New Approaches to Tactical C2 Interoperability: Apps vs. Data

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What If

- Soldiers could access their Tactical Command and Control (C2) from a standard Web Browser …

- Military Staffs could customize their own C2 Applications

- Staff could create new C2 Applications (Apps)

- All C2 applications had the same Common Operational Picture and used the same map

Would we say that these C2 Applications
Were Interoperable?

Interoperability

- The DoD Community has spent a tremendous amount of effort on Data Interoperability

- While necessary for a small set of data, this has not lead to a Common COP

- More importantly, it has not lead to more *Agile* and *Collaborative* systems, now a key attribute identified by current C2 theory (DoD Command and Control Research Program – CCRP)

So what is the right approach to C2 Interoperability
Given our current Information Technology trends?

Functionality

- Currently, the iPhone metaphor is useful in looking at how to develop a Common COP and achieve better functionality, agility and collaboration

- There is no *Common Data* in the iPhone "App" concept

- Rather, Apps exchange data as needed and agree upon only the relevant data to be exchanged

The US Army is implementing this concept in
Their next C2 Architecture – Command Web

Functionality and Interoperability via Apps

- It appears that there is an incompatibility between building additional functionality that does not use Common Data

- However, the issue is that Users require functionality! If Apps can deliver this, then they are willing to sacrifice interoperability

- But there is a way forward ...

A Case Study

- It is extremely difficult to establish new functionality via a data-driven approach with current Tactical C2 systems

- Within the US Army there are many challenges to integrating Simulations (for training, planning and mission rehearsal) into Army C2

- The new Command Web Architecture has allowed Simulations to be interoperable with C2 functions by providing them with the ability to be a C2 "App" rather than by simply exchanging data

Simulation-Mission Command Interoperability

US Army Simulation to Mission Command Interoperability Overarching Integrated Product Team (SIMCI OIPT)

MISSION

Provide recommendations on Army level policy to the Army Leadership for improving <u>interoperability</u> between the Models and Simulations (M&S) and Mission Command (MC) Domains.

OBJECTIVES

- Seamless interoperability between M&S and MC systems.
- Alignment of M&S and MC standards, architectures, and common MC components.
- Identification of requirements for simulations and MC to support interoperability
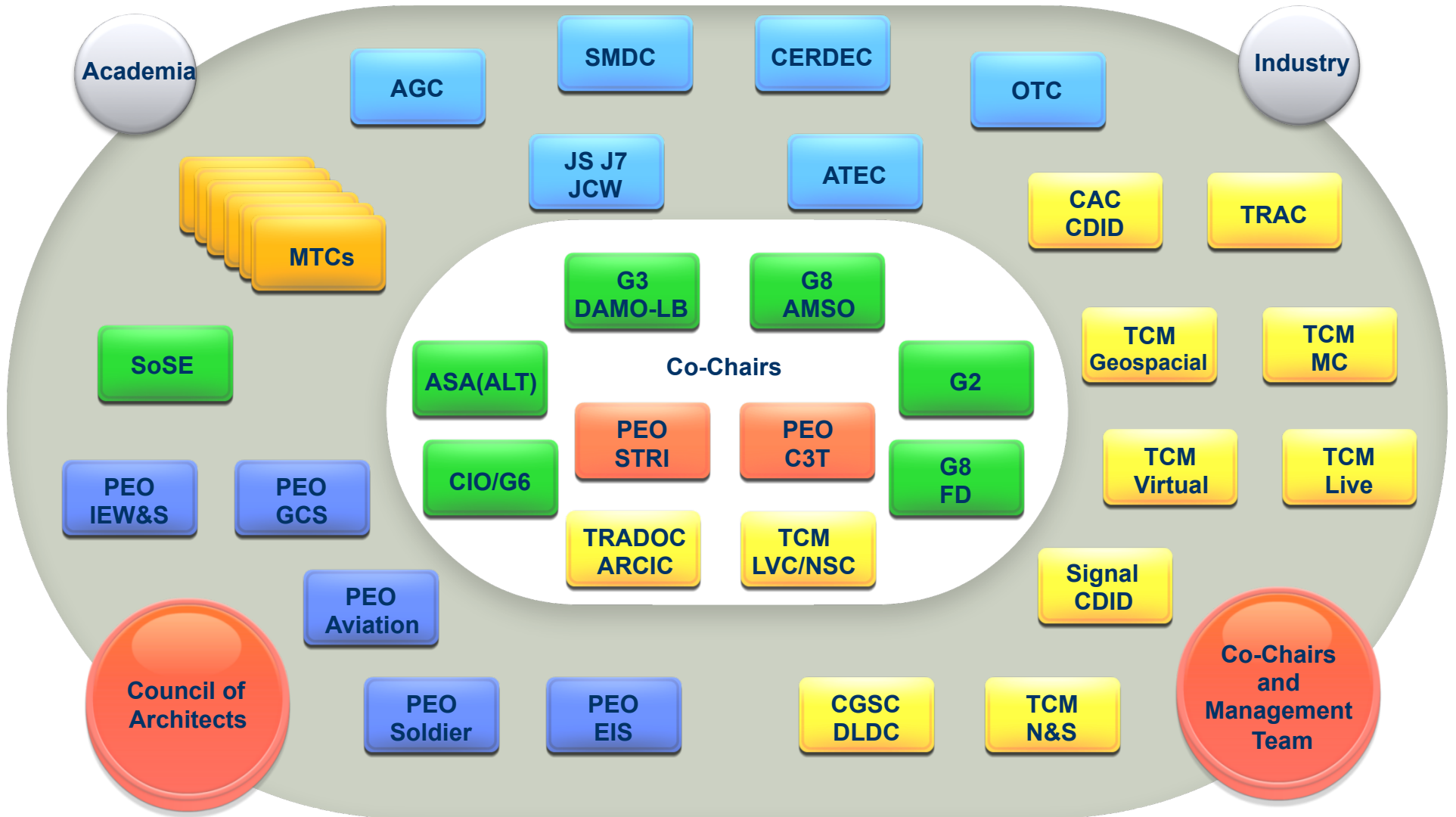
IPT MEMBERS

