Introduction to Opportunity Driven Multiple Access (ODMA)

Source:

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Outline

- ODMA Concept
- ODMA Infrastructure Configurations
- ODMA Probing and Route Acquisition
- Lesson Learned from ODMA
- Routing Strategies for MANET

ODMA Concept

- ODMA
  - A communications relaying protocol proposed for UMTS TDD mode
  - Introduced at ETSI SMG2 in 1996
  - Aim at increasing the range of high data rate services
  - Each relaying node
    - must be within the planned coverage of the cell
    - may receive essential L1 sync. information

ODMA Border Coverage

High Bit Rate Data TDD Coverage

Low Bit Rate Data TDD Coverage

Border Region

NO coverage

TDD ODMA

High Bit Rate

TDD ODMA

High Bit Rate

ODMA TERMINAL

Layer 1 Synch Information
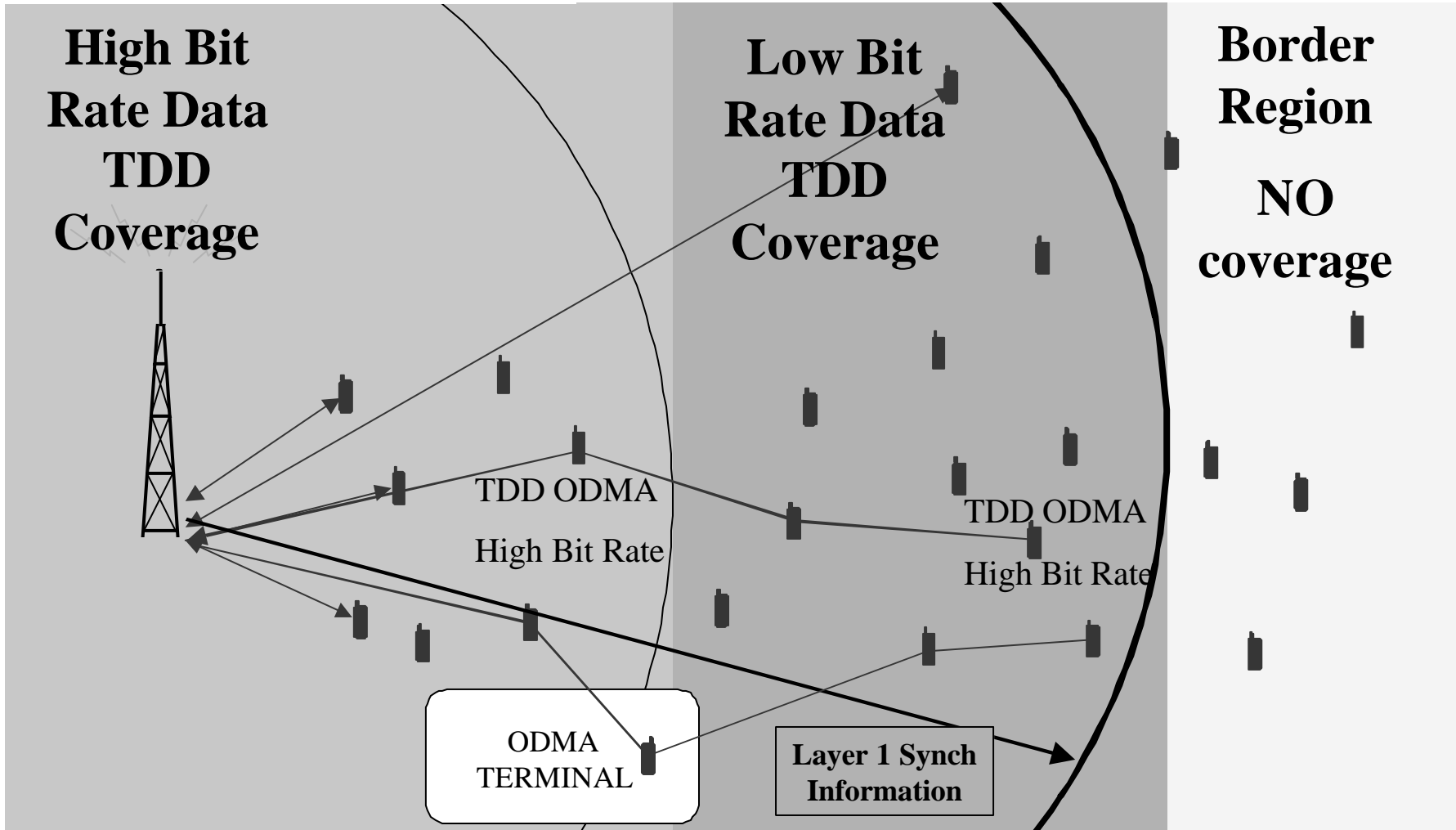
ODMA Infrastructure Configurations

