Vehicular Integration for C4ISR/EW Interoperability (VICTORY)

Briefing to the Training Community

I/ITSEC 2012
4 December 2012
Meeting Objectives

- Inform the Training Community
  - What is VICTORY
  - Why should Training Community care
  - How to get involved

GOAL: Begin to establish an IPT (government & industry) to develop training portions of the VICTORY architecture and specification (2013 release)
Addressing Training

- Two new sections of VICTORY specification address training
  - Mission Recorder – how data is recorded (included in latest release)
  - Embedded Training Interface – addresses what data is recorded (2013 release, AI_CP_076)

- Establishing IPT to develop Embedded Training Interface section
  - Government and Industry

- Multifunction Vehicle Port (MFVP) enables future interface to VICTORY Data Bus
  - MFVP Interface Standard v1.0 available at www.lt2portal.org

Training Adds to Problems Driving VICTORY

- Hardware Redundancy
- Limited Information Sharing
- Complex cabling
- Large system re-set and life cycle costs
- Limited Ability to support CP mission sets
Why should Training Community care about VICTORY?

- VICTORY is gaining momentum
  - VICTORY compliance included in recent acquisitions
  - Bradley and Abrams ECP’s call out VICTORY compliance
  - PEO GCS guidance for training – leverage VICTORY
- ~125 participants at December F2F meeting, 200+ members
- Identified by COE as a critical enabler
  - Key role in Real Time Safety Critical Embedded CE
  - Mounted CE will be changing ICDs to be VICTORY compliant (reps at December VICTORY F2F)
Army Common Operating Environment (COE)

I/ITSEC 2012
4 December 2012
COE: Apps & Services
Vision and Computing Environments (CE)

Organize Computing Environments

Clustering similar systems based on mission environments to facilitate implementation
- Data Center/Cloud/Generating Force CE: PEO EIS
- Command Post CE: PEO IEWS/PEO C3T
- Mounted CE : PEO C3T
- Mobile/Hand Held CE: PEO Soldier
- Sensor CE: PEO IEWS
- Real-time/Safety Critical/Embedded CE: PEO Aviation

Establish the Platform IPT

What’s being integrated on our platforms – when, how, by whom
- Soldier as a Platform: PEO, Soldier
- Aviation Platforms: PEO, Aviation
- Ground Platforms-Combat: PEO CS&CSS
- Ground Platforms-Tactical: PEO GCS
- Ground Platforms-Fires: PEO M&S
- Command Posts: PEO C3T
- Forward Operating Base Installation/Fixed Base: PEO EIS

Control Points (CPs) define interfaces between CEs
ITE Cross Cutting Capabilities:
- Virtual/Constructive Sim/Stim
- Scenario/Exercise Control
- Live Training Instrumentation Systems

Control Point/Interface Specs:
- Training/Test Instrumentation
- Appended TESS
- Instrumentation Interface with FACE
- Multifunction Vehicle Port (MFVP)
- Sim to Mission Command Interfaces
- MILES Comms Codes

CE Compliant/Embedded Capabilities:
- Target Control
- Training Standards/Capabilities in VICTORY:
  - IS-TESS
  - PAN
  - MFVP
- TaaS – Training as a Service in the Cloud

Examples

Training and the COE (DRAFT)
Embedded Training

Vision
For Embedded Training
12 June 2012
Version 37

- Software product line approach
- Software re-use
- Composibility
- Portable
- Modular
- Scalable
- Extendable
- Open standards

FACE & VICTORY are critical enablers for COE as part of the Real Time/Safety Critical/Embedded CE

FACE

- Future Airborne Capability Environment (FACE)
- Standard for aviation systems

VICTORY

- Vehicular Integration for C4ISR/EW Interoperability (VICTORY)
- Standard for ground vehicles
- Addresses Embedded Training
  - Mission Recorder (August 2012)
  - Embedded Training (Spring 2013)
- PEO STRI Initiatives
  - Multifunction Vehicle Port Standard
  - Live Training Engagement Composition
Vehicular Integration for C4ISR/EW Interoperability (VICTORY)

Kase Saylor
I/ITSEC 2012
4 December 2012
VICTORY 101 – Background

28 June 2012

A converged modular architecture for vehicle/electronic systems interoperability in a modular expeditionary Army at War
Motivation: problems driving VICTORY
Approach: how we are moving toward a solution
VICTORY framework: what we are producing

BACKGROUND
An Army SoS Problem: C4ISR/EW Integration in Ground Vehicles

Traditional Approach

"Bolt On" Mission Equipment Integration

Proposed Approach

VICTORY Data Bus enables interoperability across C4ISR/EW and platform systems

VICTORY Benefits

1) Reduces SWaP-C impact
2) Systems interoperate with each other via the VICTORY Data Bus (VDB)
3) Enables additional capabilities
4) Enabler for Commonality
VICTORY Goals

