Domain Reuse

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Background

The Fires Software Engineering Division has been moving and promoting domain reuse for the last 20 years. We have an active on-going reuse effort that has been used to benefit systems undergoing Acquisition, as well as systems in sustainment. Over time, our reuse activities have matured and grown in order to address dynamic threats and meet maintenance challenges on the systems we maintain and support for various PM offices. Reuse of Requirements, Design, Code, Test, and Training artifacts is methodical and process driven. The Acquisition community faces unique challenges when employing reuse both from external and internal program drivers. This presentation will attempt to convey solutions and challenges to PEOs and PMs in this era of constrained resources, attempting to point out potential cost savings and cost avoidance opportunities.
ORGANIZATION

• The Army is organized around the way we fight.
• The Army trains around the way it is organized to fight.
• The Army institutes warfighter doctrine to support the Army organization.
• The Army attempts to sustain as it is organized.
• The Army does not procure as it fights or is organized.

Does this make sense?
Challenges to Domain REUSE

- Government Program Management not aligned with Army Organizational structure.
- Not in the best business interest of the OEM.
- Perceptions of loss of control – government and OEMs.
- Not invented here.
- Attempts at one size fits all.
- Cross domain solutions that aren’t.
CONCEPT

• Re-architect reuse components to generate install programs which can be used during:
  – System build/installation process.
  – Updating the tactical system hard drive without rebuilding the tactical system.

• For updates in the field, this will be limited to those changes which do not require an API change.

• Greatly reduces the need for rebuilding and re-fielding tactical systems for reuse components and IAVM updates.

• Tactical systems with the new reuse component and/or IAVM updates will be validated locally and will not need to re-enter a full blown Army certification event.
## REUSE COMPONENT ANALYSIS

<table>
<thead>
<tr>
<th>REUSE PRODUCT</th>
<th>RPMs</th>
<th>SYSTEMS IMPLEMENTING</th>
<th>ESTIMATED % OF TIME RPM WILL CORRECT A TAR SUBSEQUENT TO FIELDING</th>
<th>REASON RPM WILL NOT FULLY CORRECT A TAR SUBSEQUENT TO FIELDING</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>LINUX</td>
<td>WINDOWS</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>FOS</td>
<td>Q36</td>
<td>Q37</td>
</tr>
<tr>
<td>AB</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>COI</td>
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<tr>
<td>CR</td>
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<td>X</td>
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<tr>
<td>ETS</td>
<td>3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>FSMS</td>
<td></td>
<td></td>
<td>LOADABLE COMPONENT NOT BEING DEVELOPED</td>
<td>MOST SW CHANGES WILL REQUIRE CHANGES TO TACTICAL SYSTEM</td>
</tr>
<tr>
<td>MAP-DT-OM</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>MAP-LD-OM</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>SAT</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>SDS-MP</td>
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<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>SRP</td>
<td>1</td>
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<td>X</td>
<td>X</td>
</tr>
<tr>
<td>RPAS</td>
<td>1</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>IAVA PATCHES</td>
<td>1 - 4 (PER IAVA)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

- **FOS** = Fielding Operation System
- **Q36** = Quarter 36
- **Q37** = Quarter 37
- **Q48** = Quarter 48
- **FOS** = Fielding Operation System

**Notes:**
- API CHANGES ARE INFREQUENT AFTER FIELDING
- MESSAGE FORMAT CHANGES REQUIRE API CHANGES
- EMBEDDED CODE IN TACTICAL SYSTEMS; PARTIAL REUSE; API CHANGES
- API CHANGES ARE INFREQUENT AFTER FIELDING
- LOADABLE COMPONENT NOT BEING DEVELOPED
- STAND ALONE 3RD PARTY UTILITY
- JAVA COMPILER FIXES AND LINUX KERNEL UPDATES MAY REQUIRE TACTICAL SYSTEM REBUILD

**Abbreviations:**
- AB: Application Building
- COI: Component of Interest
- CR: Component Reuse
- ETS: Embedded Tactical System
- FSMS: Faulty Software Management System
- MAP-DT-OM: Map-DT-OM
- MAP-LD-OM: Map-LD-OM
- SAT: System Analysis Tool
- SDS-MP: SDS-MP
- SRP: System Reuse Program
- RPAS: Reusability of Products for Adaptive Systems
- IAVA PATCHES: Incremental and Adaptive Virtualization Architecture Projects
REUSE COMPONENT DEVELOPMENT APPROACH

