

Innovative MAC and Higher Layer Solutions for 60 GHz Radio Technology

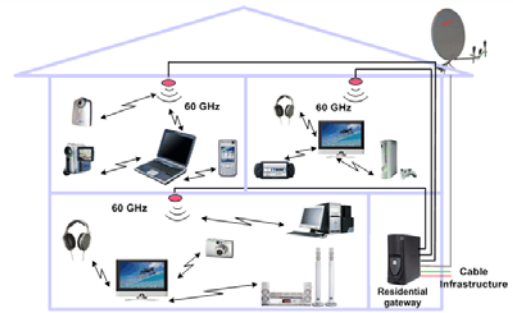
(SiGi Spot project activity: WP6)

Xueli An, WMC, EEMCS, TU Delft

SiGi Spot Goal

Currently, wireless LAN technology can achieve some 20 Mbit/s payload at the network layer. This is not sufficient to support high data rates required by the transport of multiple multimedia streams throughout an "Ambient Intelligence" home environment with sufficient Quality of Service. Furthermore, these systems have a fluctuating performance in terms of throughput and link availability because of mutual interference and interference with other sources.

The principal goal of this project is to define a new low-cost radio technology that utilizes the license-free 60 GHz band which provides effective solutions for these problems.



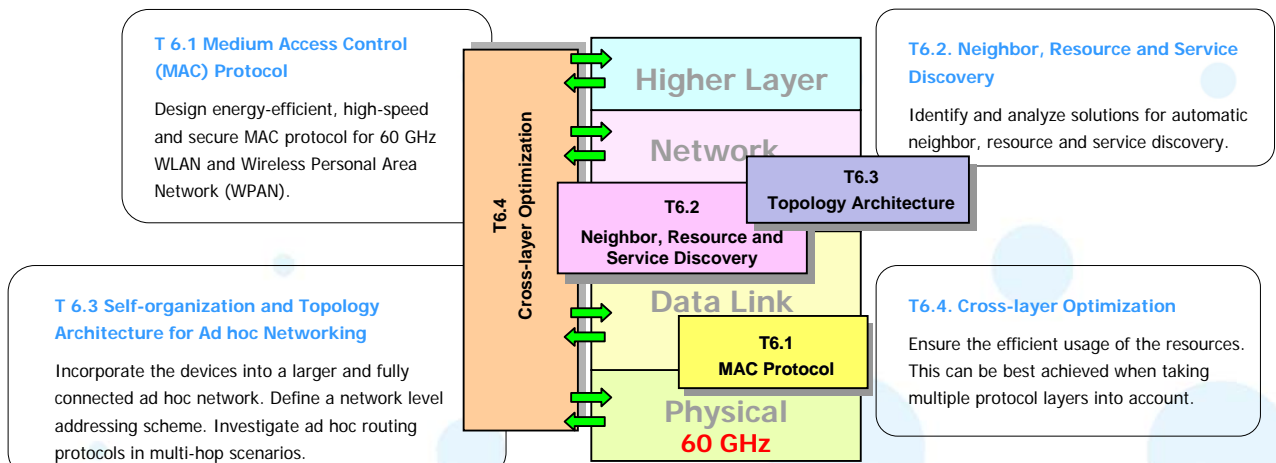
60 GHz system scenario in home environment

WP6 Task Description

The aim of Work Package 6 is to design protocols for MAC and upper layers in order to form a fully connected ad hoc network for new and emerging in-home applications using the new 60 GHz radio technology. Protocols for MAC, routing, self-configuration, neighbor, resource and service discovery are identified and analyzed. Finally, cross-layer optimization is applied to produce a highly efficient protocol stack.

Open Challenges

- What network architecture is most suitable for a 60 GHz piconet?
- To what extent is it beneficial, feasible and desirable to apply cross layer design.
- How can the MAC protocol exploit advanced features offered by the 60 GHz technology?
- Is it possible to increase capacity and robustness through the emerging concept of network coding?



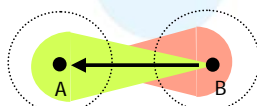
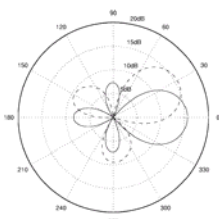
WP6 Tasks description based on OSI reference model

Current research

Directional Neighbour Discovery (D-ND)

➤ Directional Antennas

Compared with omni-directional antennas, directional antennas concentrate the energy in a certain direction to achieve a higher antenna gain. Therefore, directional antennas have been widely used in system design to extend transmission range and increase system capacity.



Directional antenna transmission

➤ Neighbor Discovery

Neighbor discovery is an important functionality to realize self-organization in ad hoc networks. It provides a mechanism for discovering nearby nodes. It aims at incorporating nodes to form a larger and fully connected ad hoc network.

A well-designed ND protocol is essential for efficient neighborhood detection. Some key metrics needed to be considered in the D-ND design process are:

- How long does it take to discover the in-range neighbors when a node joins the network for the first time?
- How many transmissions are needed to discover the whole neighborhood?
- How to detect the neighbors' positions and directions?