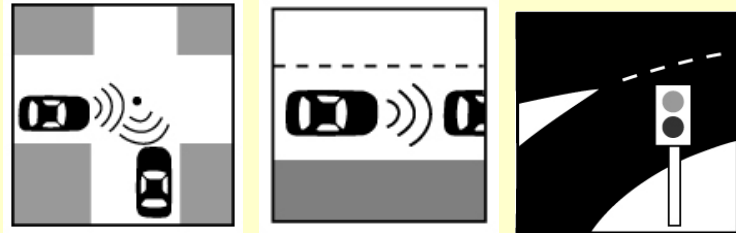
Geo-Cooperative Protocols for Dense, Highly Mobile Networks

Marco Gruteser

Why Location-Aware Networking?

- “The Revenge of Geography”
 - While at first, the Internet seemingly shrunk distances, As we increasingly intertwine physical and virtual world, geography remains important
 - Low cost localization (GPS system-on-a chip ~\$5-10)
- Can also improve network protocols
 - High node densities
 - Highly mobile systems
- Research Challenges
 - Exploiting location to enable opportunistic forwarding in highly mobile networks
 - Integration into network architecture
 - Testbed infrastructure

Automotive safety



Mobile Sensing (e.g., Traffic Information)



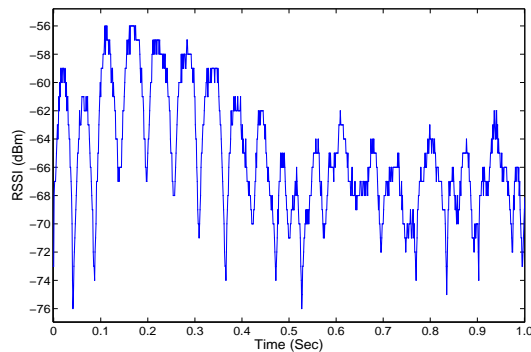
Automotive Safety Challenges

- Next generation safety applications need reliable, higher bandwidth communications
- Challenges
 - High node density
 - Severe fading channel due to obstructions and low antenna heights

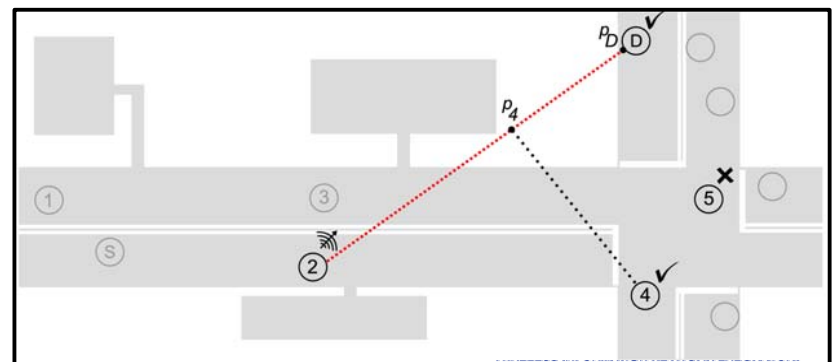
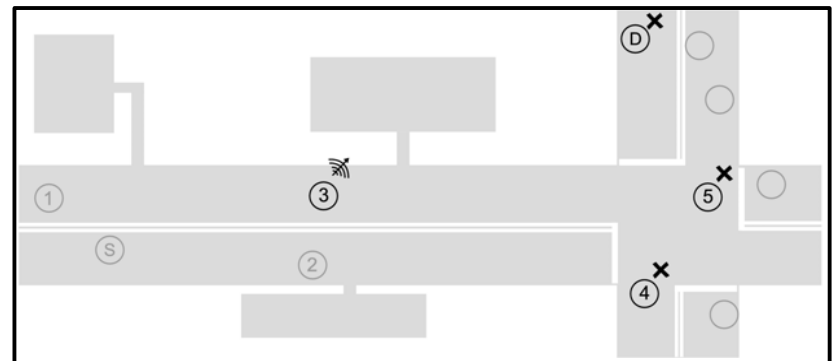
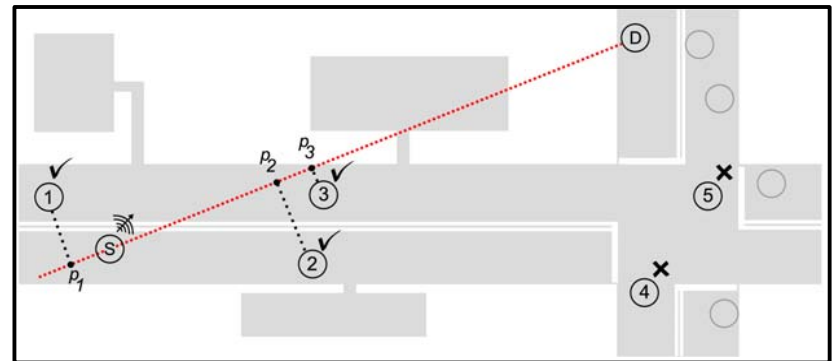


