1. Scaling Up A Distributed Wildlife Tracking System

The goal of this project will be to analyze the structure of a distributed wildlife tracking system and to propose and evaluate strategies for scaling it up by 2-3 orders of magnitude.

There are now about 10 instances of this system, some of which are new and some that have been in operation for up to 8 years. Each system contains 10-30 base stations (receivers), a large number of mobile transmitters attached to animals, one or more servers, an SQL database, and visualization and user-interface software.

To support a much larger number of systems, and/or a unified system (with thousands or base stations or more), we need a new architecture and new mechanisms (e.g. for software upgrades to base stations in the field, for backups, etc).

The project will begin with a systematic study of the existing system (e.g., SQL tables, queries, and transactions, configuration management, reliable data transport, etc), then consideration of alternative architectures and components (e.g., non-SQL databases), and evaluation of the strengths and weaknesses of the proposed architectures, including quantitative evaluation (e.g., in cloud costs or hardware costs).

Experience in large-scale software architectures is an advantage in this project.

2. RF-based ground moisture sensor

The level of moisture in the ground causes changes in the RF propagation properties of signals that travel through the ground. The project will survey existing ground moisture sensors that are based on measuring changes in RF propagation. We will then develop a novel RF ground moisture sensor and evaluate its performance and applicability using both simulations and a real-world prototype.