WIND: Wireless Networks of Devices
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Project Overview

The goal of the WIND project at MIT is to design and implement self-organizing networks with a high degree of decentralization, robustness and distributedness in their operation. The WIND protocols and middleware provide built-in support for user and device mobility, resource discovery, service location, and group communication in a decentralized manner. Our key innovation is the use of an intentional naming architecture where applications describe what they are looking for (i.e., their intent), not where to find it (which is how most network naming schemes work today). In this architecture, name resolvers can also route messages to the eventual destinations, leading to an integrated approach to resolution and routing. Thus, WIND is built around the premise that a flexible naming architecture and the ability of the name resolution process to be involved in data routing is a key enabler of large-scale self-organizing device networks.

Our application scenario uses these building blocks to demonstrate a location-aware applications over heterogeneous indoor wireless technologies (in-building RF wireless LAN and Infrared). Here, users can access data and control dynamic, mobile information sources (e.g., mobile cameras, sensor nodes) as well as enable devices to obtain information based on their location (e.g., if you walk into a specific room, the devices, nodes and users in that room automatically become known to your handheld or laptop computer) or other system characteristics. Our vision is to achieve all this with no prior manual configuration. The navigation metaphor for WIND is via an active map application called "floorplan".

Progress Through June 2000

1. Implementation of Cricket v1.0

The goal of the Cricket effort within WIND is to enable applications and users to automatically obtain location information and learn about and navigate services based on geographic attributes such as physical location. In particular, we are developing hardware and software for an accurate “indoor GPS” and its integration with the rest of the WIND system. We have completed an implementation of Version 1.0 of Cricket using a combination of RF and ultrasound wireless technologies, enabling fine-grained mobile location discovery without compromising user-location privacy.

2. Self-configuring overlay algorithms have been designed for INS resolvers. In particular, we have implemented a novel distributed and asynchronous minimum spanning tree algorithm in INS.

3. We have completed the design of "Migrate," a novel end-to-end architecture for host mobility. Migrate solves the problem of mobile host routing in networks like the Internet by separating the problems of mobile host location from seamless connectivity. It uses dynamic updates to a naming system like the Domain Name System or the Intentional Naming System for the former, and a secure end-to-end connection migration scheme for the latter. In particular, using Migrate, TCP connections can now survive IP address changes.

Research Plan for the Next Six Months

1. The applications of Cricket will include an active map navigation tool that will change as the user moves, and which will allow the user to discover and access diverse services (advertised using intentional names) in any area. We plan to develop such applications and integrate with other INS applications.

2. Experimental evaluation of location-support system, in particular power consumption and scalability experiments.

3. Implementation and evaluation of the Migrate approach to mobile routing.

4. Evaluation of wide-area service discovery using INS.