- ODMA configurations:
  - Systems with integrated TDD/ODMA NodeB
  - Systems employing last hop Gateway ODMA relay nodes

ODMA with integrated TDD/ODMA NodeB

High Bit
Rate Data
TDD
Coverage

FDD/TDD
ODMA
TERMINAL

Low Bit
Rate Data
TDD
Coverage
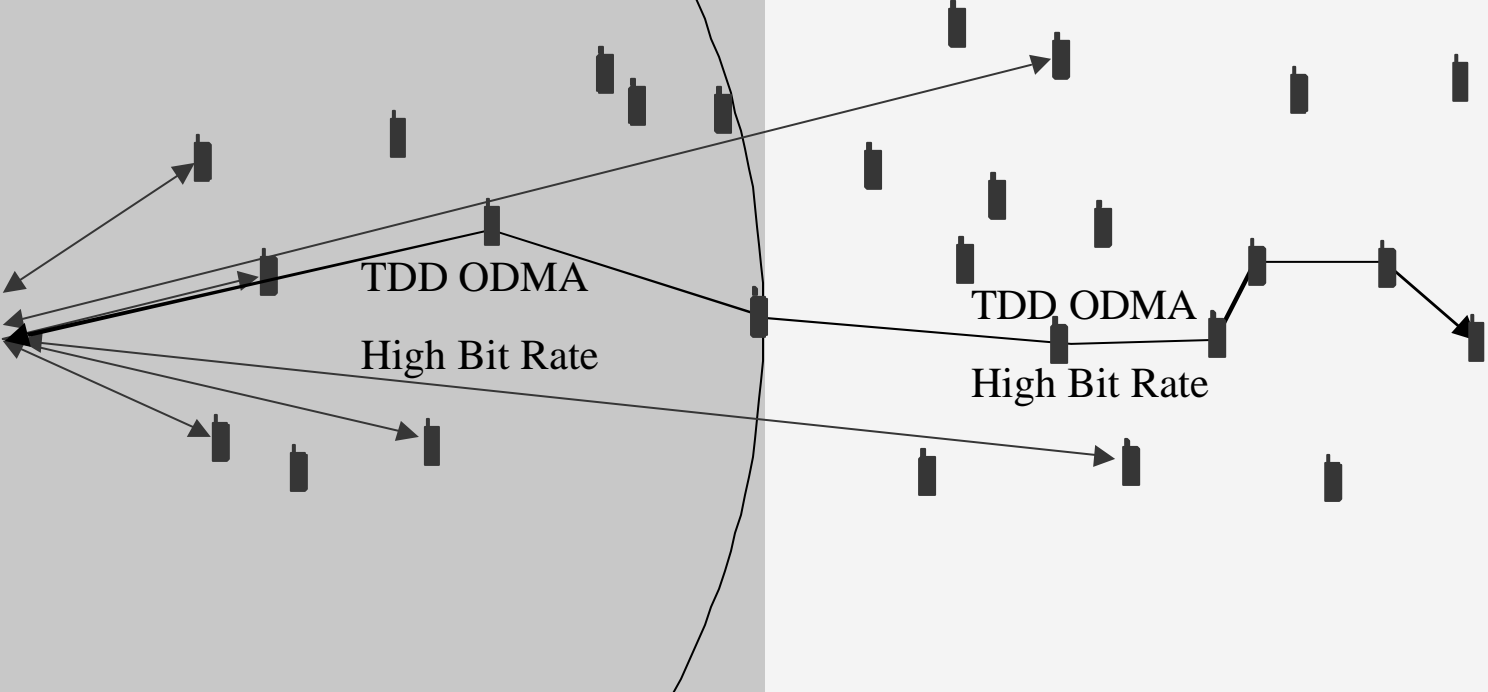
TDD ODMA

High Bit Rate

TDD ODMA

High Bit Rate

ODMA with last hop

High Bit Rate Data FDD Coverage

Low Bit Rate Data FDD Coverage

FDD TERMINAL

FDD/TDD ODMA TERMINAL

Conventional FDD

High Bit Rate

TDD ODMA

High Bit Rate

