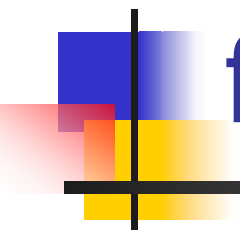
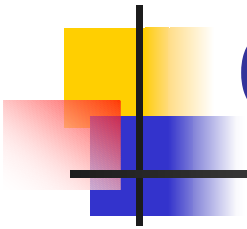


MobiCast: A multicast scheme for wireless networks

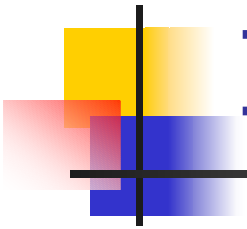
Cheng Lin Tan and Stephen Pink

Mobile Networks and Applications, December 2000



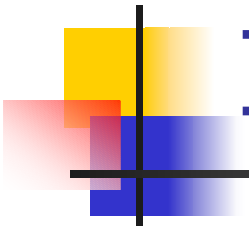
Outline

- Introduction.
- Related work.
- Mobility Architecture.
- Beacon period and buffer size.
- Performance measurement.
- Conclusion.



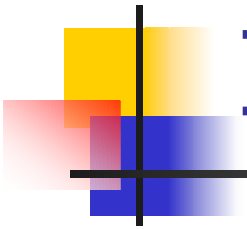
Introduction

- Smaller Cells are preferred because:
  - Frequency reuse.
  - Lower power requirement.
  - …
- Multicast applications are popular.
- Handoffs during multicast session are common.
- Multicast scheme for wireless networks should:
  - Minimize re-computation of the multicast tree.
  - Reduce packet loss when handoff occurs.



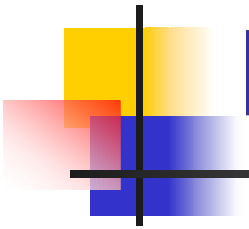
Introduction

- Problems:
  - Dynamic group membership and dynamic group member location.
  - Hosts are not static during multicast session.
  - Mobile host may be the multicast group's sender or receiver.



Introduction

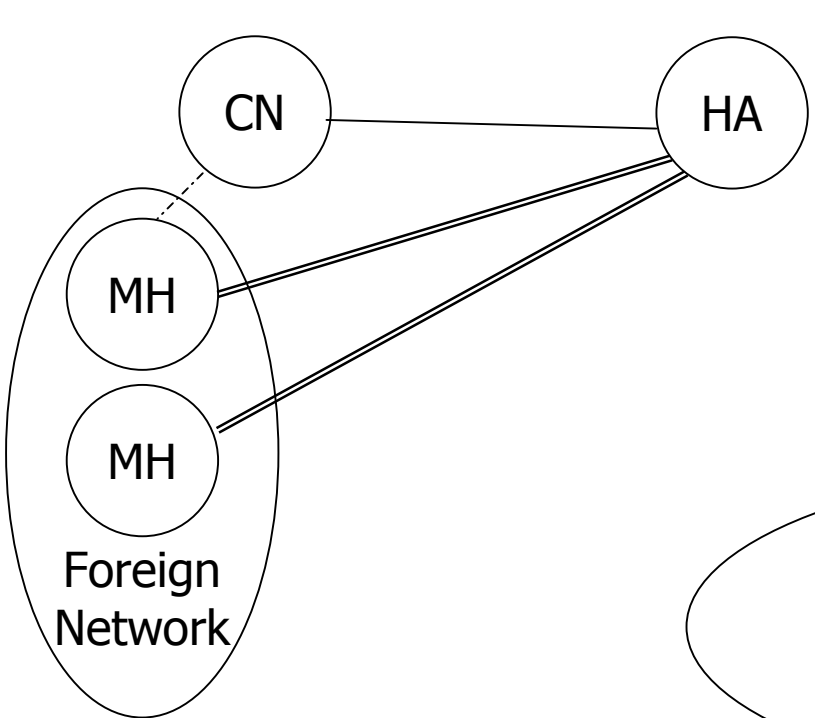
- Proposed scheme:
  - Hierarchical method.
  - DFA: Domain Foreign Agent.
  - Translated Multicast Address.
  - DVM: Dynamic Virtual Macro-cells.