SW CHANGE OR IAVM NOTICE

REUSE COMPONENT BASELINE

UPDATED REUSE COMPONENT ENG OR CM BUILD

REUSE COMPONENT RPM (LINUX) OR INSTALL PROGRAM (WINDOWS)

INCORPORATE RPM OR INSTALL PROGRAM IN TACTICAL SYSTEM BUILD PROCEDURE

UPDATE PROCESS

CREATE SYSTEM RPM FILE (LINUX) OR INSTALL PROGRAM (WINDOWS)

REBUILD

UPLOAD ON TACTICAL SYSTEM
ASSUME TACTICAL SYSTEMS HAVE BEEN FIELDED

BUILD TACTICAL SYSTEM UPDATE CD FOR LINUX OR WINDOWS

INSTALL ON TACTICAL SYSTEM IN THE LAB

DEVELOP SCENARIOS FOR REUSE COMPONENTS OR IAVA(s) TO BE VERIFIED ON TACTICAL SYSTEM

PERFORM MINI-FQT (CONCENTRATE ON REUSE AFFECTED SCENARIOS)

LETTER TEST REPORT

PERFORM SYSTEM C&A SCAN(s)

UPDATE POA&M

FIELDED TACTICAL SYSTEM

TACTICAL SYSTEM UPDATE CD (OR OTHER MEDIA)

NOTICE SENT TO FIELD USERS OF SYSTEM UPDATE AVAILABILITY

TACTICAL SYSTEM ADMINISTRATOR DOWNLODES SYSTEM RPM FILE AND CREATES LOADABLE MEDIA

TACTICAL SYSTEM ADMINISTRATOR PLACES SYSTEM RPM FILE FOR UPDATES ON AKO

FSED AKO WEBSITE

LETTER TEST REPORT

TACTICAL SYSTEM RPM FILE

NOTICE SENT TO FIELD USERS OF SYSTEM UPDATE AVAILABILITY

TACTICAL SYSTEM ADMINISTRATOR INSTALLS UPDATES

VALIDATION FOR FIELDED SYSTEM
TACTICAL SYSTEM FIELD UPDATE APPROACH

1. **REUSE COMPONENT (1)**
   - REUSE RPM FILE (LINUX) OR INSTALL PROGRAM (WINDOWS)

2. **REUSE COMPONENT (n)**
   - REUSE RPM FILE (LINUX) OR INSTALL PROGRAM (WINDOWS)

3. **IAVM FIX (1)**
   - IAVM RPM FILE (LINUX ONLY)

4. **IAVM FIX (n)**
   - IAVM RPM FILE (LINUX ONLY)

5. **FSED AKO WEBSITE**
   - UPDATE RPM FILES FOR EACH TACTICAL SYSTEM / VERSION
   - TACTICAL SYSTEM ADMINISTRATOR DOWNLOADS RPM FILE AND CREATES CD (OR OTHER MEDIA)

6. **TACTICAL SYSTEM UPDATE CD (OR OTHER MEDIA)**
   - TACTICAL SYSTEM ADMINISTRATOR INITIATES INSTALLATION VIA SAT

7. **FIELDED TACTICAL SYSTEM**
   - REUSE RPM FILE (LINUX) OR INSTALL PROGRAM (WINDOWS)
   - IAVM RPM FILE (LINUX ONLY)
   - IAVM FIX (1)
   - IAVM FIX (n)
NEW REUSE UTILITIES FOR LINUX RPM IMPLEMENTATION

- Tactical Update Utility
  - Utility needed to validate and load updated RPMs from a CD (or other media) in the field into the tactical system.