Co-Chairs:* PEO C3T** (Program Executive Office for Command, Control and Communications-Tactical) ***& PEO STRI (Program Executive Office for Simulation, Training and Instrumentation)

US Army Simulation to Mission Command Interoperability Overarching Integrated Product Team (SIMCI OIPT)

SIMCI

PEO C3T
PROGRAM EXECUTIVE OFFICE COMMAND CONTROL COMMUNICATIONS-TACTICAL

PEO STRI

Simulation-Mission Command Interoperability

Academia

Industry

AGC
SMDC
CERDEC
OTC

JS J7 JCW
ATEC

CAC CDID
TRAC

MTCs

SoSE

G3 DAMO-LB
G8 AMSO

Co-Chairs

ASA(ALT)
G2

PEO STRI
PEO C3T

CIO/G6
G8 FD

TRADOC ARCIC
TCM LVC/NSC

TCM Geospacial
TCM MC

TCM Virtual
TCM Live

PEO IEW&S
PEO GCS

PEO Aviation

Signal CDID

Council of Architects

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PEO EIS

CGSC DLDC
TCM N&S

Co-Chairs and Management Team

Material Developers
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Cross Domain
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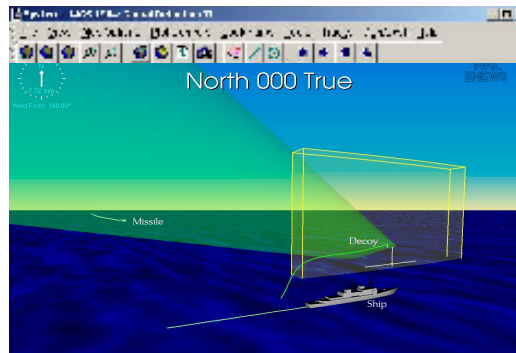
Potential of Advanced Simulation Technologies in C2

What?
- Information/processes beyond human cognition
- Geospatial information other than track data

How?
- May be multidimensional (2-3D plus time)
- Displayed in C2 as separate data/objects overlays
- Displayed in Operational Picture as alternate views
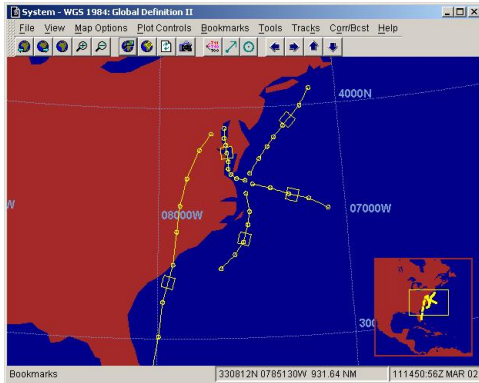
Planning Domain

Examples

Real-Time Operational Picture

Electromagnetic Spectrum Domain

North 000 True

Missile

Decoy

Ship

Chem Bio Domain

US Army Mission Command

- The following slides have been provided by PM Mission Command (PM MC) and their use is gratefully acknowledged

- The slides provided by PM MC have been approved for Public Release.