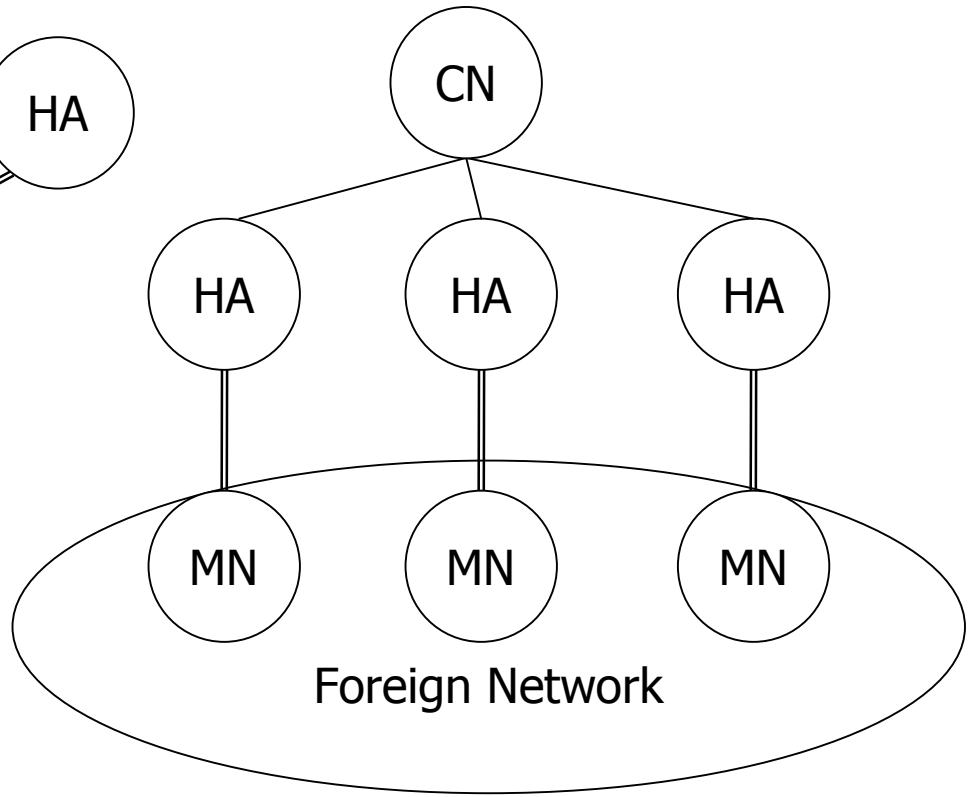


Related Work

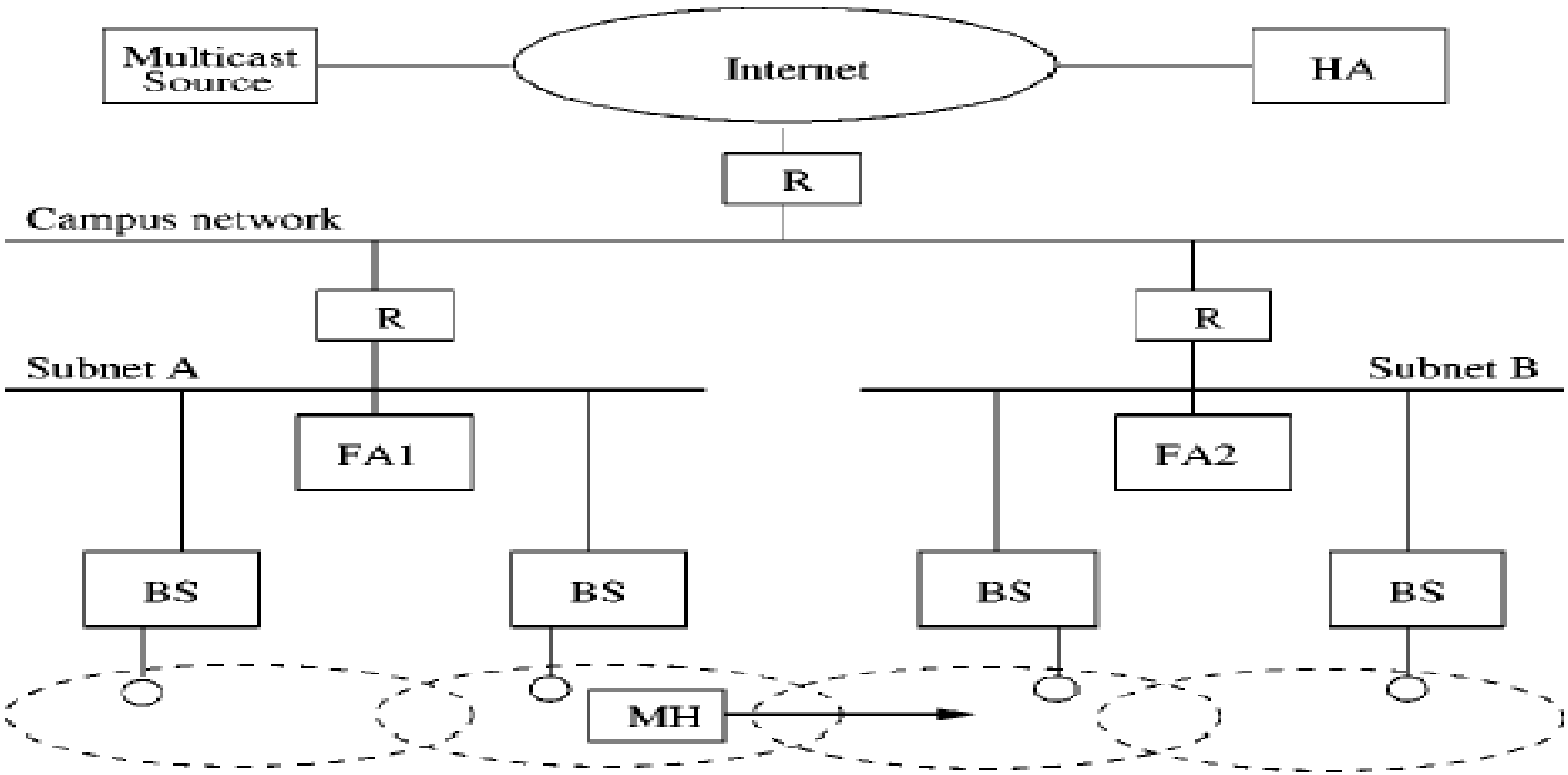
- IETF Mobile IP:
  - Remote subscription: mobile host must re-subscribe when it visits a foreign network.
  - Bi-directional tunneling.
- Bi-directional tunneling:
  - MH receives/sends multicast packets through HA.
  - The routing may be sub-optimal.
  - It can be bandwidth inefficient.
  - Tunnel Convergence Problem.

