Data Replication over Disadvantaged Links

A Canadian Naval Perspective

By Commander John Bycroft
# Data Replication Over Disadvantaged Links: A Canadian Naval Perspective

## 1. REPORT DATE
01 DEC 2007

## 2. REPORT TYPE
N/A

## 3. DATES COVERED
-

## 4. TITLE AND SUBTITLE
Data Replication Over Disadvantaged Links: A Canadian Naval Perspective

## 5. AUTHOR(S)

## 6. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Defence R&D Canada Valcartier

## 7. SPONSORIZING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

## 8. SPONSORIZING/MONITORING AGENCY REPORT NUMBER

## 9. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited

## 10. SUPPLEMENTARY NOTES
See also ADM002082, The original document contains color images.

## 11. ABSTRACT

## 12. SECURITY CLASSIFICATION OF:
a. REPORT
unclassified

b. ABSTRACT
unclassified
c. THIS PAGE
unclassified

## 13. NUMBER OF PAGES
32

## 14. NAME OF RESPONSIBLE PERSON

## 15. SUBJECT TERMS

## 16. LIMITATION OF ABSTRACT
UU

## 17. NUMBER OF ABSTRACT OF PAGES
32

## 18. NAME OF RESPONSIBLE PERSON

## 19. NAME OF RESPONSIBLE PERSON

---

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18
The Maritime Imperative

National, Joint or Coalition Maritime Operational Efficiency, Effectiveness and Timeliness
The Solution

Network-Centric Information Management requiring:

- Access to the shore Information Management Infrastructure;
- A web-enabled user community; and
- Seamless communication links.
The Problems

- Extremely small ‘footprints’
- Highly unstable platforms
- Non-continuous Connectivity
- Small antennas/limited power
- Mutual interference
- Disparate systems

= Disadvantaged Users
The Compromise

Collaboration at Sea
(C@S)
C@S Elements

- High Speed Data Connectivity (HSDC) Project - technical architecture
- Connectivity through INMARSAT/SHF SATCOM – Ship/Shore/Ship Pipe
- IBM/Lotus Software – enabling technology
C@S Elements - HSDC

- Routers provide access to three separate domains:
  - DNET (Unclas/Protected, including Enterprise applications)
  - CNET (Classified)
  - COWAN (Coalition) (Tactical WAN)
- Voice over IP (VoIP) telephones
- Combined Operational Picture (COP)
- COMSEC encryption (TACLANE/KG-175)
- Link (TRANSEC) encryption (KIV-7)
HSDC

2 x VoIP

DNET

CNET

COWAN

Router

INMARSAT (NERA B)
C@S Connectivity

- 24/7 Connectivity through commercial provider (INMARSAT)
- Leased channels
- 64 kbps ISDN – concurrent 64k up and down
- 128 kbps with binding (2x64 channels)
- Packet switching through CISCO routers
- Reliability (23:40 hours per day = >99%)
C@S Elements – Software

- Domino Network
  - Standardized Task Group Website
    - Standardized Web Site Design
    - Distributed Web Environment
    - Web Site Data Replication

- Lotus Sametime
  - Chat and Whiteboard
Collaboration At Sea

Using Information and Web Technology for Tactical Command and Control
Task Group Website

- Principal means to share data & information
  - Not only a flagship or flag-staff tool
  - Used by all TG units and involved shore commands
  - Common source of information
- Easy to access/intuitive to use
- Timely
Secret of Success

Frequent Data Replication
Constraints on Replication

- Need for an initial ‘Large dump’
- Need for reliable communications (QoS)
- Need for standardized TEMPLATES
- Need for learning (some) web techniques.
Advantages of Replication

- Significant bandwidth saving
- Continuous operation
- Provides a common locally accessible data-base.
- Ability for units to continue operations during EMCON silence
Domino REPLICATION

- Monitors data transfer during replication
  - Will restart interrupted replication at point of interruption automatically
- Website made up of multiple databases – replication can be selective within the Website
- Replication can be “server” specific vice “network”
Standardized BG Web Site
CTG 307.1 Web Site

This website is under the control of Commander Canadian Fleet Pacific (CCFP).
Collaboration At Sea

Distributive Web Environment
Traditional Non-Replicated Web Environment

- Web site and content managed by centralized (Shore) personnel
- Numerous inefficiencies
- Web pages downloaded with each user visit
- INMARSAT outages degrade site availability
Non-Replicated TG Web Site

Original Configuration
- Excessive bandwidth needs
- Centralized data posting (bottleneck)
- Connectivity failure = Site data inaccessible
C@S Distributive Web Environment

- Web Site centrally controlled by TG Commander
- Standardized
- Sites reside on each ship
- Users visit site via ship’s LAN
- Changes to data/info are downloaded to each unit only once:
  - Clustered, cyclic, or on demand
  - Overall bandwidth demand significantly reduced (huge benefits for the “bandwidth-challenged”)
C@S TG Web Network

Collaboration at Sea Web Environment

- Replicated (“mirrored”) web sites
- Decreased bandwidth needs (only changes in information are replicated)
- Dispersed content management responsibility
- Connectivity failure = Web site data remains accessible
Lotus Sametime

A Robust Tool for Real-Time Distributive Collaborative Planning

Provides:
- One-on-one or group chat
- Multi-user whiteboard collaboration
- Live application sharing
Real-Time Chat
Real-Time Collaboration: MIO
Real-Time Collaboration: Strike

- **Challenge**
  - Use of Satellite imagery to evaluate “targets”
  - Involving Hawaii, Washington, Ottawa
  - Typical >48 hr turn around

- **Solution**
  - SAMETIME with whiteboard and text/video chat to enable “real time” collaboration
  - Turn around <4 hrs
Real-Time Collaboration: Engineering
Implications for the Warfighter

- **Real-time Chat/Collaboration**
  - CNET/COWAN Website

- **Current Operations / Execution**
  - Collaborative Planning
  - Chat Rooms, Email Messaging

- **Shared Commander’s Intent**
  - CWC / Warfare Commander DIMS
  - OPREP 5 Feeders, CONOPS
  - Daily OPSUMs

- **Shared Situational Awareness**
  - CEPS, SORTS, TIRS
  - OPSTAT, Circuit Status Report
  - Intel Summaries, Info Email

- **Unclassified / Support**
  - Email Coordination
  - Human Resources Databases
  - Logistics/Supply, Admin

- **Immediacy / Importance**

- **Volume of Information**

**DNET & ENTERPRISE APPS**
Collaboration at Sea…

- Is an evolutionary step towards NCW
- Promotes an IT to KM transition
- Is a distributed web environment
- Demonstrates that replication can provide bandwidth conservation & savings
- Demonstrates that replication can benefit disadvantaged users
- Shows that chat can speed decision-making
But, one must never forget the aim......
ADMIRAL, WITH ALL DUE RESPECT—COULD WE HAVE LESS NETWORK-CENTRIC AND MORE ROUNDS ON TARGET?!