- The US Army uses "Mission Command" as their term for Tactical C2

The Command Post Challenge

PEO C3T — PROGRAM EXECUTIVE OFFICE COMMAND CONTROL COMMUNICATIONS-TACTICAL

Mission Command

Communications

Command Post

Enablers

* Partial System Listing

PEO C3T | PM AMF | PD COMSEC | PM JBC-P | JTNC | PM JTN | PM MC | PM MNVR | PD TNI | PM TR | PM WIN-T | MILTECH

![PEO C3T - Program Executive Office Command Control Communications-Tactical]
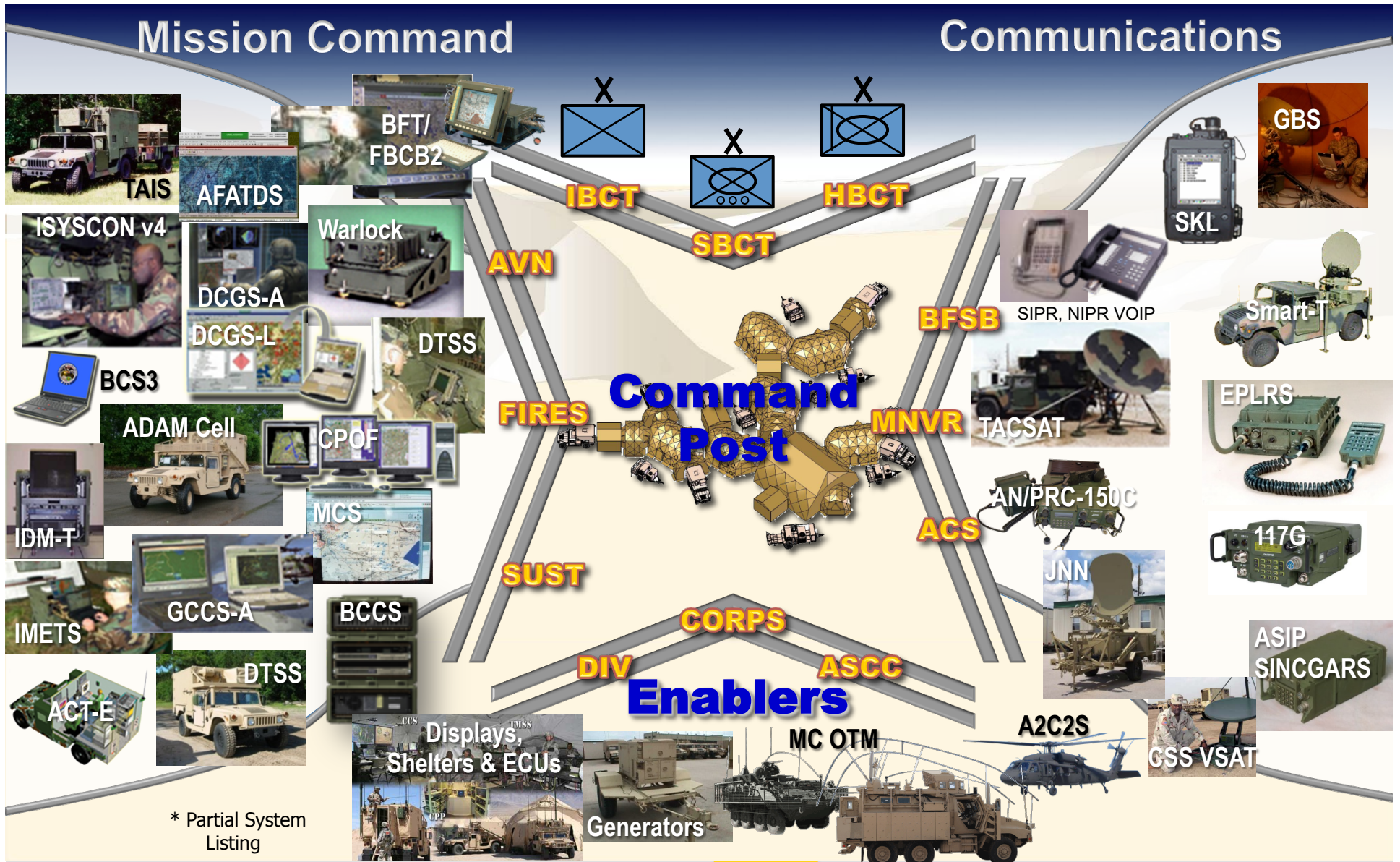
Historical Mission *Command Evolution*