Related Work

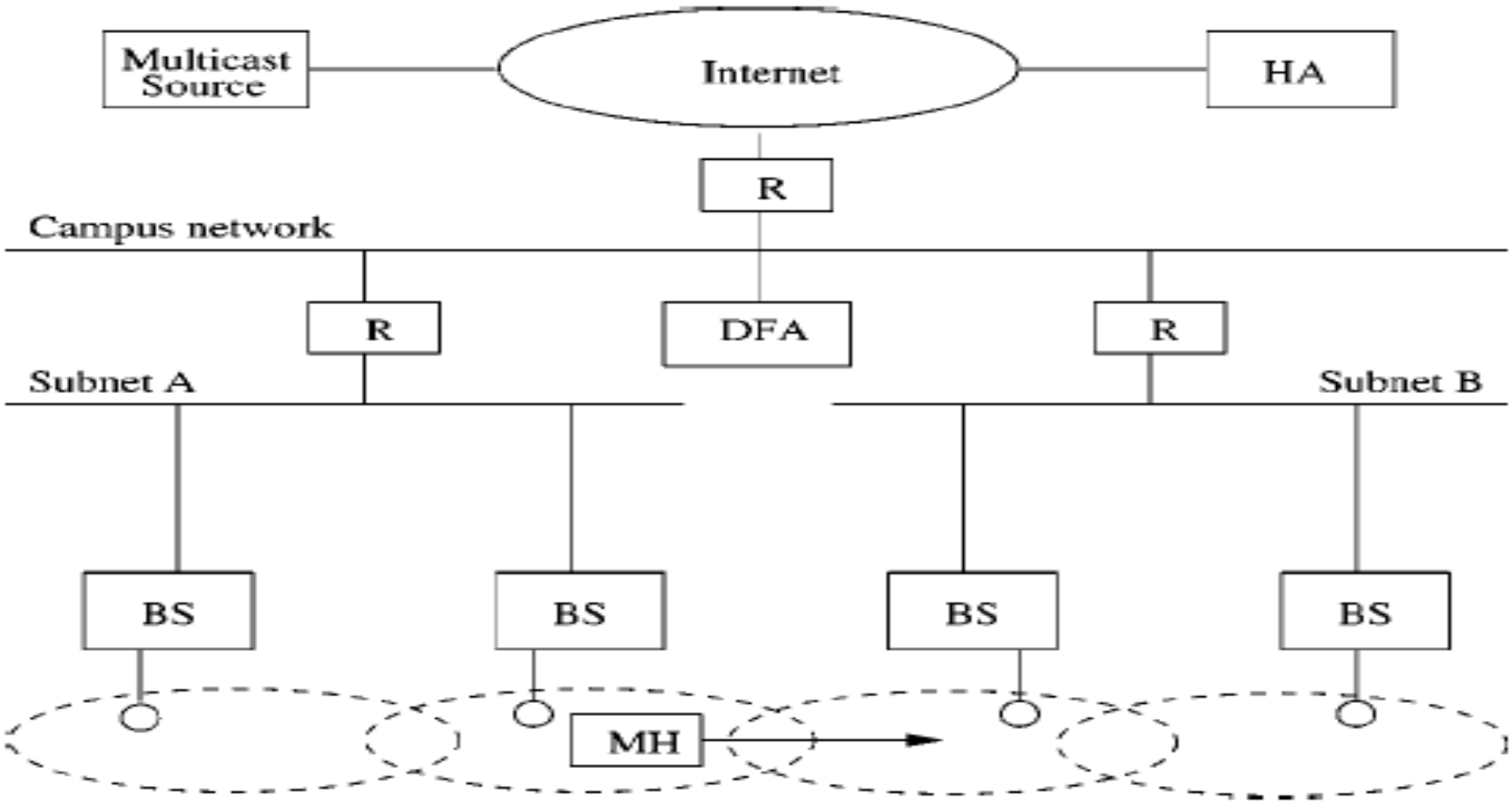


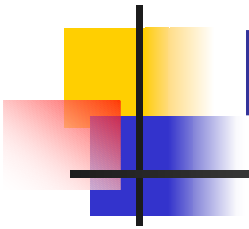


Related Work



Mobility Architecture





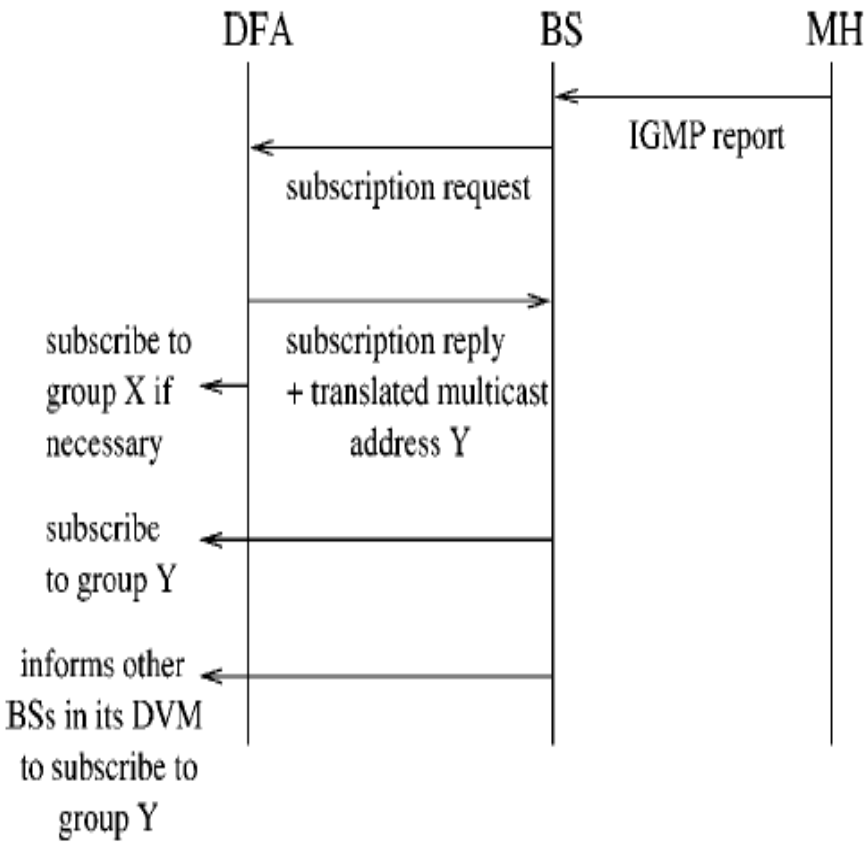
Mobility Architecture

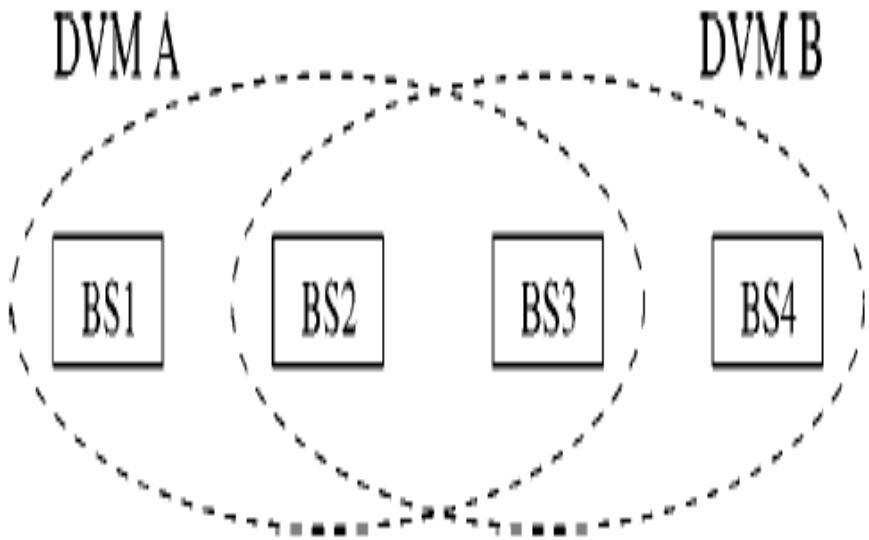
- DFA is responsible for all foreign mobile hosts with the domain.
- MH is a multicast source:
  - MH encapsulate its multicast packet and unicast it to the DFA.
  - DFA decapsulates it and send out the multicast packet with the DFA's address in the source address field.

Mobility Architecture

- MH is a multicast receiver:
  - MH sends IGMP report to the BS to subscribe to multicast group X.
  - BS relays this subscription to DFA.
  - DFA supplies a different multicast address as the translated multicast address.
  - DFA should subscribe to the group X and reply the subscription with translated multicast address to BS.
  - DFA forwards the requested multicast packets to the MH using the translated multicast address.

Mobility Architecture





Mobility Architecture

- Handoff Protocol (MH is the receiver):
  - DVM: A set of cells that are neighbor of the serving cell and the serving cell itself.
  - The serving BS informs the other member BSs in its DVM to subscribe to the same translated multicast group.
  - The serving BS forwards multicast data and the other BSs in the same DVM buffer the multicast packets.
  - No join latency is involved as the new BS is already on the multicast tree prior to the handoff.