Geo-Cooperative Forwarding

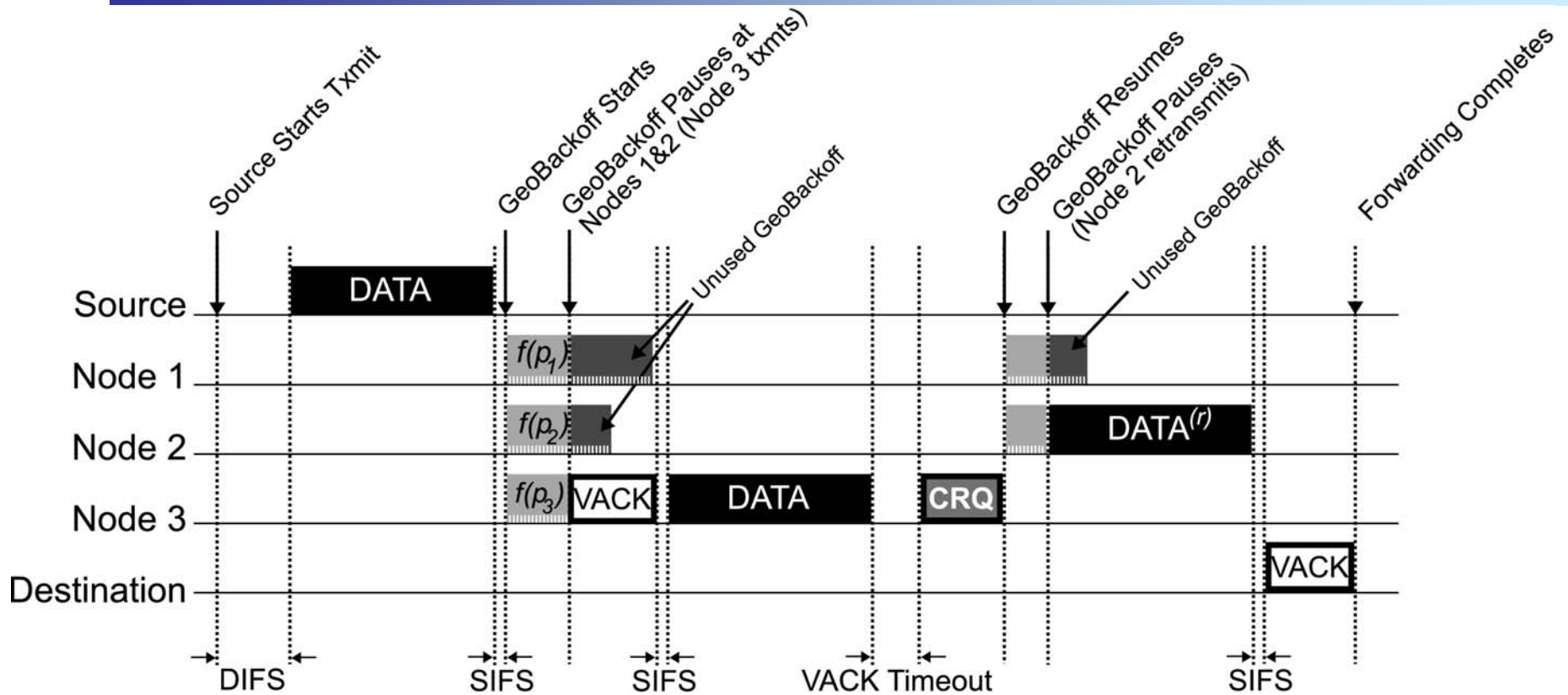
- Highly-time varying channels (shadow fading)



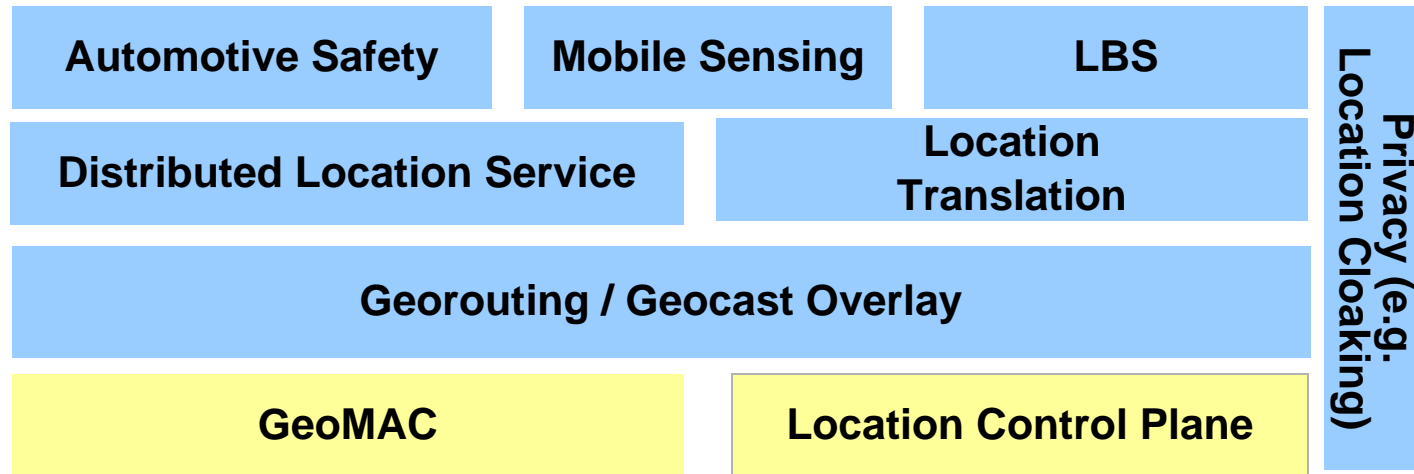
- Traditional routing selects next hop prior to transmission
 - too slow for fast link changes
 - Need more opportunistic protocols not based on static link assumption
- Geobackoff for selecting next-hop from successfully received nodes: Receiver Diversity, and cooperative ARQ



