Military Communications

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Comparative Review of Commercial vs Tactical Wireless Networks

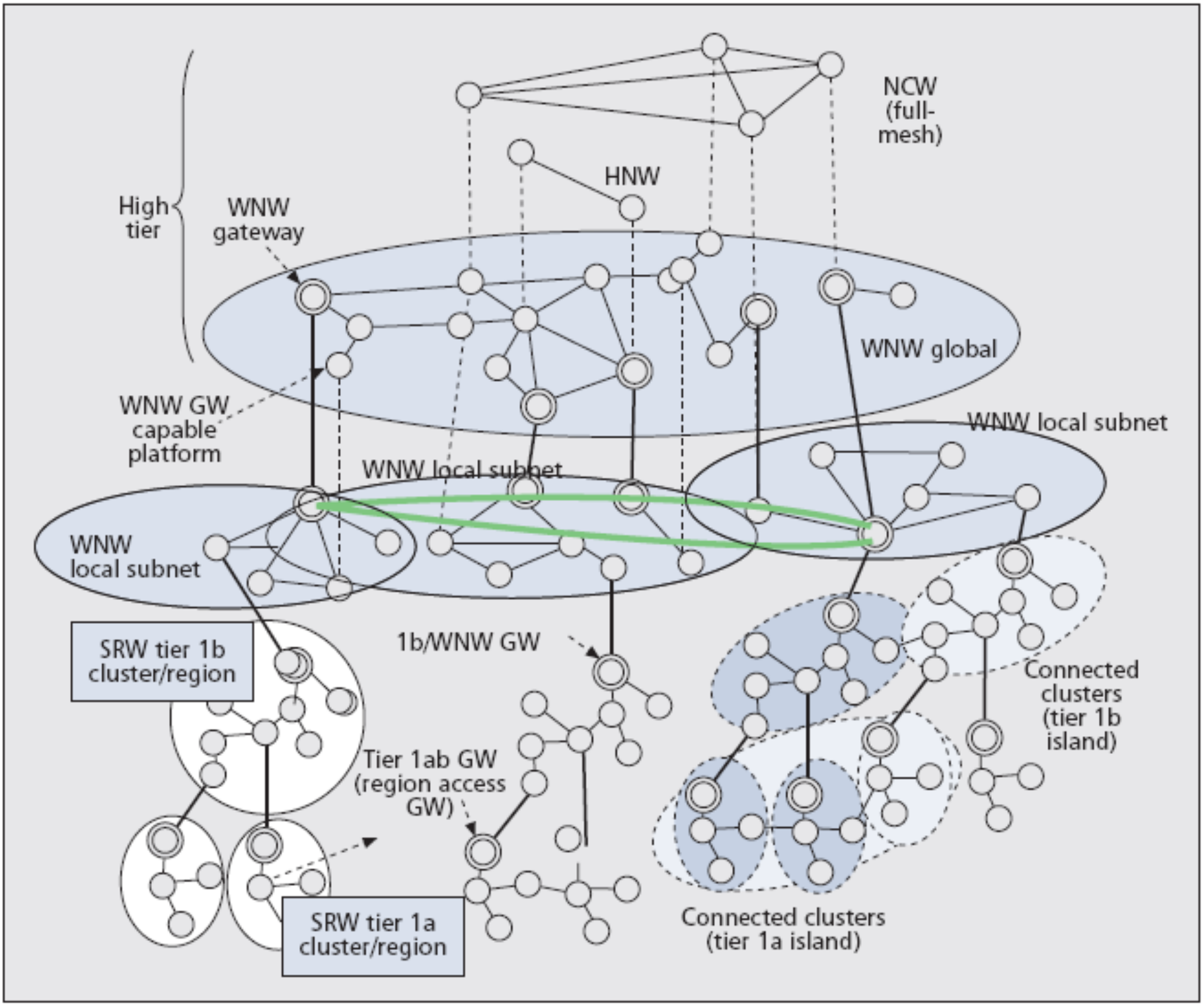
- By Elmasry
- Topics
  - Advances in commercial vs military networking
  - Network model for military systems

Military vs Commercial Success

- Starting from similar places, commercial wireless technology and deployment has vastly outpaced military
  - Innovation, competition stifled by military directly conducting solitary, stovepiped, complex projects
  - Military should have instead defined standard interfaces, architectures/models, and let developers go at it on their own, largely using their own funds

Military Network Model

- Model of military networks
  - Focus on security domain model/architecture
  - Interface locations among layers for standardization
- Probably mostly of interest for security work, specific military implementations
  - Seems subsumed by OSI stack, Internet models
- But, good information on specific structure...