• Eliminate, where possible, the practice of “Bolt On” systems
• Significantly reduce SWaP-C
• Support new capabilities
• Reduce overall life cycle costs
• Maximize C4ISR/EW portability
• Support current & future IA requirements
  – Enable “defense in depth” security designs
  – Support many IA requirements and levels
• Integrate with current-force systems
  – Define a path toward network-centricity
Late ‘06 – “In-Dash” Concept formed by PEO C3T, PEO CS&CSS and CERDEC – *Loose Confederation of the Willing*

**Management Formalization**

Late ‘11 & Early ‘12 – Transition MOA signed and Management Directive signed to formally establish the *VICTORY Executive Steering Group (ESG)*, the *VICTORY Standards Support Office (VSSO)* and cost share strategy

**Major Milestones**

- **2006**
  - Late ‘06 – “In-Dash” Concept formed by PEO C3T, PEO CS&CSS and CERDEC – *Loose Confederation of the Willing*

- **2007**
  - Jul ‘07 – JLTV Tech Dev Phase Specification

- **2008**
  - Oct ‘09 – Stryker Spiral 1 Demo

- **2009**
  - Jun/Jul ‘10 – TWV Survivability ATO Demo

- **2010**
  - Apr ‘10 – Architecture A Release
  - Jul ‘10 – Experimental Spec V0.5 Release

- **2011**
  - Apr ‘11 – MRAP Digital Backbone Convergence Demo
  - Jan ‘12 – Architecture A1 and Standard Spec V1.1 Release
  - May ‘10 – Standards Body Kick-Off

- **2012**
  - Jul ‘11 – Standard Spec V1.0 Release
  - Apr ‘12 – Standard Spec V1.2 Release

- **2013**

- **2014**

- **2012 & Early 2013**

**Acquisition Adoption**

- **Sep-Nov ‘11** – RFPs for Abrams & Bradley ECPs

**Vehicular Integration for C4ISR/EW Interoperability**

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VICTORY focuses on adopting/adapting/authoring, validating and managing a Single Authoritative Framework and Standards for vehicular integration.
Standards Body

Working Groups build the standards bottom up

- Draw on both Government and Industry expertise
- Adopt, adapt and author standards with formal definition and suitable use cases
- Reiterate standards to reach maturity
- Ensure standards are open
**VICTORY Technical Approach**

- **Add a data bus (network) to vehicles**
  - Integrate C4ISR/EW systems, interface with other electronic systems
  - Provide the plumbing for systems and components to interoperate (work together cooperatively)

- **Provide shared hardware and services as part of the data bus**
  - Shared processing and user interface hardware
  - Shared services
    - Management: configuration, control, health reporting
    - Position, orientation, direction of travel

- **Define components with standard, open network-based messaging interfaces**
  - IA components: protect data & control access
  - C4ISR/EW components: interoperate via network messages
  - Platform systems: interface with VDB via network messages
VICTORY Architectural Tenets

• Specify “on-the-wire” network-based interfaces

• Mature specifications into standards
  – Validate the architecture & standards through experiments
  – Prove that architecture and standards are reasonable and effective

• Keep specifications open to the ground vehicle community

• Treat Information Assurance (IA) as a vital

• Keep time critical processing integrated with sensors
  – Publication on data bus can be secondary (e.g. high-rate video)

• Enable open competition

• Identify roadmap from current to future architectures
  – Include current-force systems in the architecture
  – Evolve toward network-centric C4ISR/EW
Definition of Open

1. Not controlled by a single vendor
2. Not tied to a specific vendor’s platform (platform independent)
3. Available for implementation by multiple sources
4. Usable without royalties or non-disclosure agreements (NDAs)
5. Published and managed by a standards body

Open places power in the procurement process with the Army
**VICTORY Scope**

- VICTORY provides enablers for integration and interoperability between electronics systems on Army ground vehicle platforms
  - Enables integration of C4ISR/EW systems
    - Interface to the sensors, many components and systems
  - Enables interfaces to (bridges) to platform systems
    - Interface to platform systems

- **Scope / boundaries of current VICTORY framework**
  - Stops at the edge of the platform network
    - Interface to satellite, terrestrial, dismounts, mobile sensors
    - Interface to data/voice radio
  - Stops at the edge of platform systems
    - Interface to automotive, weapons, power distribution, logistics, protection
  - Does not integrate safety critical systems
  - Does not define common physical components or software applications
What is VICTORY?