1981-1999	2000-2007	2008-2012	2013 - 2017	2018+
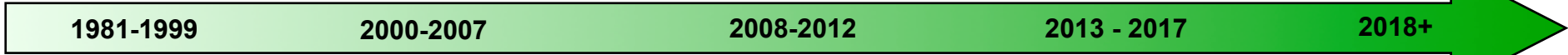
Standalone Systems

Original ABCS System Concept

Individual, Separate BFA Architectures

GCCS-A
Global Command and Control System-Army
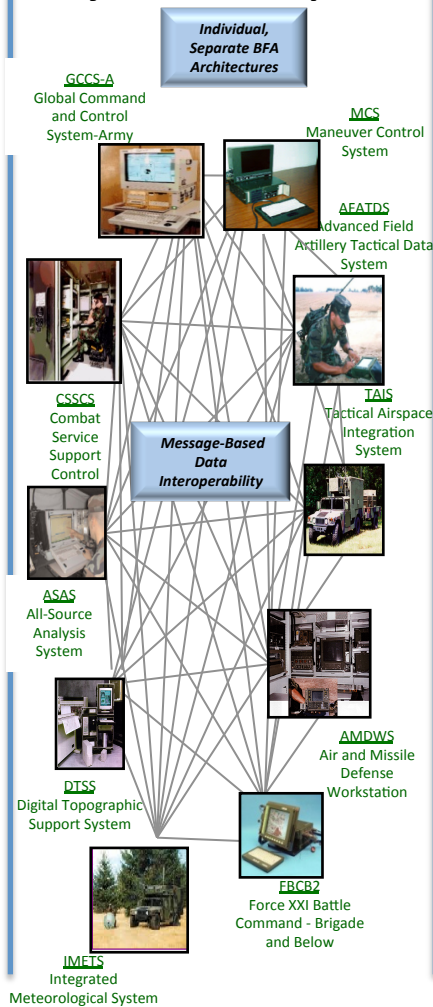
MCS
Maneuver Control System

AFATDS
Advanced Field Artillery Tactical Data System

CSSCS
Combat Service Support Control

Message-Based Data Interoperability

TAIS
Tactical Airspace Integration System

ASAS
All-Source Analysis System

AMDWS
Air and Missile Defense Workstation

DTSS
Digital Topographic Support System

FBCB2
Force XXI Battle Command - Brigade and Below

IMETS
Integrated Meteorological System

Battle Command Collapse

BCS3
GCCS
BCCS

Services

Enterprise

Collaboration

Mvr CoMotion

Fires CoMotion

Collaborate

Air CoMotion

Log CoMotion

JADOCS
AFATDS
TAIS
BCS3
GCCS-A

DDS/ MIP
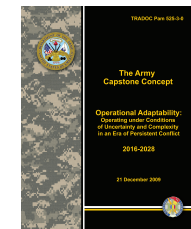
Others

Web Services Environment
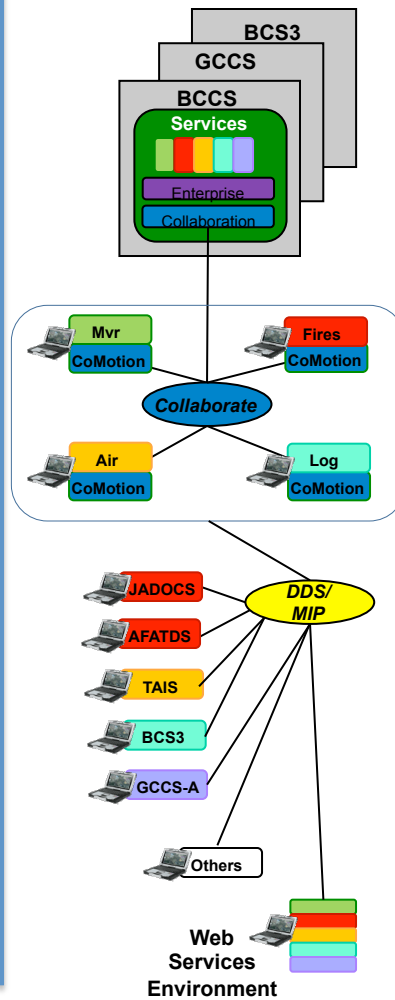
Common Operating Environment (COE)

COE V2
Unified Collaboration

- Common Virtual Server implementation
- Converged Server Hardware
- Rich Web Client

COE V3
Std Shareable Geospatial

- Unified Collaboration
- Common Operating Picture
- Common Map
- Tactical Appstore
- Cloud Analytics