PIPE

GATEWAY ODMA Relay Node (SEED)
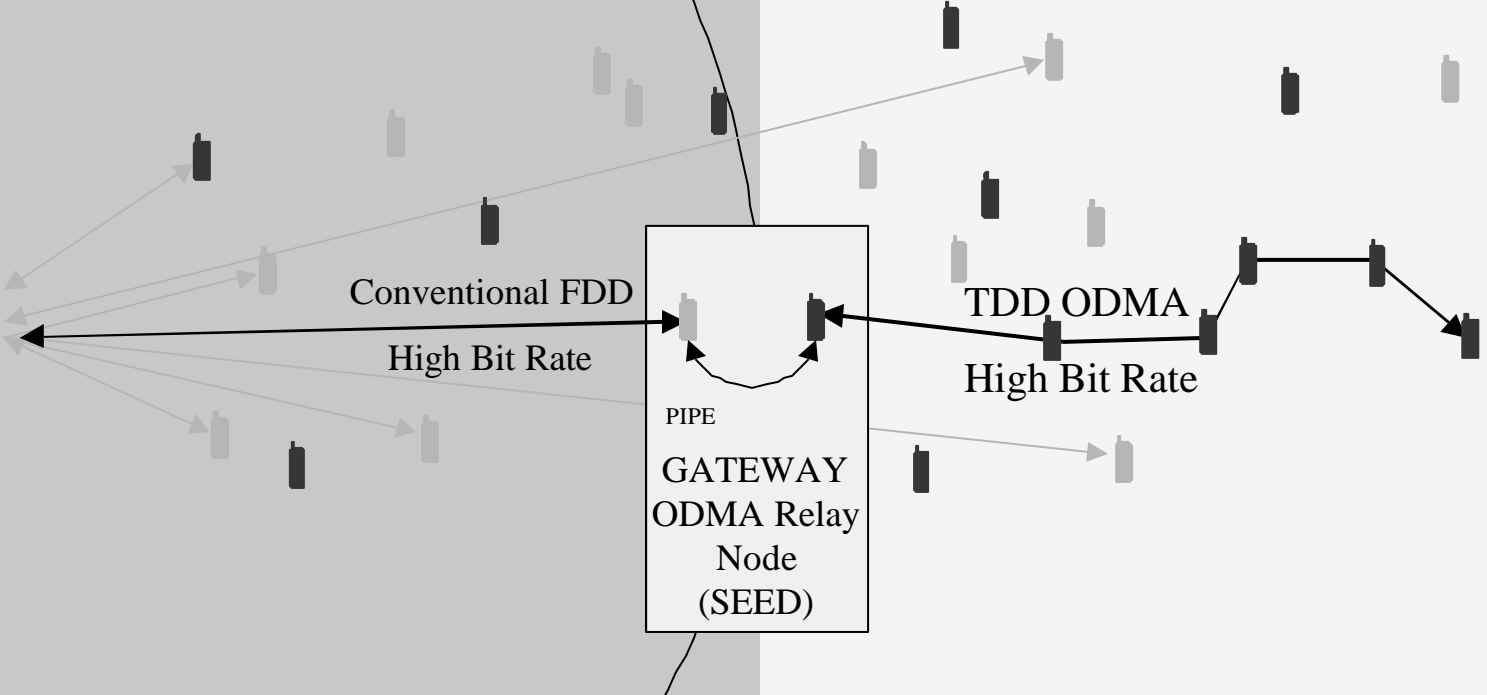
ODMA Probing and Route Acquisition

- Probing
  - a mechanism used by a relay node to build a neighbour list
  - It is defined within the idle mode cell selection
- Relays' probing activity levels are influenced by
  - Number of neighbours
  - Gradient to the base information of the neighbours
  - Speed of the terminal
  - Battery power level
- Three probing states:
  - full probing,
  - duty maintained probing,
  - relay prohibited.