Sample Implementation at MAC Layer



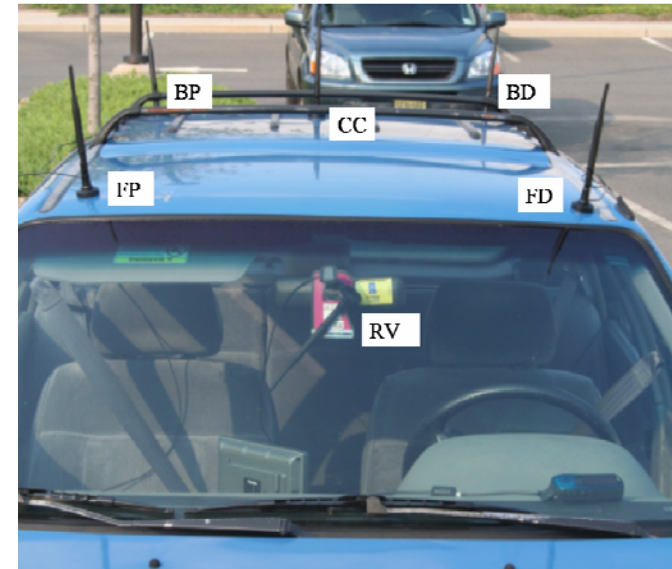
Towards a Geometric Network Stack



- Location information can provide lightweight topology information for opportunistic protocols
- Requires local dissemination of location information

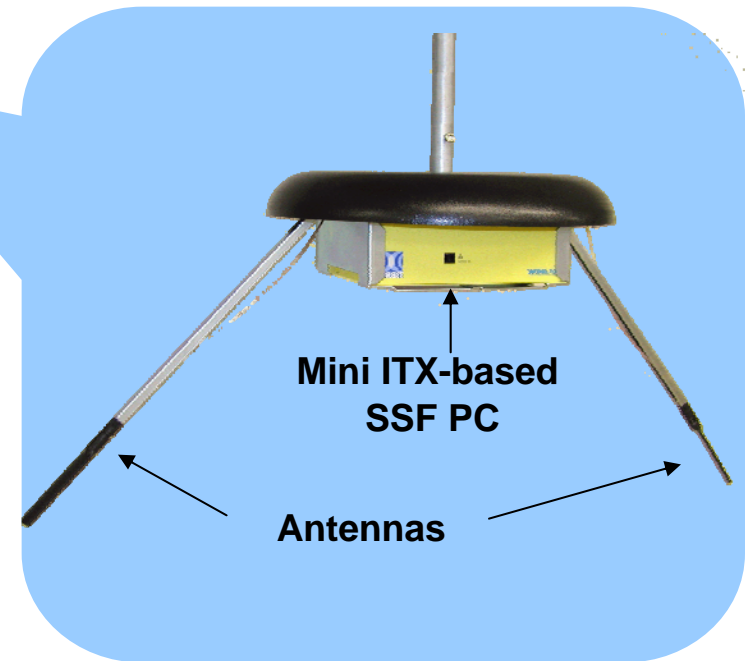
Mobility Testbed: Vehicle Equipment Setup

- ORBIT node
 - Node : Linux 2.6, 1-GHz VIA C3CPU, 512 MB of RAM, and a 20 GB local hard disk
 - Wireless : Two IEEE 802.11a/b/g based on the Atheros 5212 chipset.
 - Location : Garmin eTrex GPS



- Antenna mounting, vehicle type significant
- Only few vehicles available

Testbed for Dense Networks



- ORBIT: 400 nodes in 20m x 20m– two 802.11 radios each (atheros and intel-based)
- Challenge: Emulate a degree of mobility

Research Directions

- Opportunistic forwarding in highly mobile environments (exploiting location information)
- Architecture of network stack for integrating location and opportunistic protocols
- Testbed infrastructure to support experiments in dense, highly mobile networks

Questions?