COE V4 Unified Data

- Disconnected Workstation and Web-client
- Joint interoperability
- Enhanced Common Operating Picture
- Unified Data

COE V5 MCOTM

- Disconnected Infrastructure services
- Enhanced Performance
- Operational Adaptability

Post COE/ MC Vision

Global Access

TRADOC Pam 525-3-0

The Army Capstone Concept

Operational Adaptability:
Operating under Conditions of Uncertainty and Complexity in an Era of Persistent Conflict 2016-2028

21 December 2009

Big Data

Figure 3-1. Integration through the mission command warfighting function

Design

PEO C3T Mission Command Game Changers

Cyber Warfare

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PEO C3T	PM AMF	PD COMSEC	PM JBC-P	JTNC	PM JTN	PM MC	PM MNVR	PD TNI	PM TR	PM WIN-T	MILTECH

COE Snapshot

PEO C3T
PROGRAM EXECUTIVE OFFICE COMMAND CONTROL COMMUNICATIONS-TACTICAL

APPLICATIONS & SERVICES

GENERATING FORCE

BANDWIDTH, SWAP-C, MOBILITY

NETOPS, SECURITY, DATA, VOICE, VIDEO, IMAGERY

ECOSYSTEM

COE Enables
Increased Capability Agility
Reduced Life Cycle Costs
Flexible Standards-based Infrastructure
Enhanced Cyber Protection

Command Post

Data Center / Cloud / GE

Sensor

COE

RT / Safety Critical / Embedded

Mobile / Handheld

Mounted

Example Services

Collaboration, e.g., Chat

Enterprise E-Mail

Enterprise Query Common Map Display

Fusion

Data Mediation

Interoperability Gateway

…

EcoSystem
Reference Architecture
Policy
Governance
Investment
Incentives
Development/Integration/Test/
Deployment Environment
Help Desk

NIPRNET
COALITION
SIPRNET
JWICS
NSANET

TACTICAL EDGE

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PEO C3T PM AMF PD COMSEC PM JBC-P JTNC PM JTN PM MC PM MNVR PD TNI PM TR PM WIN-T MILTECH

PM Mission Command

PEO C3T
PROGRAM EXECUTIVE OFFICE COMMAND CONTROL COMMUNICATIONS-TACTICAL

☐ **PM MC Unity of Command**

☐ **PM MC Unity of Effort**

Source: ADRP 6-0, Mission Command, May 2012

Airspace
• *Tactical Airspace Integration System (TAIS)*

Mission Command
• *Global Command and Control-Army (GCCS-A)*
• *Joint Command and Control (JC2)*

Protection
Joint Warning and Reporting Network

Protection
Chemical-Biological Incident Reporting System

Air Defense
• *Air Missile Defense Workstation (AMDWS)*
• *AMDWS Situational Awareness Provider Map Widget*
• *Integrated Air and Missile Defense Battle Command System (IBCS)*

Intelligence
Distributed Ground Station – Army (DCGS-A)

Sustainment
• *Global Combat Support System – Army (GCSS-A)*
• *Standard Army Management Information Systems*

Maneuver
• *Mission Command Workstation (MCWS) Joint Convergence*
• *Command Post of the Future*

Mission Command
• *Command Post Web*
• *Battle Command Common Services*
• *Command Web Widget*
• *Data Distribution Service*

Maneuver
• *Joint Battle Command – Platform*
• *Joint Capability Release*
• *Force Battle Command Brigade & Below (FBCB2)*

Fire Support
• *Advanced Field Artillery Tactical Data System (AFATDS)*
• *Fires Command Web Widget – Capabilities SAB*
• *Joint Automated Deep Operations Coordination System (JADOCS)*

Fire Support
Joint Effects Targeting System (JETS)

Sustainment
• *Battle Command Sustainment*
• *Support System (BCS3)*
• *Combat Power Widget*
• *Logistics Reporting Tool Widget*

Movement and Maneuver Warfighting Function

Protection Warfighting Function

Fires Warfighting Function

Mission Command Warfighting Function

Intelligence Warfighting Function

Sustainment Warfighting Function

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Standardize Operating Environments