Mobility Architecture

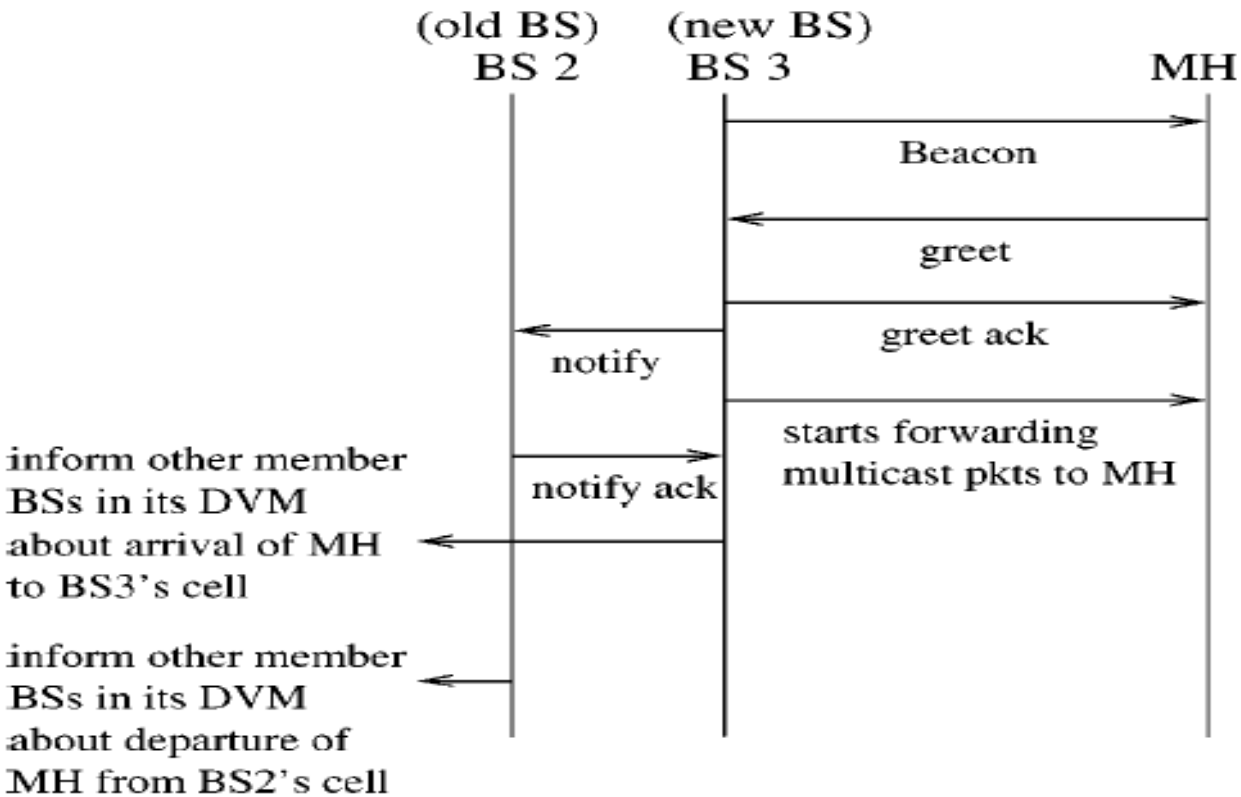


Figure 7. Message exchange during a handoff when MH is a multicast receiver.

Mobility Architecture

- Handoff Protocol (MH is the sender):
  - IP ID: the last packet received by the old BS prior to the handoff.
  - The old BS should tell the new BS the IP ID.

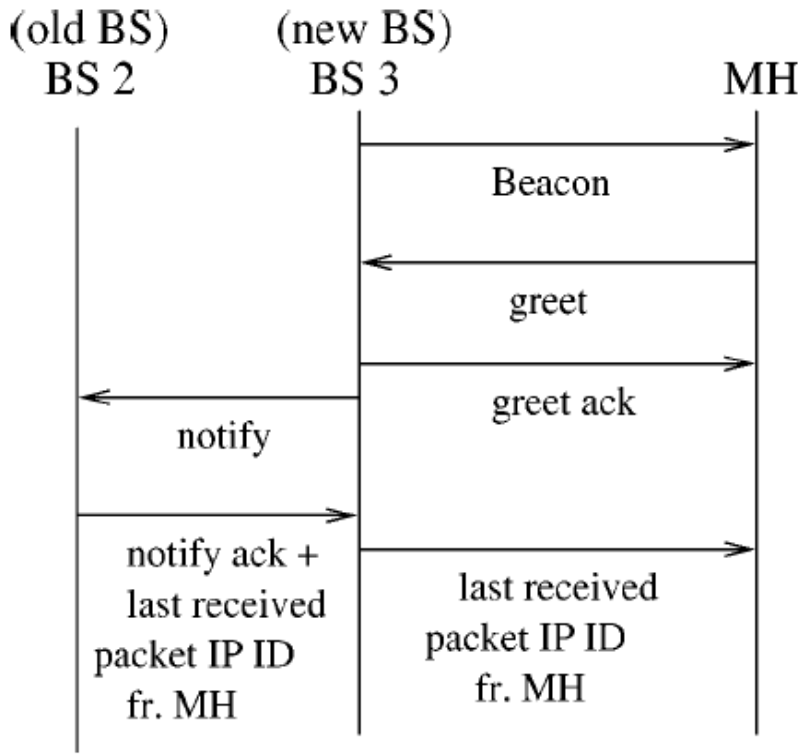


Figure 9. Message exchange during a handoff when MH is a multicast sender.

