Remote Sensing

Remote sensor systems use complex algorithms to factor out noise. SNR decreases rapidly with distance, which limits the accuracy of the data collected. Remote sensing is often used in conjunction with other methods to improve the accuracy of the measurements. However, remote sensing is expensive and requires large amounts of data to be processed. This makes it difficult to deploy in certain situations.

Future Wireless Sensor Networks

Future wireless sensor networks will have processing capability on each node, allowing the network to be more intelligent and adaptable. The deployment of these networks will be easier due to the wireless connectivity, and the data collected will be more accurate and detailed.

Directed Diffusion

Directed diffusion is a protocol used to forward data in a network. It is based on the idea that data should be forwarded based on the destination's interest rather than the source. This allows for more efficient use of bandwidth and reduces the amount of data that needs to be transmitted.

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Interest Propagation

The desired data rate will be achieved by reinforcement. Initial interest specifies low data rate as exploratory. Flood the interest. After receiving an interest, the node creates states and resends to a subset of its neighbors. Direct interest or limit scope using GPS info. Direct interest using route history.

Exploratory Data Propagation and Gradient Establishment

Sensor’s first data is exploratory (low-rate data). Map attributes to next hop at each node in network to establish gradients. Sent throughout network, establishing gradients. Nodes have multiple gradients. Each hop propagates reinforcement back to sources. Which link to reinforce? Alternatives: maximum remaining energy, or greedy tree.

Negative Reinforcement

Paths that send the same info should detect and prune unnecessary paths. Implicit negative reinforcement (just let gradient time out). Negative reinforcement explicit negative reinforcement.

Naming and Attributes

Needs resource discovery. Humans use search engines. IP has node address and ports and DNS and URLs. Embedded systems use something like Jini embedded search engine. Sensors publish sensor IS acoustic; target IS lions; lat GT 100; lat LT 101; long GT 43; long LT 44.

Filters


Exploratory Data Propagation and Gradient Establishment
Differences from Traditional Networking

- Neighbor-to-neighbor communication (not end-to-end)
- No globally unique IDs
- Localized algorithms
- No explicit global information (routing tables)
- Data and queries are named independently from their producers

In-network processing

- Application-specific
- Net-wide attributes (like sensor type or latitude/longitude)
- Application-specific data aggregation

Energy Scaling

- Good performance even as number of nodes grows
- Better scalability than multi-hop communication (ex. aggregation)
- Data-centric communication between sensors and users

Critique

- Duplicate suppression is critical to diffusion
- Shows the importance of app-specific in-network processing

Discussion

- Routing scheme is not too complex
- In-network processing articulates the rationale behind this architecture well
- Motivated by a new technology
- Really a radical new networking architecture

In-Network Processing

- Uses attribute-based names (rather than addresses)
- Application-specific routing layer and routing protocol (fixes routing layer and network)
- Uses in-network processing (ex. aggregation)
- Data-centric communication
- Multi-hop communication
- Distributed communication between sensors and users

Diffusion uses less energy than omniscient multicast (optimal)

100s of embedded, unattended, small devices
Looking at sensor networks
Coordinate communication between sensors and users
Multi-hop communication
Distributed communication between sensors and users

In-Network Processing

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