

The C2 Workstation and Data Replication over Disadvantaged Tactical Communication Links

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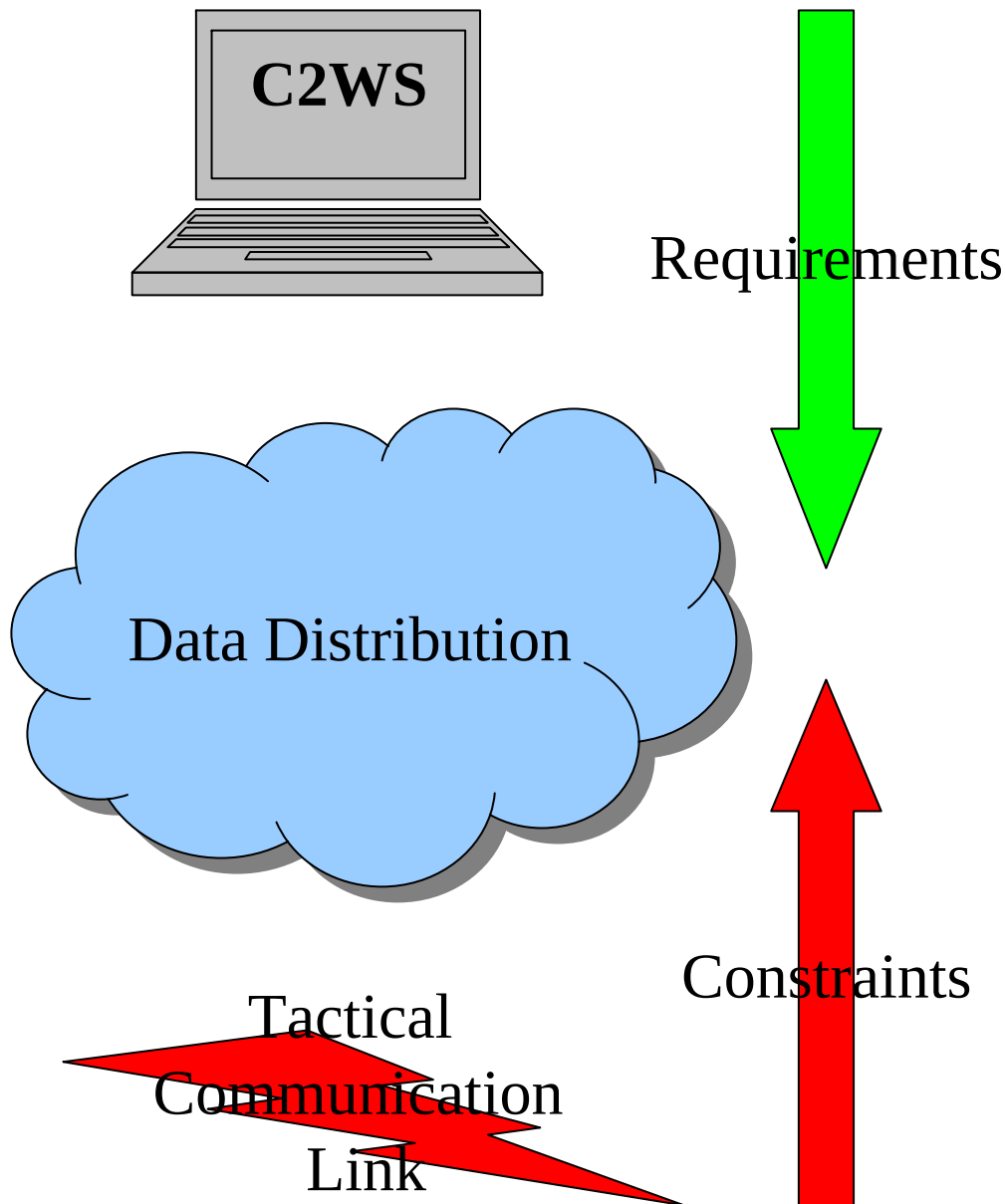
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Part 1. Introduction

Structure of this Presentation:

- Part 1. Introduction
- Part 2. The Problem Domain
- Part 3. The C2 Workstation (C2WS)
- Part 4. Conclusions and Recommendations

