

Specialized Networking Technologies (Group Communication)

Gowri S Rajappan

Thomas Kostas

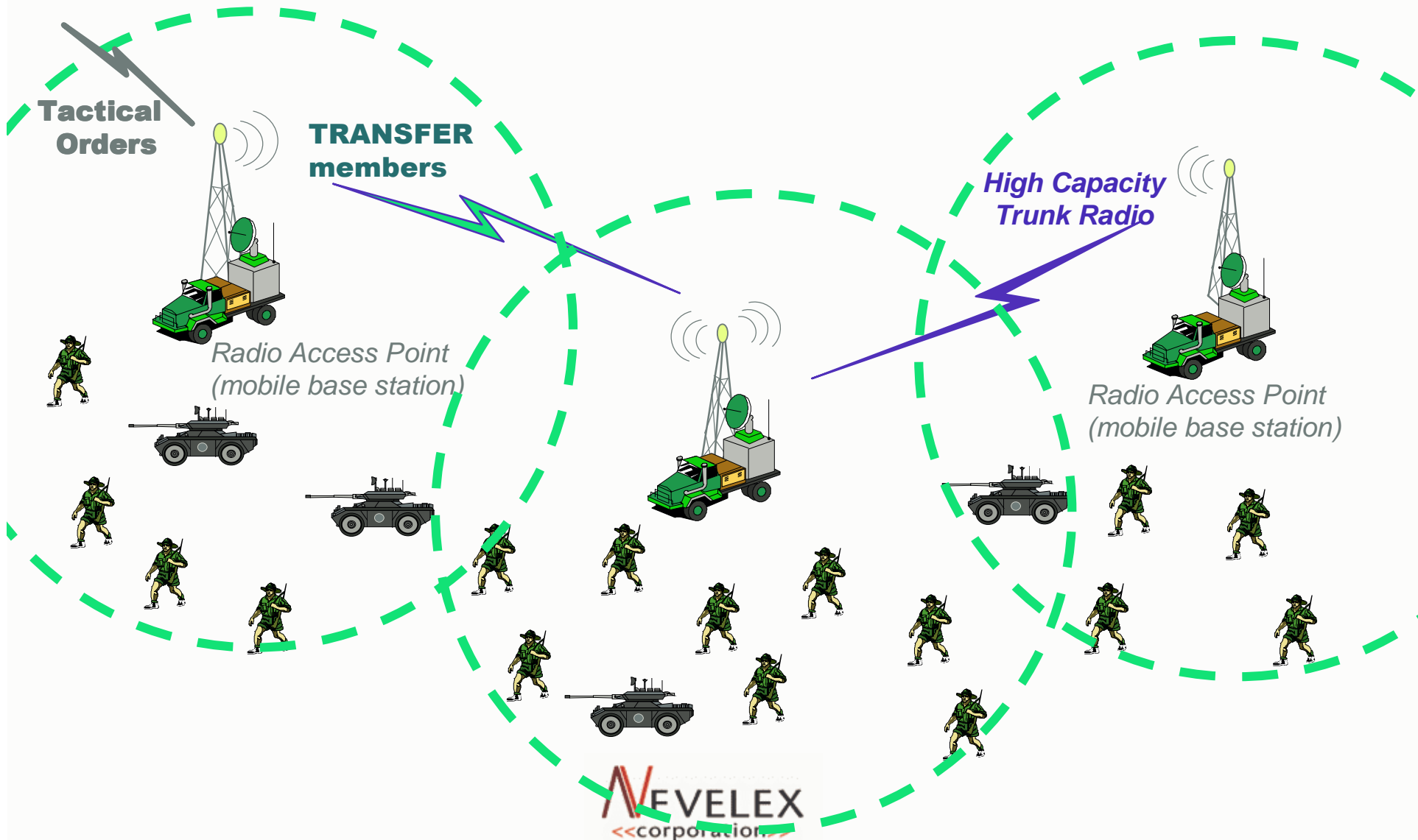
The Vision

- Wireless ad hoc using off-the-shelf technology that
 - Provides *reliable, content-sensitive* data delivery
 - Enables efficient *many-to-many collaborative communication*
 - Extends a *secure* communication infrastructure

Rationale

- Why use off-the-shelf and standards-compliant technology?
 - Harvest significant performance gains by new approaches
 - Unearth limitations of current technology, and hence direct future efforts optimally
 - Rapid proof-of-concept and technology transfer

