Using Ad-hoc Networking in Orienteering - A Demonstration

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We describe a demo scenario where we apply ad-hoc networking to the sport of orienteering. This interactive demo integrates ad-hoc networking using our AODV-UU implementation, Internet integration, and aspects of self-configuration. Demo visitors can participate in a small competition by going from one ad-hoc node to another. Each ad-hoc node will report a participant’s visit to the demo booth where the competition can be followed on-line on a scoreboard.

1 Orienteering and why it is an interesting Application for Ad-hoc Networking

Competitive orienteering involves using a map and a compass to navigate one’s way round a course with designated control points which are drawn on the map. On the route, control markers are set in the places that correspond to the points on the map. The winner of the competition is the participant who has used the shortest time to visit the control points in numerical order.

Orienteering is a popular sport in Europe for both young and old because organizers offer courses with different length and difficulty. Having different courses means that there are more control markers placed in the terrain than a participant has on visit. The location of control points and one particular course of a competition in Sweden are shown in Figure 1.

The course is most often in forests and not visible from the event center (e.g., finish area). It is therefore difficult to follow a race: the participant disappears after the start and eventually comes to the finish line. In an effort to make orienteering more interesting for spectators, organizers report intermediate times from selected points of the course.

Ad-hoc networking is an ideal technology to provide a realtime information system in orienteering. Compared to traditional approaches (e.g., a person reporting through a walky-talky, long cables, high power radio links, etc.), using every control station as an ad-hoc node allows to get results from any control station. Furthermore, low power radio technology can be used to bridge the short distances between close-by control stations rather than the long distance between one selected control station and the event center.

Even though the static setup does not challenge the responsiveness of routing protocols, we met quite a few interesting research questions. Most interesting are power considerations, making technology “invisible” and truly self-configuring, and traffic aggregation towards the common message destination.
Figure 1: A particular course visits only a subset of all control points in the terrain. The example shows an elite course for women in a short distance (3.9 km) competition in Sweden. The terrain information is not shown in this example.

2 The Demo

In our demo we show a prototype for a realtime information system in orienteering competitions using ad-hoc technology. We set-up a small orienteering course with about five control points using the SPORTIdent punching system [1]. The participant wears a RFID-tag on his finger and goes from one control point to another. At every control point, the control number and a timestamp is written on the RFID-tag, and the information is passed to the attached network node. The network node forwards the information to the server at the demo booth where the competition can be followed in real time on a screen.

2.1 Equipment

One server located at the demo booth Laptop running Linux with lightweight database and web-server that stores results. A Screen or projector is attached to the server for visualization. If the conference policy allows, we connect the server to the local network such that every visitor of the conference can access results from his own computer.

Five stations distributed in the demo area Laptop with IEEE 802.11b cards in ad-hoc mode running Linux, SPORTIdent station connected to the Laptop via RS232, our AODV-UU implementation for routing. A small program on the Laptop forwards all messages from the SPORTIdent station to the server. We are currently migrating the demo to programmable Linksys WiFi accesspoints [2] to replace the Laptops. Their use in the demo is dependent on stability.

One station acting as a gateway to the local network Laptop with both IEEE 802.11b and ethernet interface featuring our AODV-UU extension for Internet connectivity. The gateway allows nodes in the ad-hoc network to communicate with hosts on the Internet (i.e., the server).

Participant equipment SPORTIdent RFID tags to wear on a finger. The tag is used for identification at SPORTIdent stations and stores timestamps of the identification events.
2.2 Scenarios

**Set-up and auto-configuration** Stations and server are placed at suitable places and switched on. The stations make use of the IETF Zeroconfig protocols (i.e., Apple Rendezvous) to configure their network address and to discover the server. The AODV routing protocol provides on-demand (multihop) routes, and in case the destination is on the Internet seamlessly routes through the gateway.

**Competition** Visitors of our demo are welcome to participate in a small competition. We provide them with an RFID tag and a map over the demo area to find the way to the stations. While a participant identifies himself or herself to a station, the identification, station number and a timestamp is sent to the server where the competition can be followed in real time on the screen.

**Visualization** The system collects more information than can be visualized in a meaningful way. We show a scoreboard with all the events of current participants in the Competition on the screen where the results can be compared to the overall ranking. Besides of the scoreboard we also show the network topology. Visitors can add an extra station to the network, observe the effects on the topology, and experience the ease-of-use.

We presented the demo at some local workshops. It usually stimulates the sportsmanship of the participants and is an appreciated opportunity to get some extra movement under a long conference day. The set-up of the orienteering course will be done in collaboration with the demo coordinator of the conference. The idea is to demonstrate a four-hop network while not disturbing other demos.

3 Conclusion

We wish to demonstrate that ad-hoc networking is ready to leave the research labs and that orienteering is an interesting application scenario. Even though the network is static, there are plenty of interesting research questions to solve. We combine a number of technologies and protocols to make the system work and easy to use.

References
