GENERAL INFORMATION

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- **Project Start:** April 1st, 2007
- **Project Lenght:** 2.5 years
- **FIT-IT Project:** #813310
- **Project Partners:**
  - Oregano Systems Design and Consulting (Austria)
  - inIT – Institut Industrial IT (Germany)
- The project ε-WiFi is sponsored by the Austrian Federal Ministry for Transport, Innovation and Technology under the FIT-IT Programme.

ÖAW Austrian Academy of Sciences

bmvit

Oregano Systems

inIT Institut Industrial IT www.init-owl.de

FFG

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ÖAW Austrian Academy of Sciences

ε-WiFi

iis2 iSS Institute for Integrated Sensor Systems

PROJECT DESCRIPTION

In today's office environments wireless communication is omnipresent. Also for industrial devices support of WLAN becomes more and more common. The main advantages are increased flexibility and mobility in comparison to conventional wired connections.

However, having the option of mobile devices raises new challenges. In comparison to wired networks, it is far more difficult to guarantee that nobody gets unauthorized access to the network. Access control can, for example, be based on the position of the clients. Therefore, the FIT-IT project ε-WiFi (Embedded Position Determination and Security in Wireless Fidelity Networks) develops a localisation scheme for wireless LAN, where the WLAN infrastructure can be used not only for data communication but also for localisation of the data source.

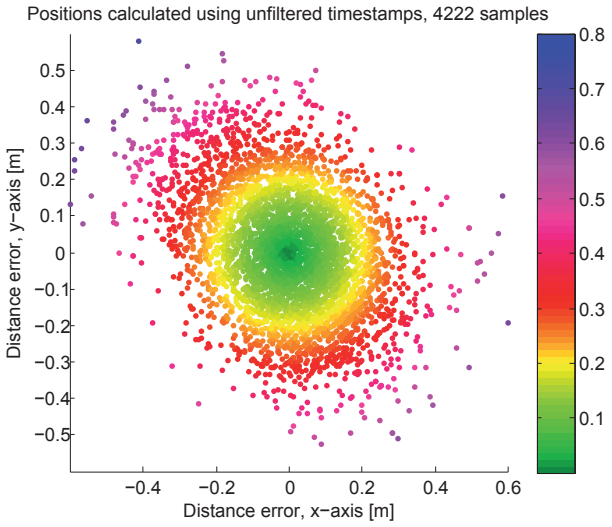
Localisation is done by using the Time Difference of Arrival (TDoA) technique. This method is based on the concept that a mobile station transmits a message, which is received by at least three access points (for 2D localisation), all synchronized with each other. Knowing the position of the access points and the propagation delay differences, the location of the mobile station can be calculated.

To measure the delay highly accurate clock synchronization is needed, which is reached by hardware timestamping. Although the techniques are based on principles well known from Ethernet, significant adaptations are required to cope with the challenges of wireless environments, especially with multipath propagation.

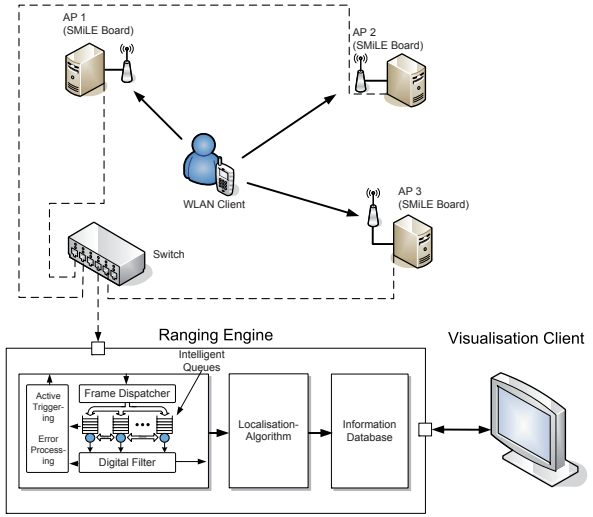
PROJECT OBJECTIVES

The goal of ε-WiFi is to localise wireless devices by evaluating propagation delay differences. The knowledge of the position opens new possibilities for safety and security in WiFi networks. In office networks, security can be enhanced by providing location based access rights, while in wireless industrial automation applications safety can be increased by restricting remote control to areas with direct line-of-sight to the machine. For example, a crane may only be operated from a position with direct sight to the load rather than from outside of the production building.

The overall vision of the project is to accurately determine the position of an unmodified sender as a base for new techniques for access control as well as system security and safety based on spatial access policies.



SYSTEM CONCEPT



The figure above shows the structure and functional principle of the localisation system. This example uses three Access Points (APs) and a processing device hosting the position calculation and visualisation. All components are connected in a star topology, using a switch supporting the IEEE 1588 standard for clock synchronization.

The Ranging Engine (RE) is responsible for collecting and grouping the timestamps from all APs. Timestamps of the same message, which are taken at different receivers, are grouped together in a tuple (set). The tuples are identified by the frame checksum and the source MAC address of the message. Each tuple of timestamps is used to calculate the position of the node. To finally determine and visualise the current location, the calculated position is filtered using preceding positions from a database.