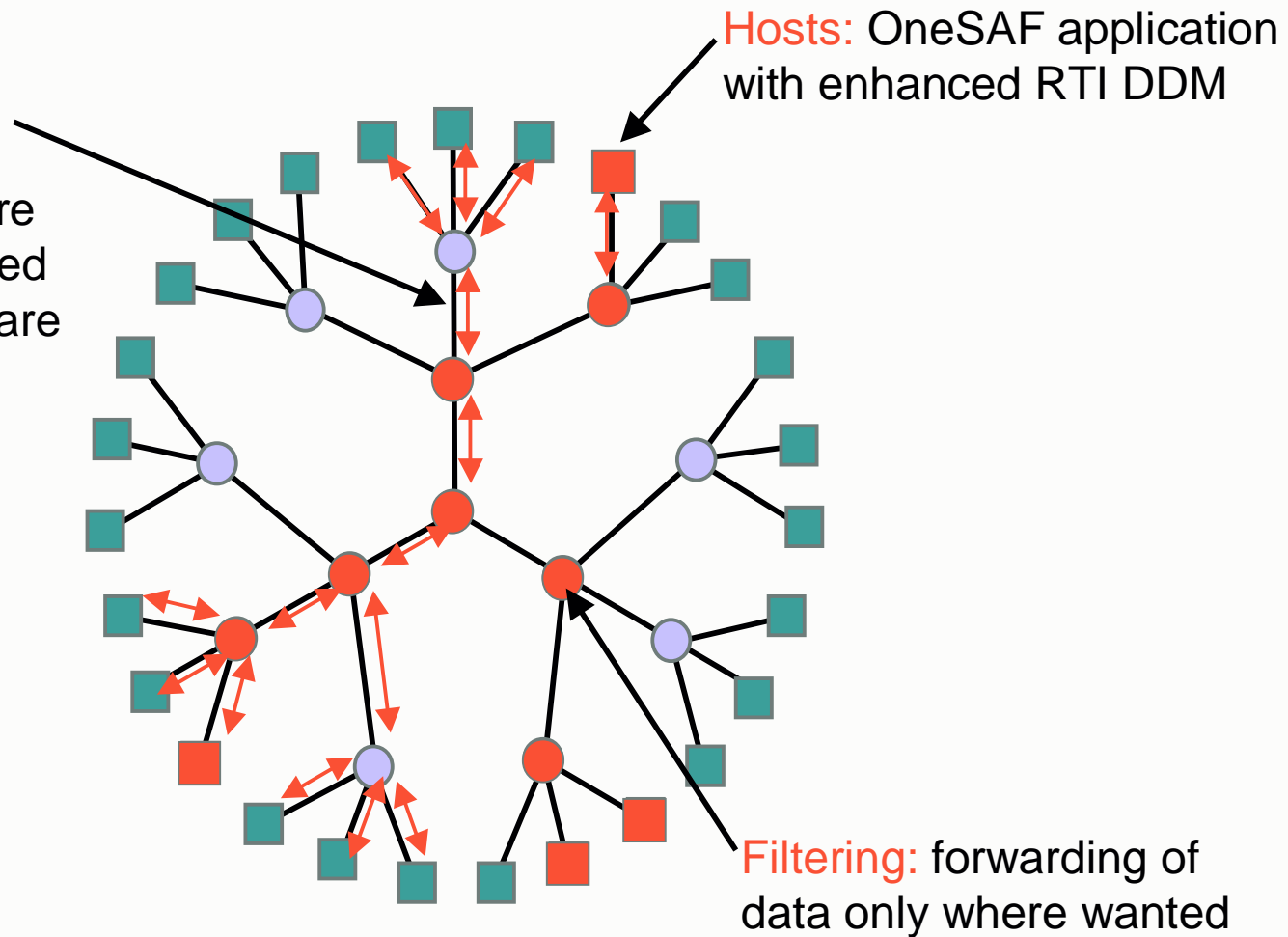
Military Communications



Dynamic Active Filtering

Signaling:

