Multicast-Protocoll for connecting wireless Cells

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The trend to increase the bit-rates of wireless LANs will lead to very small radio-cells, so called pico-cells. This trend follows clearly from the use of high radio frequencies (the higher the radio frequency the worse is the wall penetration), the tendency to limit the sending power (to save the batteries and avoid electromagnetic pollution) as well as tendency to spacial reuse of frequency. In addition a decrease of the number of mobile stations per radio-cell is achieved, which improves the performance of the multiple access protocols. The coverage provided by a single pico-cell will definitely not be sufficient for a LAN. One approach to achieve the desired coverage is connecting a group of pico-cells by a wired backbone, with unconstrained support of mobility among the connected pico-cells. A mobile host must be able to move from one cell to another (handover) without decreasing the supported quality of the transmission. What we require is assuring a possibly continuous, time bounded and relatively reliable service in spite of relatively frequent handovers.

The following topology (similar to IEEE 802.11) is assumed: A particular wireless LAN consists of SEVERAL pico-cells (pC). Each pC has a base station (BS). All BSs are interconnected by a LAN-techniques with high bit rates and low error rates. The wireless LAN is connected to other networks by a Portal. A mobile host (MH) might be within a pC. During a transmission from one pC to another a handover occurs.

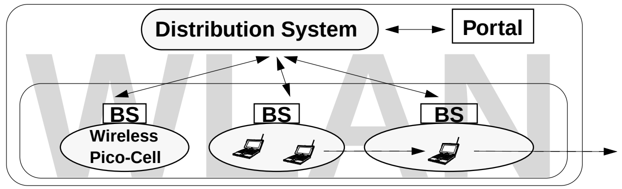
Terminal mobility is usually supported by the network layer (i.e. Mobile IP) or by the transport layer (i.e. ITCP). However within a single LAN, as defined above, a support for terminal mobility within the data link layer seems to be very attractive. In this paper we will focus our presentation on the latter alternative. We have described a multicast data link layer protocol enabling effective handover management and causing little overhead on the wireless side. In fact during a pC- transition a nearly uninterruptible service can be provided. A handover is undetectable for the higher layers. Problems which might occur because of the use of multicast protocols, like misordering, loss or duplication of packets are successfully avoided. Thus a more reliable service can be achieved.

The basic idea is, that after a packet was transmitted to the BS of the receiving MH, the same BS transmits the packet to the adjacent BS. So if a pC-transition took place the MH will immediately receive the next packet from the new base station. An adjacent BS can be assigned to another BS either statically or dynamically. The multicast group membership is defined depending on the MHs direction of movement or the actual physical cell topology (doors, etc.).

We identify two classes of approaches: with explicit registration of a MH at a BS and without such registration (searching is used instead). In the workshop we present a hybrid variant with registration of the MH at the BS and searching of MH between BS.

Introduction

- small wireless cells may have disadvantages and advantages
- reach LAN-dimensions by
  - ~ Forwarding
  - ~ Network-Layer-Functionality, one small cell per WLAN (e.g. Mobile IP)
  - ~ Grouping of serveral cells to form one WLAN
- Distribution system and Handover between cells (⟶ IEEE 802.11)
- Multicast to support handovers at high bitrates, frequent handovers, time-critical data



Assumptions

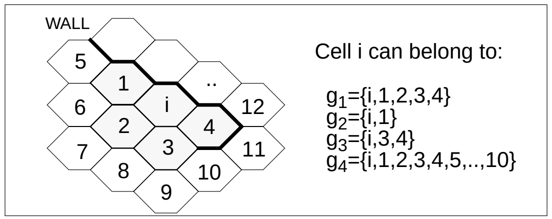
- only one Channel per Cell, hub-based communication
- Sub-layer for Distribution System and Handover between Layer 2+3
- Handover only inside WLAN, no Handover between spacial disjoint cells
- Handover supported by **Multicast**

- **Related work** [1] — **We**
  - *centralized network-architecture* ⇨ **distributed, no Server host**
  - *connection-oriented* ⇨ **connectionless**
  - *broadcast for route-finding* ⇨ **Registration**, **Searching and self-learning Basestation**

1. Ghai, Singh „An Architecture and Communication Protocol for Picocellular Networks“, IEEE Personal Communication, IV/94

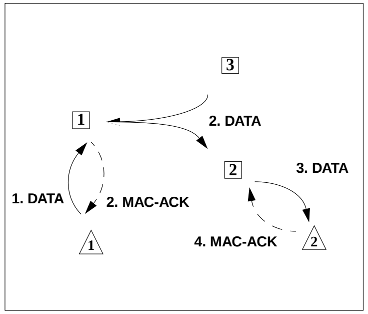
The Protocol (1)

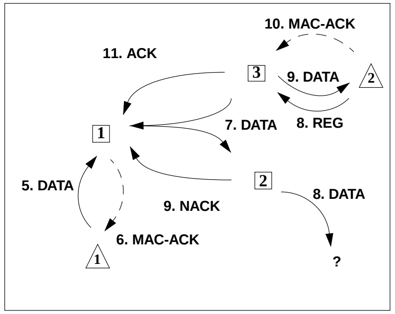
- Mobile Host registers at current Basestation
- other Basestations locate Mobile Hosts by Who-has- / I-have-packets (Search)
- location tracking for ongoing communication by ACK-/ NACK-packets (self-learning of Basestation)
  - ~ using immediate ACK on MAC-layer for wireless link
- Multicast to a Group of Cells
  - ~ topology-, direction-, speed-dependent, static, dynamic



The Protocol (2)

- Multicast without Cell-transition **Multicast with Cell-transition**





- **Mobile Hosts** 1, 2 **Basestations** 1, 2, 3
- **g={ 2 , 3 } ; MH moves from 2 to 3**

Performance Description

- **Service disruption caused by handover**

  -without Multicast:

  ~the distributing Basestation searches Mobile Host after Handover

  -with Multicast:

  ~the distributing Basestation gets new location of mobile Host through ACK

  ~Basesation buffering Multicast-packets has to drop outdated packets

- **little Overhead through protocol due to broadcast distribution medium**
- **Further work:**

  ~protocol overhead

  ~error charactersitics of the Multicast-Process

  ~Buffer Management