Part 2. The Problem Domain for this Presentation



How to:

- Collaborative working**
- Selective data distribution
- (Re-)Synchronisation
- Stand alone operation
- Security**

Despite:

- Limited bandwidth
- Limited reach
- Frequent disconnects
- Latency
- Out of order delivery
- Missing data packages
- Corrupt data packages
- Dynamic topology**

Part 3. The C2 Workstation (C2WS)

The screenshot displays the MDIForm1 C2 Workstation interface, which is a multi-paneled application. The main window is a web browser showing the weather.com website for Ambon, Indonesia. The browser's address bar shows the URL <http://www.weather.com/ambon.htm>. The website content includes a weather forecast and current conditions for Ambon, Indonesia, as reported on Monday, October 2, at 8:12 AM EDT. The forecast shows a 3-day outlook with temperatures ranging from 76°F to 84°F.

On the left side of the interface is a vertical console with various icons and labels: GIS 2D, GIS 3D, Intranet, Supplies, MIS, Video Conference, CNN, Weather, Vuursteen, and Messages. The right side features an Alerts panel with a list of messages and their timestamps, and a COP Catalog panel showing a hierarchical list of operations and phases.

Alerts Panel:

Alert	Time
Alert messag...	11:17:5
Question mes...	11:17:4
Critical messa...	11:17:2
Alert messag...	11:17:1
Critical messa...	11:17:0
Question mes...	11:16:9
Critical messa...	11:16:4
Question mes...	11:16:3
Information m...	11:16:2
Critical messa...	11:16:1
Alert messag...	11:16:0
Information m...	11:15:9
Question mes...	11:15:4
Alert messag...	11:15:3
Critical messa...	11:15:2
Question mes...	11:15:1

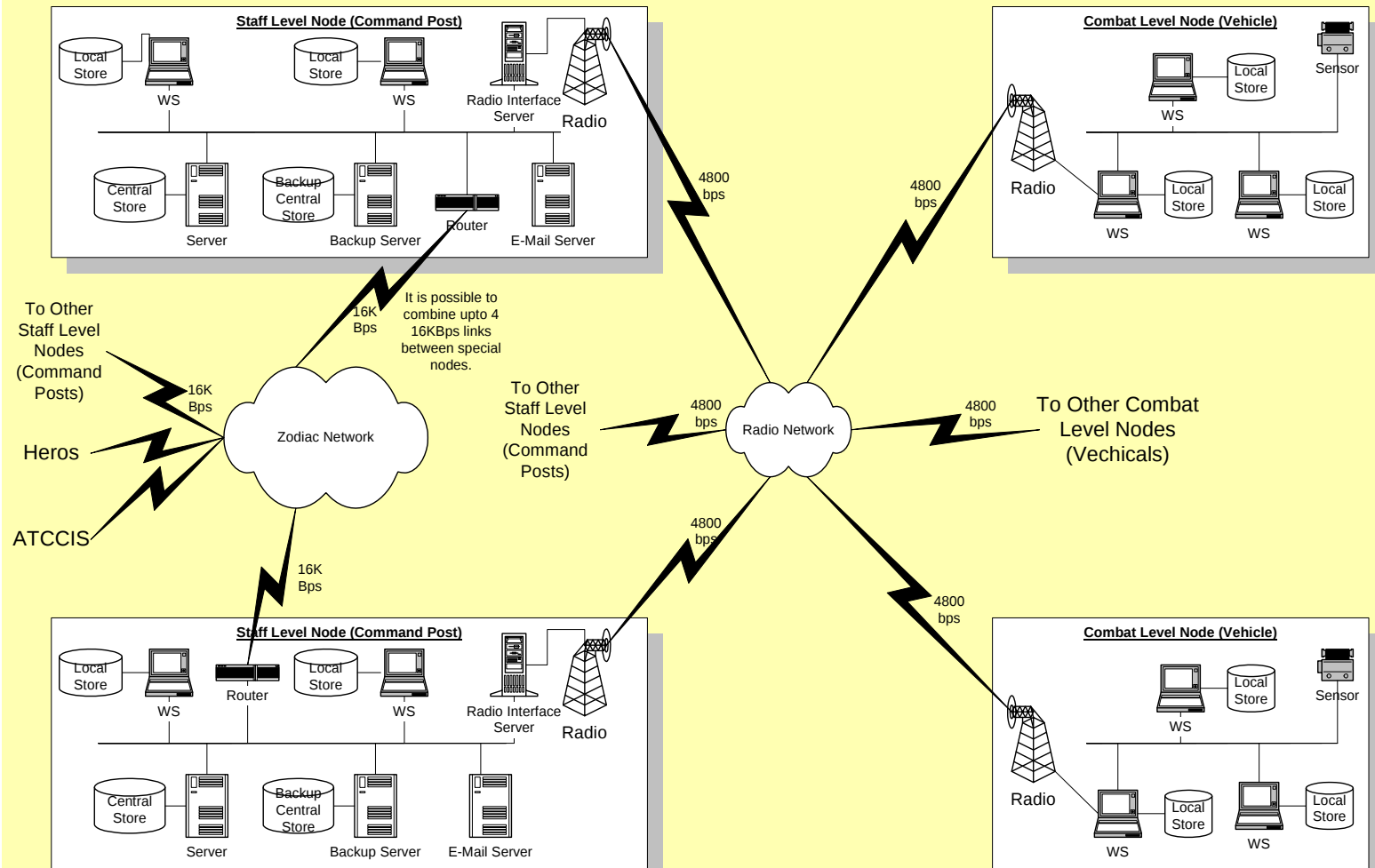
COP Catalog Panel:

- ☐ Operation Swamp
 - ☐ Phase 1
- ☐ Operation Adventure
 - ☒ 1 Div
 - ☐ 13 Bgd
- ☒ Operation Open Plan

The bottom of the interface shows a taskbar with three active windows: 2D GIS, AMMO/F..., and Browser.

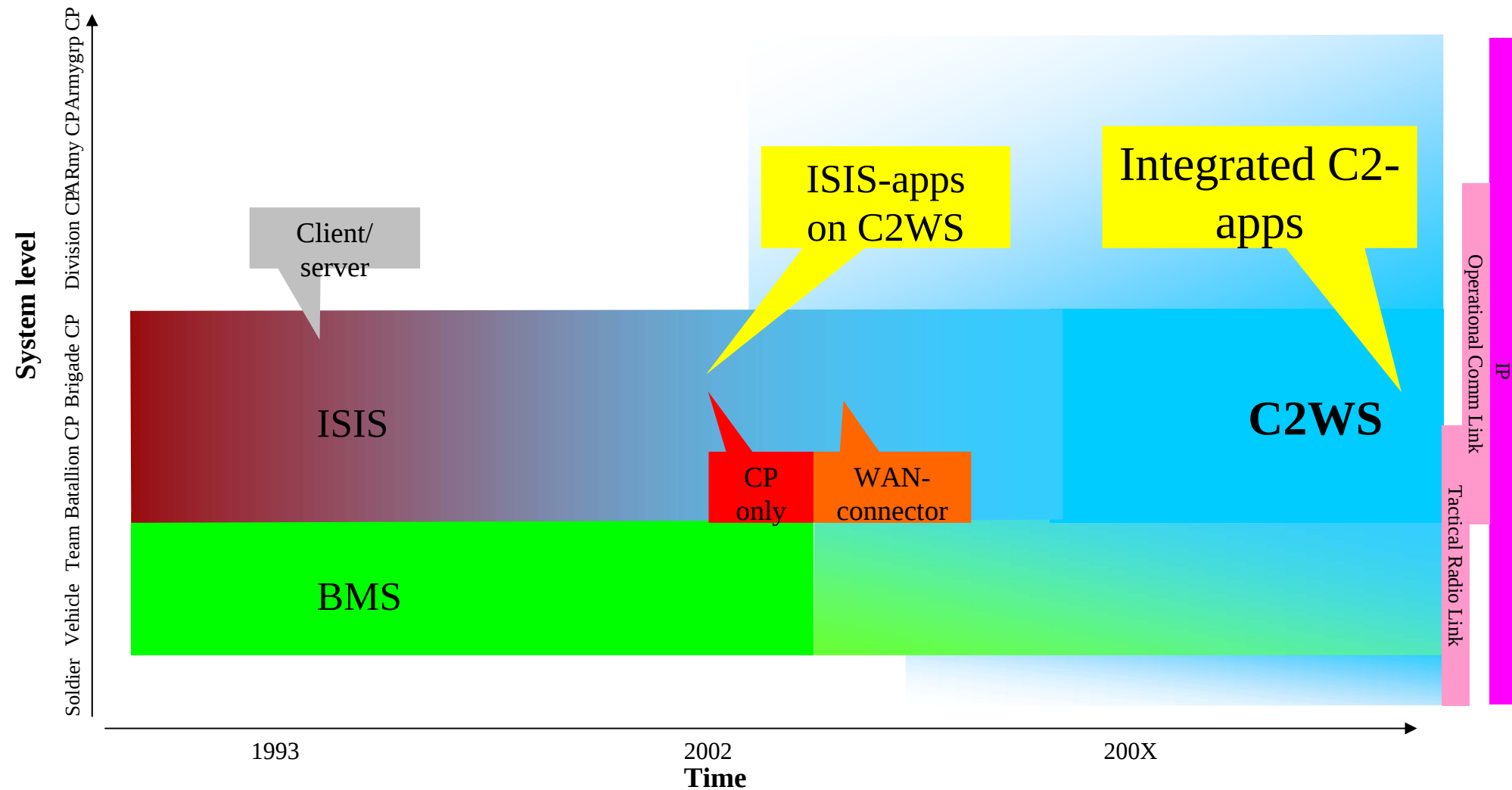
C2WS Physical Environment

C2WS System Architecture Context Diagram



C2WS Evolution

Basic Functionality - Stability - Performance – Data Distribution – Management – Security – Extend Functionality



C2WS Design Decisions I - Workstation

- Local data store (client **or** server!)
Each workstation is a replication node!
- Overlays to group information
- Publish/Subscribe on a per Overlay basis
 - no servers, no single point of failure
 - Catalog of available information
- Parallel synchronisation and processing of (out of order) messages

C2WS Design Decisions II - Data Distribution I

- Supports Overlay Concept
- Publish/Subscribe – COTS product
- C2WS messages
 - unit of data distribution
 - can be processed ‘out of order’
 - can be distributed with different QoS settings (future)
 - can be encrypted and signed (future)
 - portable data (XML) -> C2XML
 - ‘(delta) object completeness’

C2WS Design Decisions III - Data Distribution II

- Synchronization
 - For subscribed Overlays:
 - Active Information and/or
 - Historic Information (time period)
 - Configurable data loggers/synchronization servers
 - Heartbeat
- Multi-master replication with loose consistency & convergence