Standardize Computing Environments

Command Web – Tactical Server Standard
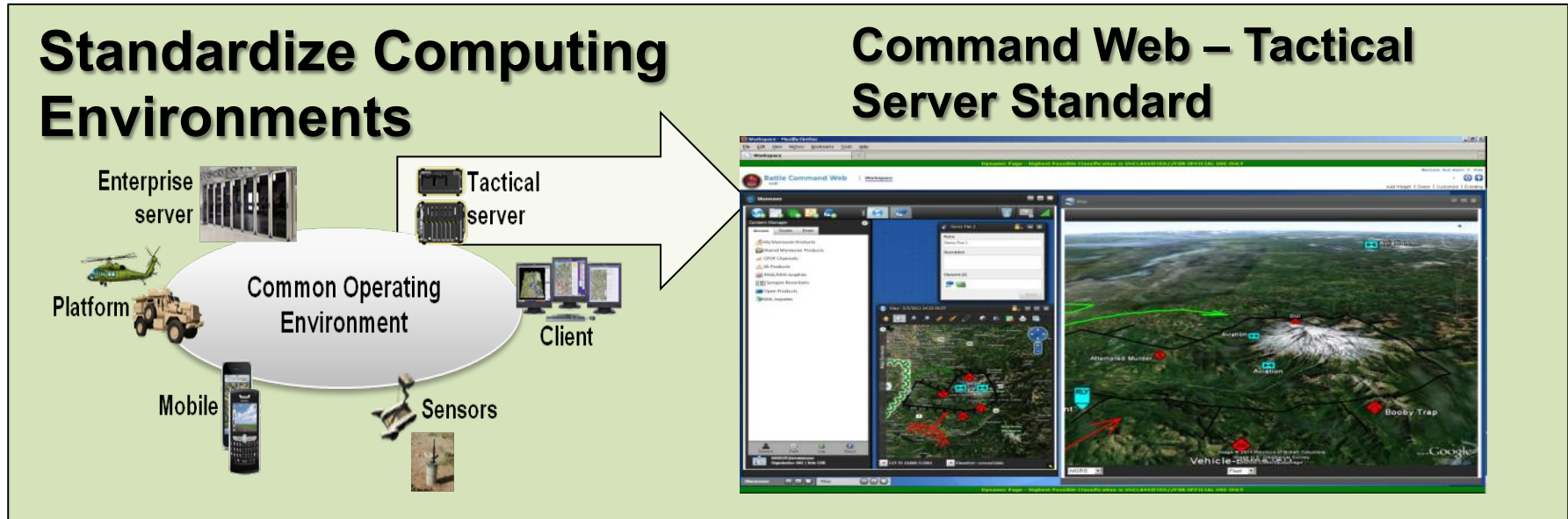
- **Command Web: Ozone Framework & Synapse Software Development Kit (SDK)**
  - No Cost License
  - Wide use by Intel Community increases interoperability & re-use
  - SDK speeds development & deployment of new widgets

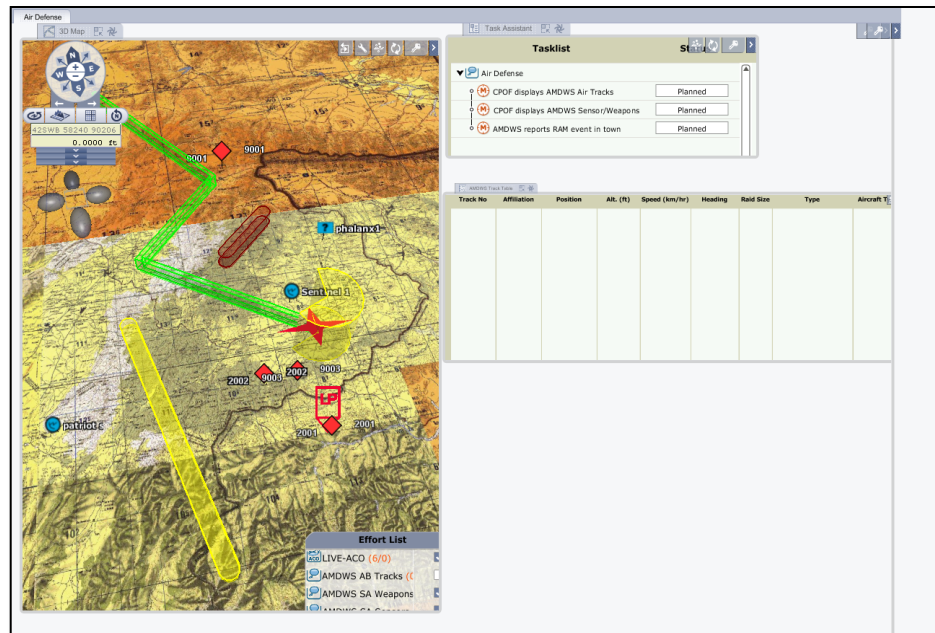Army CIO G6 Pilot with Command Web focused on Tactical COE Standards & Web Service Framework

Widget: Lightweight, single purpose apps deployed to a server based environment & accessed through a web browser
Ozone Widget Framework: is a web/server based environment designed to support the development & deployment of widgets and mechanisms to support communications between widgets.
Ozone Synapse SDK: standardizes key features used to develop, assemble and configure widgets.