UE$_R$s with different probing states

SEED
Full probing

UE$_R$ High battery level
Duty Maintained probing

Standard
TDD

Root UE$_R$

Gateway UE$_R$

NODE B

Vehicle-mounted
Full probing

UE$_R$ Poor battery level
Duty Maintained probing
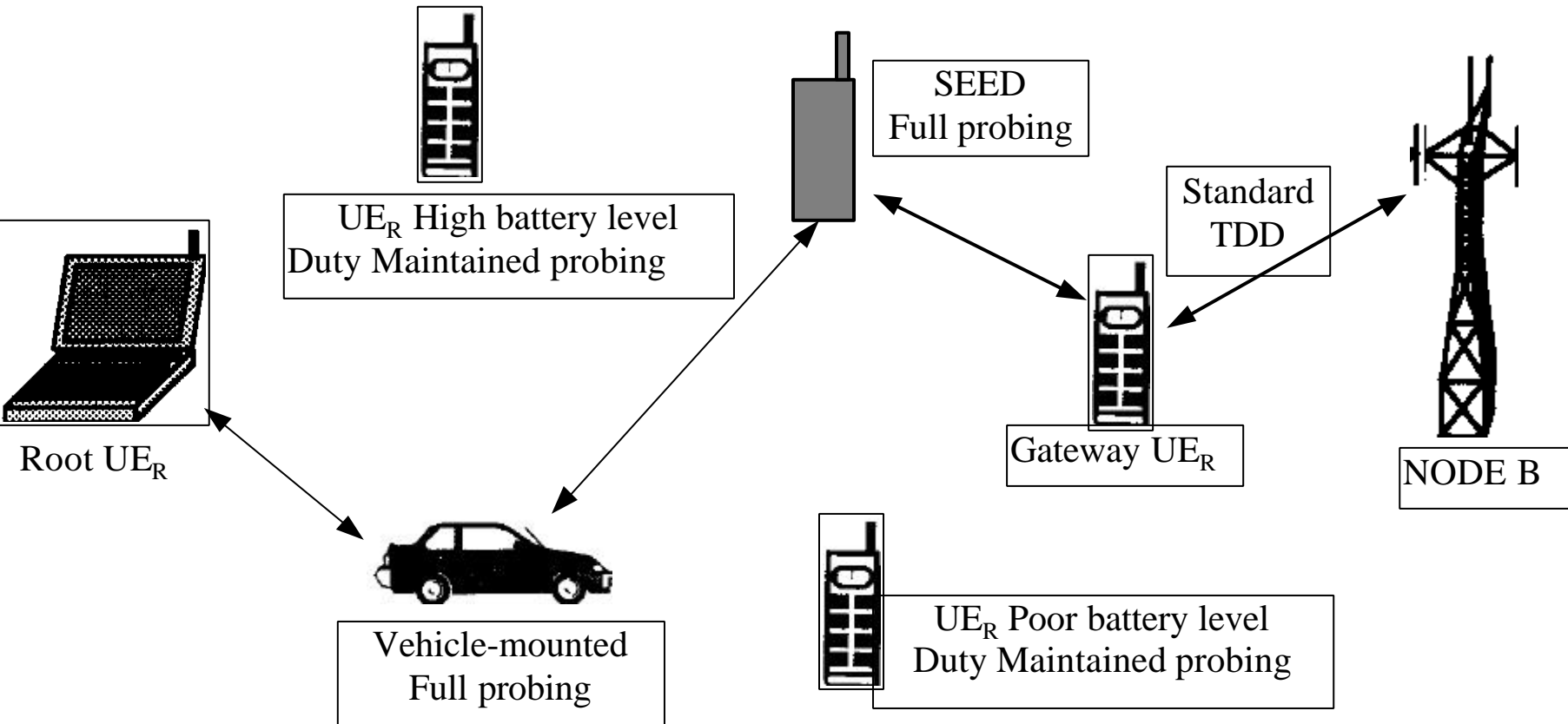
ODMA Idle Mode Procedures

- ## Neighbour gathering
  - Uses background probing messages to get local connectivity of an ODMA relay node
  - Neighbour information → Gradient tables → End-to-end connectivity
  - Ex.
    - Vodafone: 3GPP TSGR2#2(99) 179, 180 [2.3]

Lesson learned from ODMA

- Only draft idea is proposed, lots of issues are left for further study.
- ODMA was dropped by 3GPP R'99, as a result of concerns over complexity, battery life of users on standby, and signaling overhead issues [4].
  - Routing is one of the key issues

Routing Strategies for MANET

- Proactive routing:
  - discovers and maintains routing tables via probing
  - is not applicable for cellular systems adopting a discontinuous reception (DRX) functionality
    - SS will move to SLP mode for saving power and thus, the probed information would be obsolete.

Routing Strategies for MANET

- Reactive routing:
  - Floods route request (RREQ) to discover a best route
  - Need to consider [5]
    - Number of flooded RREQ
      - Complete flooding: e.g., DSR
      - Scoped flooding: e.g., AODV
    - Transmission power used to forward the RREQ
      - TX power of SS is very high
    - Hop-count limitation of the RREQ

Conclusion

- A proper routing mechanism is required if mobile RS(s) is applied.

- Need to know the price paid for the expected performance gain!

Reference

[1] 3GPP, "Opportunity driven multiple access," 3G TR 25.924, v. 1.0.0, Dec. 1999.

[2] 3GPP TSG RAN WG2 Tdoc TSGR2#2(99) 179 "ODMA routing with procedures for mobile originated calls, mobile terminated calls, and location update", Vodafone, March 8-11, 1999.

[3] 3GPP TSG RAN WG2 Tdoc TSGR2#2(99) 180 "Routing control information in an ODMA relay node", Vodafone, March 8-11, 1999.

[4] T. Rouse, I. Band, and S. McLaughlin, "Congestion-based routing strategies in multihop TDD-CDMA networks," *IEEE Journal on Selected Areas in Communications*, vol. 23, issue 3, pp. 668-681, 2005.

[5] Ray-Guang Cheng, Shin-Ming Cheng, and Phone Lin, "Power-efficient routing (PER) mechanism for ODMA systems," *IEEE International Conference on Wireless Networks, Communications, and Mobile Computing (WirelessCom)*, June 2005.