NCW
(full-
mesh)
HNW
High
tier
WNW
gateway
WNW global
WNW GW
capable
platform
WNW local subnet
WNW local subnet
WNW
local subnet
SRW tier 1b
cluster/region
1b/WNW GW
Connected
clusters
(tier 1b
island)
Tier 1ab GW
(region access
GW)
SRW tier 1a
cluster/region
Connected clusters
(tier 1a island)

Peer-to-Peer Communications for Tactical Environments

- By Suri et al
- Topics
  - Applications of P2P techniques to military networks

P2P for Tactical Settings

- P2P applicable to tactical network settings
  - No centralization, limited configuration required
  - Graceful degradation of capabilities
  - Exploit group messaging with wireless broadcast
  - Natural desire for proximity/precision correlation echoed by many protocols

Tactical Networking Requirements

- Automatic configuration
- Efficient peer discovery, continuous monitoring
- In-network data transformation
- Adaptive, policy based, disruption tolerant
  - Multiple messaging models in play
  - Use prioritization, frequency, reliability, sequencing requirements to perform efficiently
  - Must handle periodic disconnects, link loss
- Provenance management
- Integration with SOA

Robust Web Services in Heterogenous Military Networks

- By Lund et al
- Topics
  - NATO standardizing on federated, heterogenous systems connected by Web Services
  - Proxying web services for disadvantaged networks

NATO & Web Services

- NATO standardizing on service oriented architectures
  - Enable interoperability, competition
  - Loose coupling of applications, ease of assembling
  - Can't expect everyone to use same software
- Must define interfaces, discover resources

Web Services in Tactical, Heterogenous Military Networks

- To use Web Services in disadvantaged tactical networks, must:
  - Reduce amount and size of traffic generated
  - Eliminate end-to-end connectivity dependence
  - Manage, render transparent network heterogeneity

Reducing Volume

- Compression alone cannot control volume
  - Cache, reuse matching messages
  - Use pub/sub rather than request based paradigm
  - Support group dissemination, sharing messages
  - Filter, possibly transform content

Store and Forward

- Introduce store-and-forward proxy to mitigate end-to-end connectivity requirements
  - Requires higher level error control at endpoints

Heterogenous Networks

- Different networks and hosts will have different capacities, rates, and buffering capabilities
  - Have to manage those differences
  - Must store-and-forward at application layer to operate over multiple types of underlying layers

Proxy Capabilities

- Proxy core functionality does not rely on inspecting message content
- Additional functionality may read, manipulate messages at content level
  - Caching, reuse
  - Publish/subscribe---mimic at endpoints
  - Diff propagation

Web Services Discovery across Heterogenous Military Networks

- By Johnsen et al
- Topics
  - NATO standardizing on federated, heterogenous systems connected by Web Services
  - Discovery mechanisms will vary across networks but have to be connected

Types of Discovery

- Discusses several types of discovery
  - URI/label vs semantic advertisements & matching
  - Centralized registry vs decentralized vs P2P
  - Runtime vs design time discovery
  - Known compatible interfaces vs composition

Levels of Military Networks

- Three abstract levels in military networks
  - Strategic: Fixed infrastructure, hundreds to thousands of nodes and services
  - Tactical deployed: Fixed and on-the-quick infrastructure, 100s to 1000s of nodes, services
  - Tactical mobile: Very disadvantaged wireless networks, 4 to 20 nodes, small set of services
    - Mobility, robustness more important than scalability

Heterogenous Discovery

- Three main approaches to discovery across heterogenous networks
  - Adaptive service discovery: One mechanism used across entire network
  - Layered service discovery: Common abstraction layer built on top of several mechanisms
  - Service discovery gateways: Most appropriate mechanism used on each, gateways connect
    - Since different hardware and software is used, gateway most likely needed anyway