Beacon period and buffer size

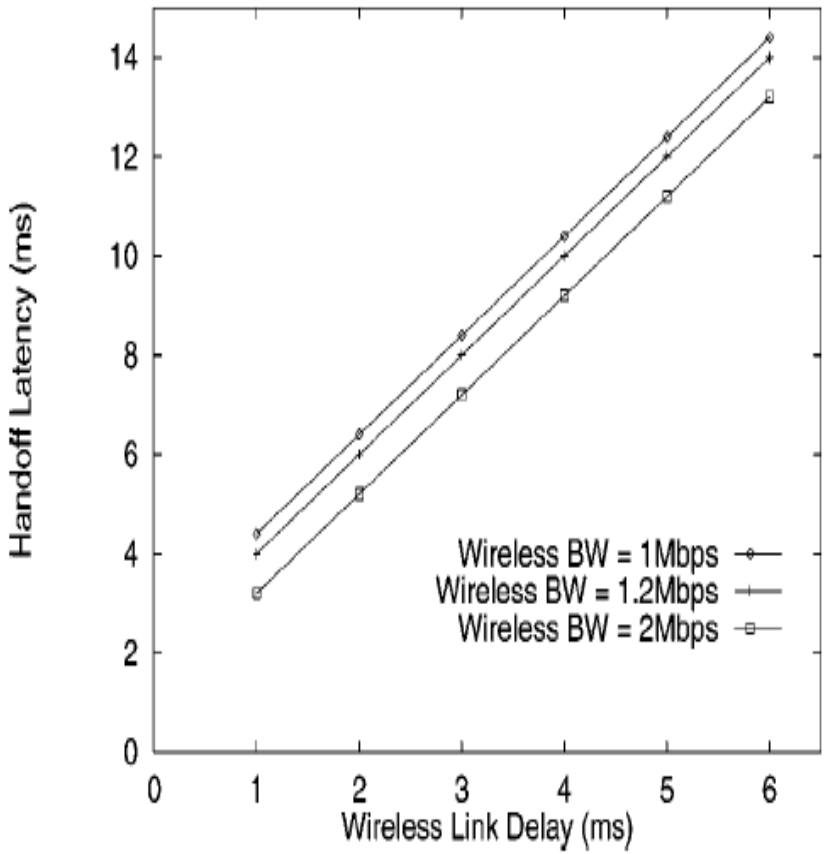
- Ideal Case: Buffer size = (maximum possible amount of packet loss due to the handoff).
- Define RT (rendezvous time) : The time taken for a MH to hear a beacon from a new BS after roaming out of the old BS's cell.
- Max. # of pkt loss during a handoff =

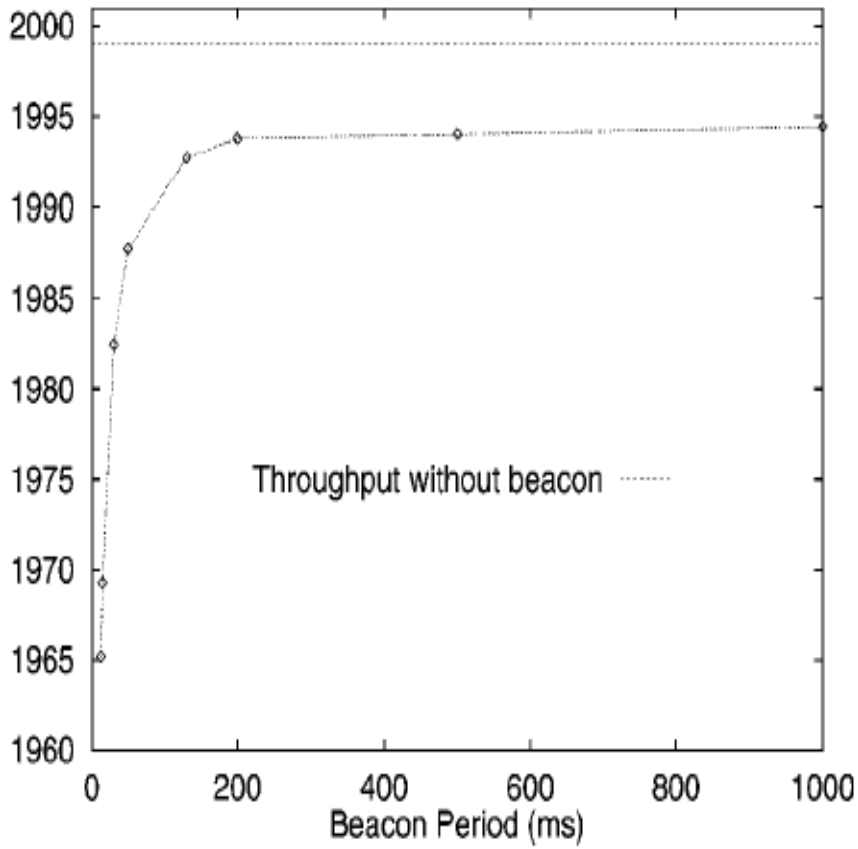
  [RT / (pkt inter-arrival time)] +1
- RT is dependent on the mobile host's mobility patten.

Beacon period and Buffer size

- The time to complete a handoff:
  - The rendezvous time.
  - The handoff latency.
- A short beacon period:
  - Consume more wireless bandwidth.
  - More increases processing overhead.
  - Reduces the amount of buffers required at the BS.
- Does a good pair of beacon period and buffer size exist?
- If yes, what is it?