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Command Web/OZONE

- Standardized Web Environment with other US Government Organizations
  - NSA, IC
  - DCGS-A
  - DISA
- Google Earth 3-D Widget
- CJMTK for Mapping
- COP Display/Graphics
- Rapid Deployment of capability
- Warfighting Function Widgets
  - Fires Support and Planning
  - Sustainment C2
  - Maneuver
  - CBRN
  - Airspace C2 and ADA
  - Engineering

Implementing the Command Post CE

Command & Control (C2)
- CIDNE
- TIGRE
- JBCP TOC Kit
- BCCS
- CPOF Server

Movement & Maneuver
- JADOCS
- MCS-WS
- TCAIMS-WS
- DTSS WS
- OSRVT

Fires
- AMPS
- JADOCS
- AFTADS WS
- DCGS-A WS

Protection
- AMDWS
- TAIS
- ADSI
- FAAD
- RAID
- IBD Server
- IBD Console

Intelligence
- DCGS-A WS
- CGS-WS
- IMETS WS
- CHATS
- DCGS-A Server
- JDOCS
- Prophet Control
- CHARCS

Integrated Mission Command
- Sustainment
- Intelligence
- Protection
- C2
- MVMT and MVR
- Fires

Sustainment
- BCS-3
- BCS-3
- CPOF
- TC AIMS Server
- CAISI Bridge
- MC4
- TC AIMS WS
- MTS CNTR
- AHRW
- PBUSE

Today
Multiple Workstations per Soldier with a Specific WfF
Different Servers Per System per WfF

Beyond FY13
One Workstation per Soldier with Integrated WfFs
Common Server Stack

* Systems are representative, not all-inclusive
- Source: Command Post Handbook and TOCFEST 2008

- Integrated infrastructure / common server stack (vice stove pipe systems)
- Common / shared set of functional applications and services visualized on a common end user environment
- Simplified architecture and system configuration – easy to install and maintain
- Reduced space, weight and power specifications
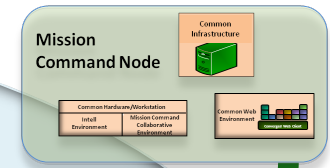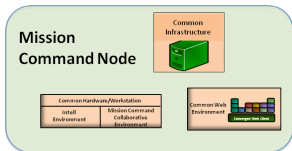- Reduced number of PORs
- Unity of Effort

Desired End State…
Common, scalable, integrated Mission Command architecture and infrastructure (hardware, services, applications) aligned with the COE
Improved interoperability -- reduced cost – reduced development and deployment timelines

PM MC Vision 2020

Mission Command in the 2020s will be transformed by Game Changers — **Operational Adaptability enabled by Global Access, Big Data and Cyber Warfare** — providing an opportunity to build a **Mission Command Global Layer** transforming Mission Command into a Global system.

Mission Command Node

Common Infrastructure

Common Hardware/Workstation | Intell Environment | Mission Command Collaborative Environment

Common Web Environment | Converged Web Client

Mission Command Node

Common Infrastructure

Common Hardware/Workstation | Intell Environment | Mission Command Collaborative Environment

Common Web Environment | Converged Web Client

Operational Adaptability

- Abstraction of the Data and Network from the applications enabling new capabilities to be integrated with speed & efficiency
- Ability to <u>customize applications in the field</u> to solve complex and unanticipated problems

Global Access

- Efficient, Reliable, and Flexible Data Exchange Mechanisms to enable the <u>flow of Mission Command Data across tactical and global networks</u>