VICTORY *IS or DOES*

- Provide design guideline input
- Partnership
- Scalable leading to multiple price points for affordability
- Provide “build to” guidelines
- Seeking convergence
- A System of Systems Engineering (SoSE) initiative
- Provide input to platform and mission equipment PMs and Industry solicitations
- A framework providing an architecture, standard specifications, and reference designs

VICTORY *is NOT*

- A vehicle design
- A PEO C3T initiative
- Cost prohibitive
- Hardware
- In conflict with other efforts
- A Program of Record
- Solicited through VICTORY RFP/BAA
- A runtime environment, middleware library, or software package
Architecture Development Approach

• Goal: network-based architecture for integration of electronic systems on Army ground vehicles

• Took a bottom-up approach
  – Begin with current force C4ISR and EW systems and components
  – Identify emerging C4ISR & EW technologies, sensors, and applications
  – Identify key platform systems for which network interfaces are needed
  – Identify common functions and opportunities for consolidation
  – Develop conceptual framework

• First identified component types representing current force systems
  – Top-down, clean slate approach would not have been evolutionary

• Next identified component types representing new capabilities being integrated into vehicles (video, recording)
VICTORY Products and Services

**Products**

- **Architecture**
  - Version A1 released Jan 17, 2012
- **Standard Specifications**
  - Version V1.1 released Jan 31, 2012
- **Reference Designs**
  - First release scheduled May 2012
- **Initial Validation Artifacts**
  - Published as completed
- **Reference Software Library**
  - First release, March 2012
- **Verification Toolkit**
  - SW tools for compliance tests
  - First release scheduled June 2012

**Services**

- **Lead/Coordinate the VICTORY Standards Body**
- **Coordination and Outreach Activities with PMs**
  - Cross-walking program performance specification with VICTORY specifications
  - Drafting VICTORY-related PWS language for PM RFPs
  - Synchronizing other on-going initiatives (e.g. COE, FACE, CBM)
Terminology

- **Architecture**: a conceptual framework defining overall concepts and terms, identifying elements to be standardized, including component types, their interfaces, design patterns and common structures.
- **Specifications**: a document containing specifications of varying maturity levels, which identify the technical details of system (application) and component interfaces.
- **Reference Designs**: documents describing how the specifications could be deployed.
- **Standard**: a specification at the “proposed standard” or higher level of maturity.

**Maturity level**: a label that identifies the level of maturity of a specification, which varies over time. Maturity levels include:
- Preliminary
- Informational
- Experimental
- Proposed Standard
- Draft Standard
- Final Standard

**VICTORY specifications document**:
- Versioned [major].[minor] (e.g. 1.0)
- Aggregates many specifications
- Each specification has an independent maturity level

Specification Types include:
- Component Specifications
- Interface Specifications
- Reference Design Specs
- Application Profile Specs
VICTORY Background - Conclusions

• VSSO aims to reduce SW&P and increase capabilities

• VICTORY is creating a framework, consisting of
  – Network-based architecture
  – Validated interface specifications
  – Reference designs
  – Reference software library
  – Verification toolkit

• VSSO is working with programs of record to transition specifications into vehicles and products

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VICTORY 101 – Process

March 12, 2012

A converged modular architecture for vehicle/electronic systems interoperability in a modular expeditionary Army at War
Top-level process: architecture and specification development
Working group process: change proposals
Maturation process: architecture and specifications validation

VICTORY DEVELOPMENT AND MATURATION PROCESS OVERVIEW
VICTORY Working Groups

• Three specification development working groups
  – Data bus working group (DBWG)
  – Information assurance working group (IAWG)
  – Application interfaces working group (AIWG)

• Working groups are made up of
  – Government organizations
  – Product vendors
  – Vehicle and system integrators

• Working group tasks
  – Develop specifications for the interfaces identified by the architecture
  – Receive and address feedback from validation activities
Top-Level Specification Process

Architecture Document → Interfaces & Components To Specify

Change Proposal Process → Specification Document

Working Groups Change Proposal Process → Priorities

Validation
- Specifications created through a Change Proposal (CP) process

- Creates specifications at the “experimental” maturity level
  - Even when adopting existing technologies

- “Experimental” maturity level
  - WG has leveraged research, previous experience, best practices, etc.
  - “Paper” level analysis has been done by working group
  - Specifications are detailed enough to develop a prototype
Maturation process: architecture and specifications validation

MATURATION OF SPECIFICATIONS
Definitions

• **VSSO**: VICTORY Standards Support Office

• **Validation**: The execution of experiments to determine whether a specification is mature enough for use in varying contexts
  – **Initial Validation**: Experiments to mature to proposed standard level
  – **Additional Validation**: Experiments to mature to draft standard level

• **Verification**: The determination of whether a particular hardware or software component complies with the VICTORY specifications

• **Certification**: The acceptance of the compliance by an authority
Specification Maturity

- **“Maturity Level”**: label identifying how “well proven” a specification is

- Specifications are matured over time through “validation”