Performance measurement





Performance measurement

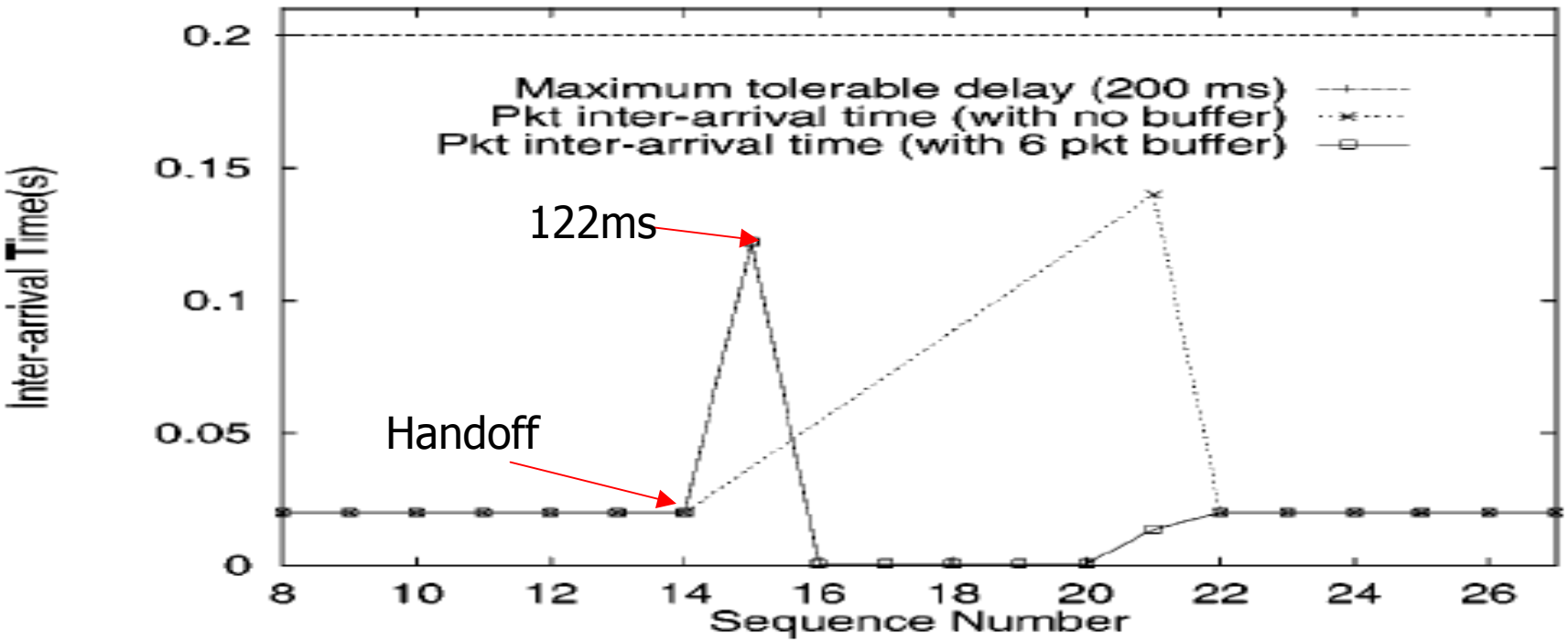


Figure 14. This graph shows the packet inter-arrival time at MH before, during and after a handoff when MH is a multicast receiver, with and without buffer.