Global Mission Command Layer

Big Data

- Dynamic, Schemaless Data Repository <u>capturing all Data of interest to Mission Command</u>
- Commercial "Big Data" Tools Integration for advanced fusion and analysis of data
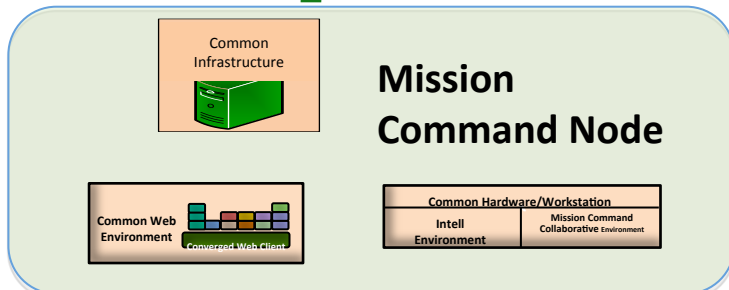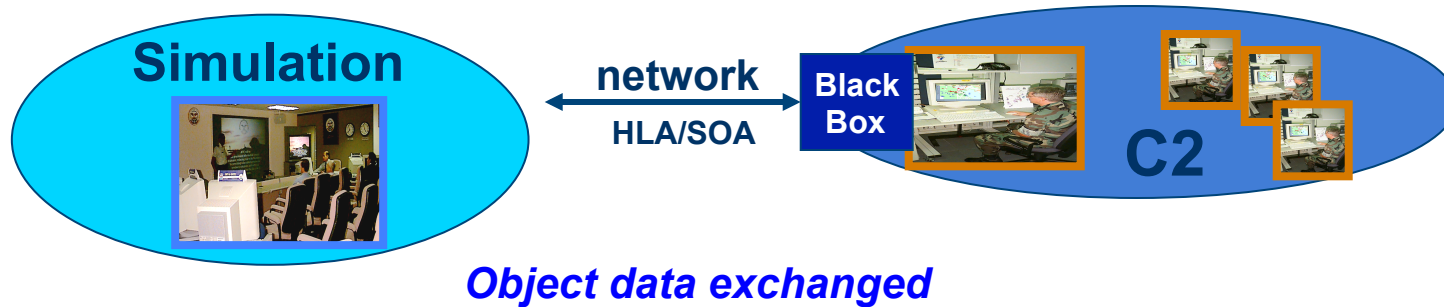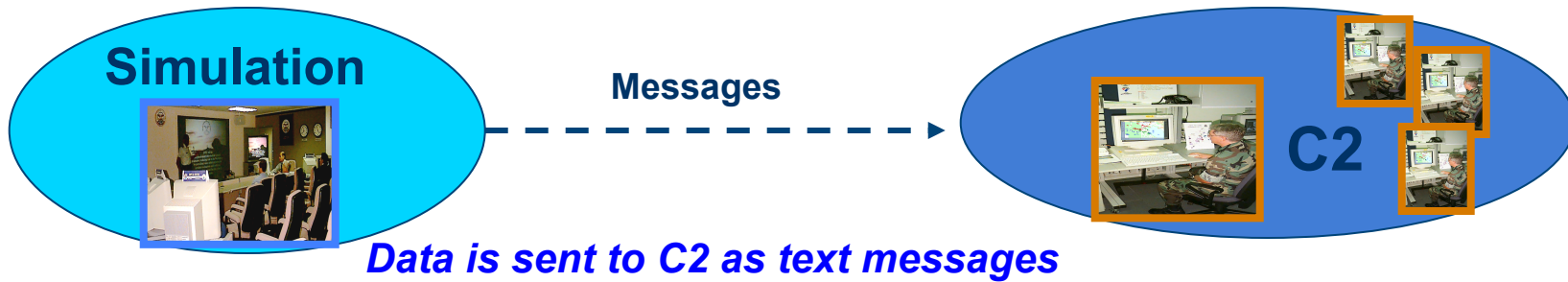
Cyber Warfare

- Security Features that enable <u>Operational Flexibility within, across, and outside of Security domains</u>
- Proactive features to initiate Cyber Warfare on an opponent

Mission Command Node

Common Infrastructure

Common Web Environment | Converged Web Client

Common Hardware/Workstation | Intell Environment | Mission Command Collaborative Environment

This enables two fundamental capabilities:

- Operate Mission Command from a global and holistic perspective
- Build & integrate new capabilities with speed and efficiency not possible with today's architecture

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Options to provide Simulation Capability to C2

Simulation

Messages ------->

C2

Data is sent to C2 as text messages

Simulation

network
HLA/SOA

Black Box

C2

Object data exchanged

Sim Engine

APP

C2

Simulation part of C2 Architecture

Functionality vs Interoperability?

- It can be argued that a focus on functionality can hamper interoperability

- In the case of Command Web, the SIMCI OIPT was able to integrate Simulation functionality for the first time with Tactical C2, due to the new capabilities of Command Web.

- Command Web also enhances agility & collaboration

Summary

- Developer Tools such as the Ozone Widget Framework allow the rapid develop of C2 functionality and also the ability to share this functionality at many levels

- Command Web provides an entirely new paradigm for Tactical C2 by enhancing Agility

- The ability to conduct C2 via cloud services will be a significant addition in the future

- Data Interoperability is still necessary, but we need to rethink what is required and what the end state is

Backups