- publishers declare data to be published
- subscribers declare desired data



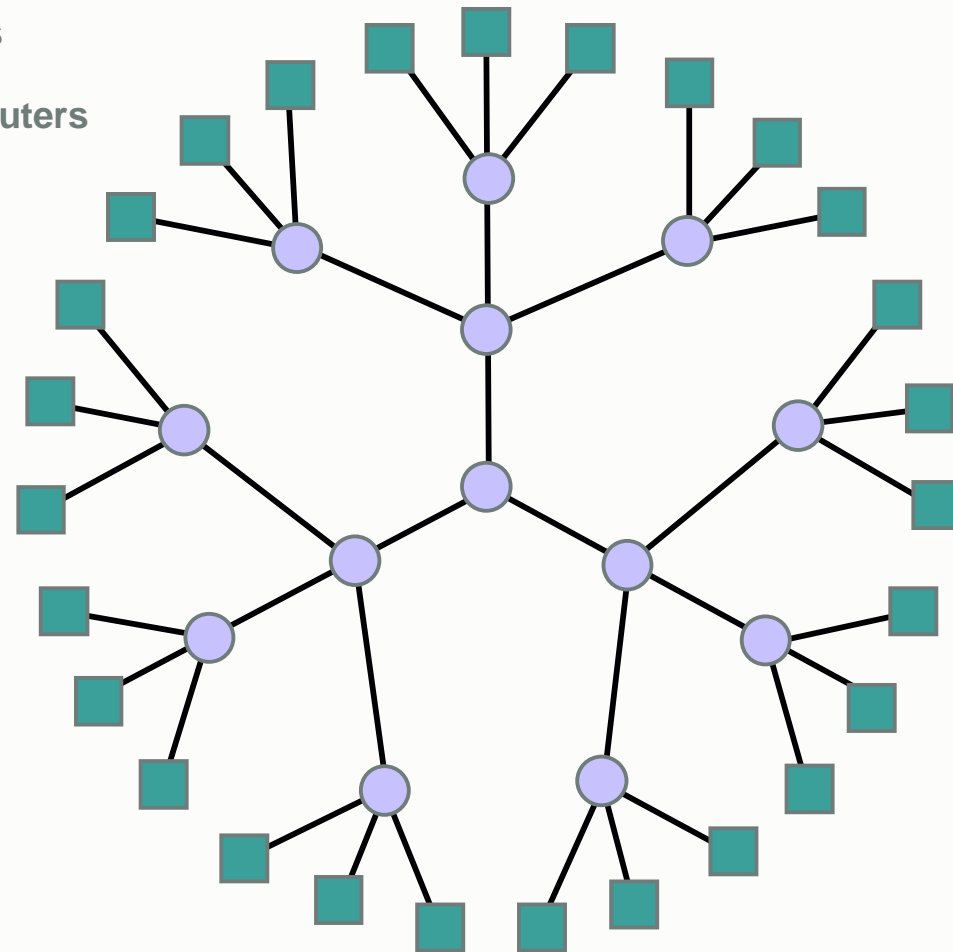
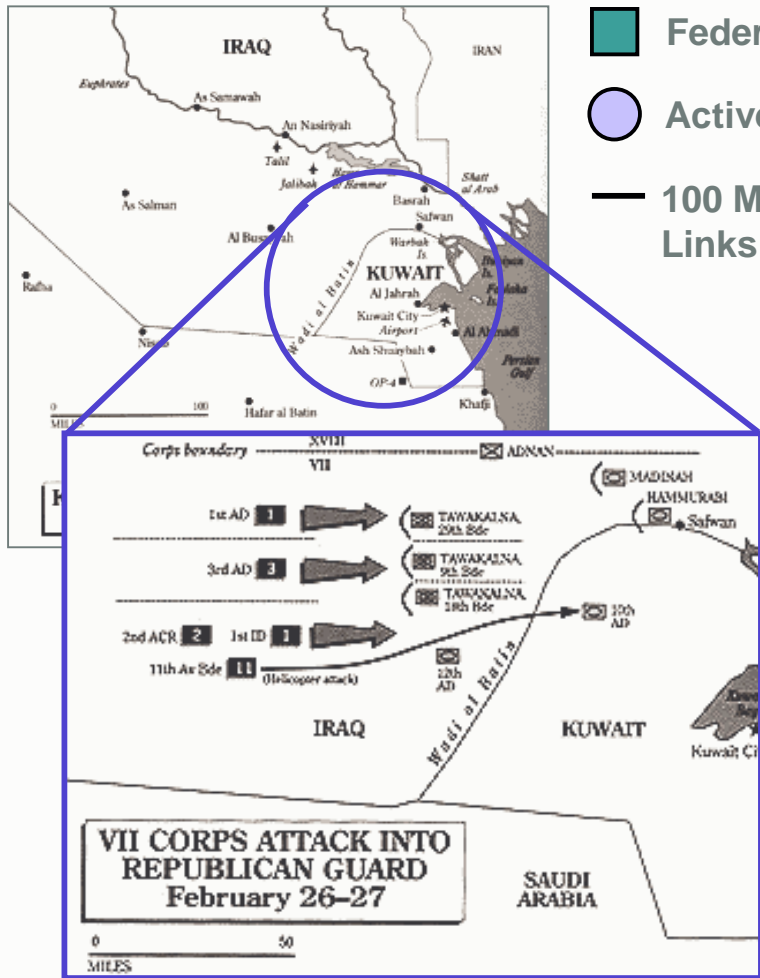
Active Filtering Infrastructure