Performance measurement

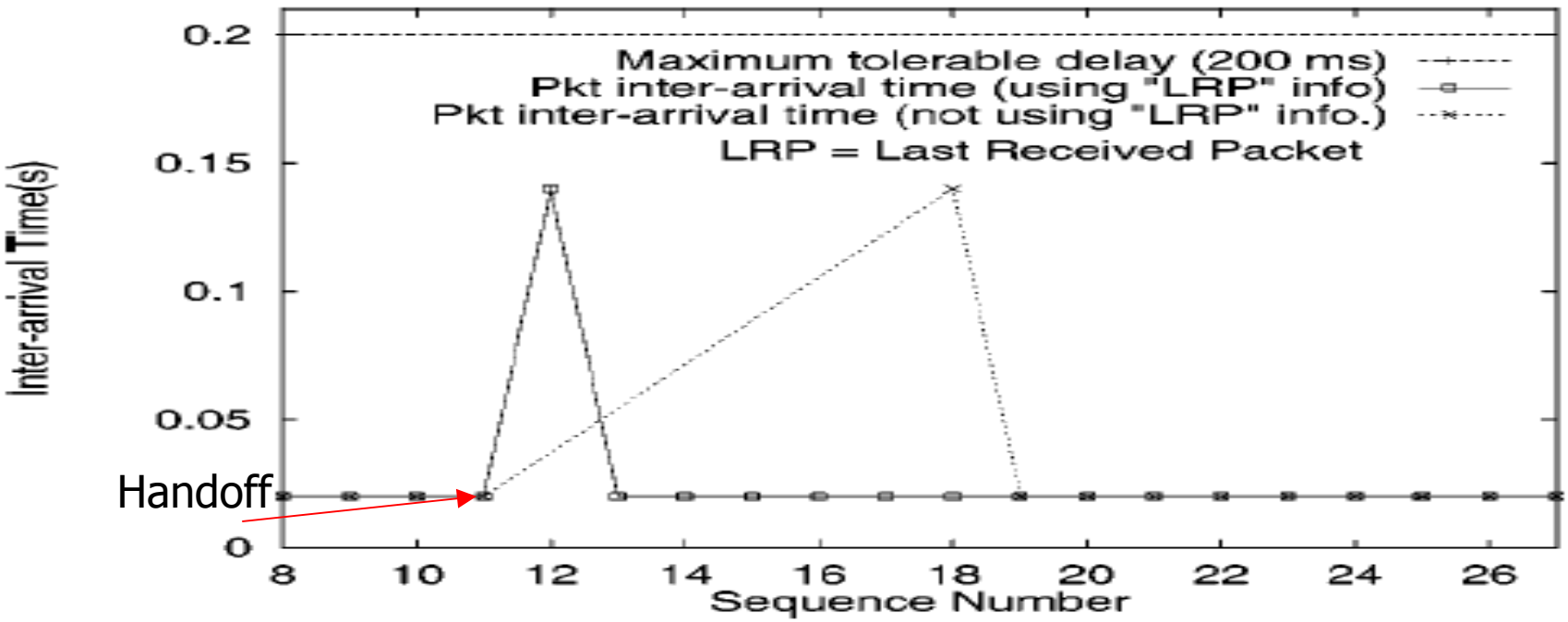


Figure 15. This graph shows the packet inter-arrival time at a multicast receiver (node B) before, during and after a handoff when MH is a multicast sender, and the "last received packet" information from the old BS arrives at the MH before the next transmission from MH to the multicast group is due.

Performance measurement

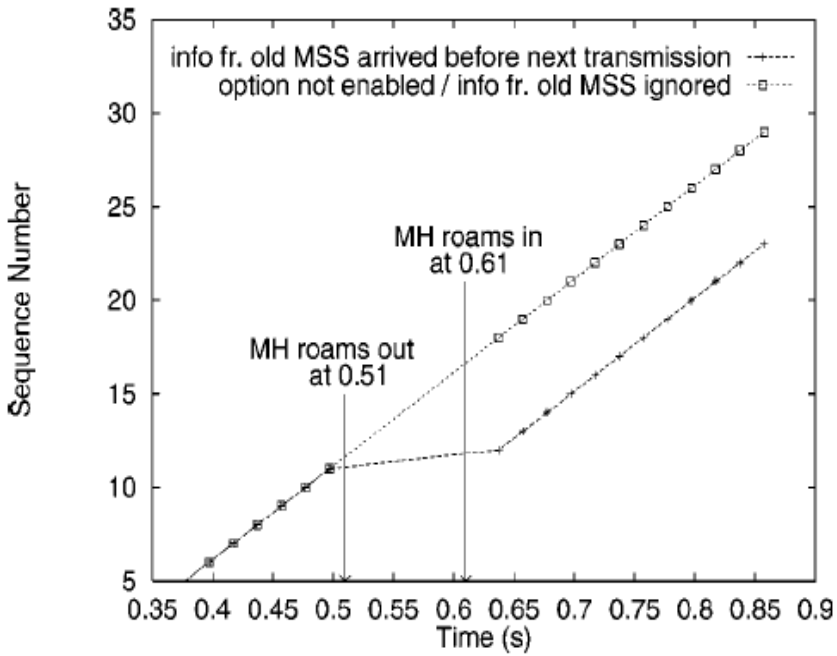


Figure 16. This graphs shows the packet arrival at a multicast group receiver (node B) when MH is a multicast source. The last received packet information from the old BS arrives at the MH before the next transmission from MH to the multicast group is due.

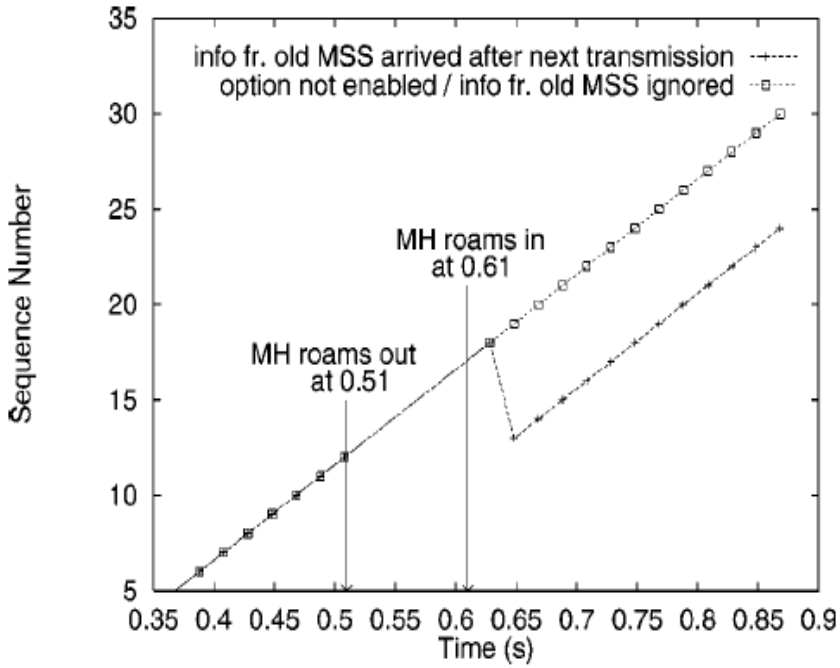


Figure 17. This graphs shows the packet arrival at a multicast group receiver (node B) when MH is a multicast source. The last received packet information from the old BS arrives at the MH after the next transmission from MH to the multicast group is due.

Conclusion

- This scheme adopts the hierarchical mobility management architecture and DVM concept.
- The DFA is the behalf of MH in the multicast tree.
- MH is a receiver of the multicast tree:
  - Neighbor cells buffer packets for the future handoff.
  - DVM is used.
- MH is a sender of the multicast tree:
  - “IP ID” is used to eliminate the packet loss due to handoff.