- Maturity levels include:
  - Preliminary Specification
  - Informational Specification
  - Experimental Specification
  - Proposed Standard Specification
  - Draft Standard Specification
  - VICTORY Standard Specification

- **“Standard”**: a specification at “Standards Track” level of maturity

- Individual specifications have independent maturity levels
  - {Preliminary | Informational | Experimental} Specification
  - {Proposed | Draft | Final} Standard Specification
• Maturity levels include:
  – Preliminary Specification
  – Informational Specification
  – Experimental Specification
  – Proposed Standard Specification
  – Draft Standard Specification
  – Standard Specification

* Deployment by a program constitutes additional validation
Version A1 Content
VICTORY Data Bus
Component and System Types \(\rightarrow\) Interface Specifications

**VICTORY ARCHITECTURE OVERVIEW**
VICTORY Architecture

• The VICTORY architecture provides a managed framework onto which the specifications are developed

• Architecture defines
  – System types, component types, interfaces

• Current Documents
  – Aligned with version 1.1 of the specifications, published January 2012

• The following walks through Architecture A1
  – VICTORY Data Bus (VDB)
  – VDB component types
  – C4ISR/EW systems and component types
  – Platform system types
• **VICTORY Data Bus (VDB)**
  – Central structure of the VICTORY architecture

• An instance of a VDB provides...

• **Network infrastructure**
  – Data transport, routing, QoS

• **Shared data services**
  – Time synchronization
  – Position, orientation, direction of travel

• **Shared HW**
  – Processing resources
  – Displays and user interface devices
• VICTORY Data Bus (VDB)
  – Central structure of the VICTORY architecture

• An instance of a VDB provides...

• Management services
  – At VDB level: interfaces to manage system as a composite
  – At system level: interfaces to manage integrated and interfaced systems
  – At component level: interfaces to manage individual components
• VICTORY Data Bus (VDB)
  – Central structure of the VICTORY architecture
• An instance of a VDB provides...
• Information assurance
  – Standard components, interfaces, and patterns to support many IA styles
• Protection from network attacks
• Data protection
  – Protection of data at rest & in transit
• Policy-based access control
  – Authentication of entities and authorization for access to resources
VICTORY Data Bus

• VICTORY Data Bus (VDB)
  – Central structure of the VICTORY architecture

• An instance of a VDB provides...

• Open network-based interfaces
  – Component level interfaces
    • C4ISR/EW system components
  – System level interfaces
    • C4ISR/EW systems
    • Platform systems
VDB Context

C4ISR/EW Systems
- Audio & Textual Communications
- Video & Imagery SA
- Threat Detection & Reporting
- Mission Recording
- Situational Awareness & C2
- Extra-Vehicle Network Interface
- Electronic Warfare

VICTORY Data Bus (VDB)
- Data Protection
- Network Infrastructure
- Shared HW Devices
- Access Control Services
- Shared Data Services
- Management Services

Platform Systems
- Automotive
- Power Distribution
- Lethality
- Logistics
- Platform Sensors
- Crew Protection
Enables Integration means the VDB provides primary data transport and management for the C4ISR/EW systems.
**Enables Interfaces** means the VDB can provide data transport and/or management interfaces at the system level (e.g. bridge).
The architecture defines sets of *component types* and *system types* which are instantiated in a VDB design.
System Types, Component Types, Interfaces

• Architecture defines
  – System types
  – Component types
  – Interfaces

• Organization of architecture
  – VDB component types
  – C4ISR/EW systems and component types
  – Platform system types
Component and System Interface Types

• Network (messaging) interfaces
  – Data transport interfaces
    • Physical to transport layer protocols: data delivery, QoS, signaling
  – Data interfaces
    • Higher layer protocols: application data format, encoding, encapsulation
  – Management interfaces
    • Configuration & control, health management (status & faults)
  – Access control interfaces
    • Authentication & authorization, data protection
    • Used in conjunction with all network, data, & management interfaces

• Software (application program) interfaces
  – Processor API (e.g. shared processing unit)

• Non-networked electrical interfaces (a few)
  – Device connections: time reference, GPS RX, display, UI devices, etc
VICTORY Architecture Conclusions

• Architecture document defines sets of
  – System types
  – Component types

• Each system and component type has...
  – Functions
  – Set of interfaces
    • Data transport interfaces
    • Data interfaces
    • Management
    • Access control interfaces
    • Non-networked interfaces

• The architecture identifies the interfaces, not the details
• The working groups develop interface specifications (details)
• VSSO matures the specifications into standards

• For more information contact:
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VICTORY Training IPT to be established January 2013

- Need government and industry representatives
- Need to develop Embedded Training Interface section to support Fall 2013 release
  - Need to ensure live, virtual, constructive, gaming interfaces are identified

Bi-weekly VICTORY Working Group telecons (AIWG, DBWG, IAWG)

Quarterly face-to-face meetings

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