- DARPA funded through 2002
- Content aware routing
- Large scale real-time group communications
- Reliable service (IEEE Milcom 2003)

Increased bandwidth efficiency

Context Awareness

Scalability Experiments on Utah's *Emulab*



Emulab Experiment Results

- Crafted ground simulation scenario: Desert Storm historical data
 - Approximately 2000 entities (>70 entities/federate)
 - Approximately 4Mb/s estimated raw data rate before filtering
- Configured Emulab nodes with AN routers and OneSAF hosts
- Configured 28 federate (41 host) topology
- *Approximately 6X reduction in inbound network traffic to each federate*
 - reduction will improve as federation size increases

Ad Hoc Wireless Communications

- Price Optimization: Microeconomic concepts to power-aware algorithms (IEEE Milcom 2003)
- Sensor collaboration, communication, mobile ad hoc communication
- Group communication

Power-aware many-to-many communication in IEEE 802.15

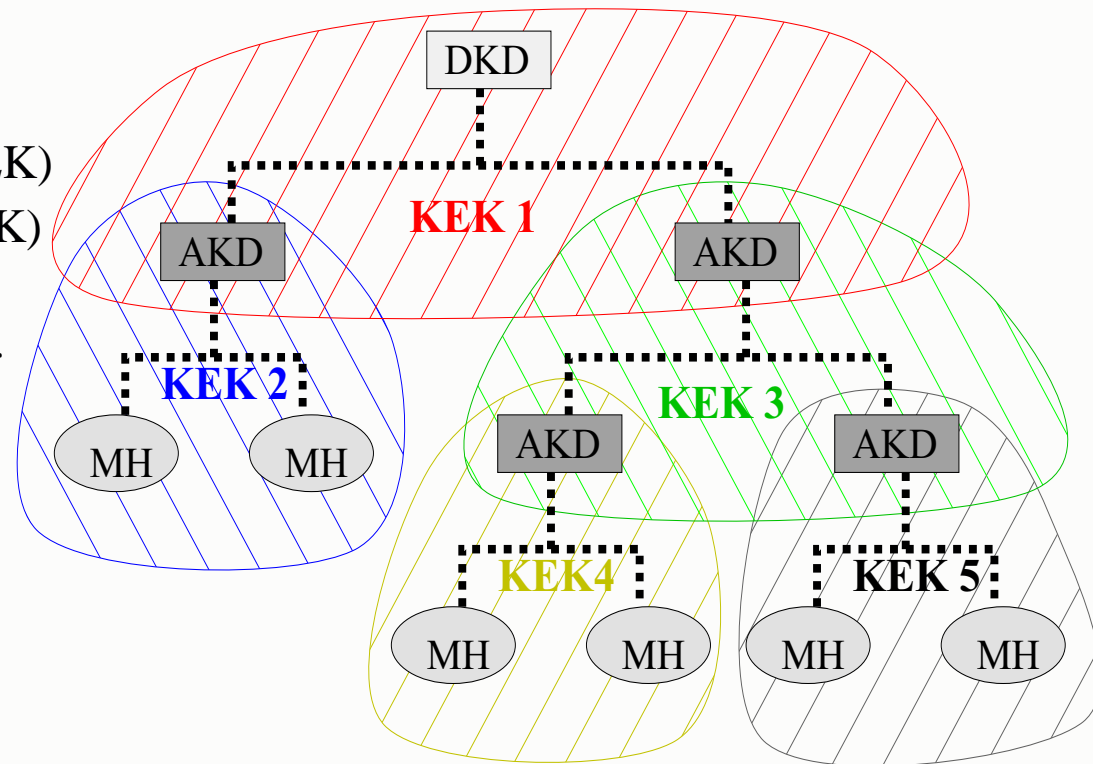
Secure Group Communications

- Secure multicast communication
- Dynamic networks
- Scalability

Multi-level hierarchical key management (IEEE Milcom 2003)

Security: Hierarchical Key Management

- Data Plane
- Control Plane
 - Keys
 - data encryption key (DEK)
 - key encryption key (KEK)
 - Distribution
 - Domain Key Distributor (DKD)
 - Area Key Distributors (AKD)
 - Mobile Hosts (MH)



Collaborations

- Motorola Labs—IEEE 802.15
- Northwestern University—Resource allocation and analysis
- Univ Massachusetts, Amherst—Active filtering, Secure group communication
- SUNY, Buffalo—Data fusion, Sensor collaboration/clustering

The Vision – Revisited

Secure, Reliable, Power-Aware Ad Hoc
Communication Infrastructure

- Dynamic Active Filtering: provides reliable, content-aware data delivery
- Data Processing Technologies for Ad Hoc: power-aware lightweight group communication
- Secure Group Communication: security!