Collaborative work on a shared Overlay

- Last update wins
 - Version numbers on object-attribute values
 - Conflict resolution on a per attribute basis only.
- Data conflict
 - Normal (foreign key, transactional) integrity is not enforced in favor of availability.
 - Left to end users after synchronizing
 - Replication mechanism only provides convergence
- Differing view - different overlay
 - Within an Overlay, data will most likely be contributory than conflicting

C2WS versus ATCCIS/MIP DEM

ATCCIS	C2WS
Database replication	Info bus
Contracting	Publish/subscribe per overlay
Contracts (predefined)	Overlays (flexible)
Relational	Object oriented
Proprietary PDU syntax	XML
Fixed QoS	COTS MOM
LC2IEDM	C3I info model
Ownership	<u>Update anywhere; access control lists/ last wins</u>
Database table changes	Object(change)s
Full bulk synchronization	Synchronization options
Increments after full bulk	Concurrent synchronization & regular data exchange

Part 4. Conclusions & Recommendations

- C2WS principles
 - Data organized in Overlays
 - Update anywhere, collaborative work
 - Use Publish-Subscribe paradigm
- Challenges:
 - Proof of the pudding...
 - How to use Overlays?
 - vehicle level and down?
 - Combine security & publish-subscribe?

Conclusions & Recommendations

- Recommendations
 - Contact TNO and/or C2 Support Centre
 - Join MIP/Seawg
 - Take care

Questions?