- RPM Build Utility
  - Utility needed to create the System RPM File with any Reuse/IAVM RPMs that have been created via a Reuse CM build.
Common Front End (CFE)
Customer Requested Joint Software Solution

PROBLEM

Many Operators Many Interfaces

SOLUTION

One Operator One Interface

IMPACT

Reduces Training For Operators - Reduces Number Of Training Products - Common Computer Based Training (CBT) - Reduce Life Cycle Costs - Increases Effectiveness

EQ-36 Interface
TPQ-37 Interface
TPQ-36/TPQ-46B Interface
Q48 Interface
TPQ-49/50 Interface
G/ATOR Interface
OEM Reuse of GFI/GFE
G/ATOR Interface
Proposed
**CFE Enables Embedded, Collective and Institutional Training**

- CFE provides extensive embedded training including the ability to inject targets, jammers and simulated communications
- OneSAF Radar Training System (ORTS) provides OneSAF based collective training at combat training centers including live and notional radars
- Radar Virtual Software extends institutional training beyond Fort Sill by leveraging virtualization and cloud technologies

**Embedded Training**

**Collective Training**
OneSAF Radar Training Software (ORTS)

**Institutional Training**
Radar Virtual Software (RVS)
Radar Virtual Software (RVS)

✓ Radar Virtual Software extends institutional training beyond Fort Sill by leveraging virtualization and cloud technologies
✓ 200+ scenarios including initialization, communications, and other key radar operator skills
✓ Virtualization and cloud migration solved key technical problems and increased performance

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>CLOUD SOLUTION</th>
<th>WARFIGHTER/CUSTOMER BENEFIT</th>
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<tbody>
<tr>
<td>Bandwidth limitations of the Local Area Network between Student Stations and Instructor Stations were causing sluggish scenario execution and GUI response.</td>
<td>Instances of student station and instructor station software are co-hosted initially on a PC at the FSED Crossley Software Development Facility then on a federally certified cloud platform.</td>
<td>Latency issues and sluggish responses due to bandwidth limitations disappear. Warfighter receives realistic training.</td>
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<tr>
<td>Information Assurance updates to the Classroom XXI systems were causing impacts to the application software, causing delays in training.</td>
<td>The Classroom XXI systems now only have installed a thin client (VmWare) that has a CON and is far less susceptible to perturbations from IA updates.</td>
<td>RVS availability is increased allowing more 13R (a critically short MOS) operators to be trained.</td>
</tr>
<tr>
<td>In order to receive institutional training, soldiers had to travel to Fort Sill. This is often unrealistic, particularly for National Guard and Reserve components.</td>
<td>This implementation allows remote execution of institutional training scenarios from anywhere with an internet connection.</td>
<td>Warfighter has tremendously increased training device availability.</td>
</tr>
</tbody>
</table>
OneSAF Radar Training Software (ORTS)

OneSAF is a composable, next-generation computer-generated forces training system that can represent a wide range of operations, systems, and control processes, from individual combatants to brigade.

ORTS is an instance of OneSAF that provides both notional radar model support and a Common Front End (CFE) live radar model interface to the Combat Training Center Instrumentation System (CTC IS).

NTC and JMRC are moving towards a solution very similar to the JRTC solution for ground based weapon locating radar.
CFE Future

- Being considered for reuse on the Q49, Q50, Q53 and Marine Corps on the Gator block 2.
- Modularize CFE for Downloadable Artillery Reuse Component Objects (DARCO)
  - Respond to update requests from Original Equipment Manufacturers (OEMs)
  - IAVAs
  - Validated issues from the field requiring immediate correction and implementation

Diagram:
- CFE
- OEM Requests Component Change
- User Working Group Approval
- REUSE RPM FILE (LINUX) OR INSTALL PROGRAM (WINDOWS)
- FSED AKO WEBSITE
- TACTICAL SYSTEM UPDATE CD (OR OTHER MEDIA)
- FIELDED TACTICAL SYSTEM
- TACTICAL SYSTEM ADMINISTRATOR INSTALLS UPDATE VIA SAT
- REUSE RPM FILE (LINUX) OR INSTALL PROGRAM (WINDOWS)
- REUSE RPM FILE (LINUX ONLY)
- REUSE RPM FILE (LINUX ONLY)
- VALID FIX (1)
- VALID FIX (2)
- VALID FIX (n)
- REUSE COMPONENT (1)
- REUSE COMPONENT (n)
New Reuse Components

- CTS-OneSAF – replaces current CTS
- C-RAM Interface
- CFE Mission main
- CFE Mission GUI
- PDF/TM
- FMA-GUI
- Maintenance Tracking (MT)
- Q-36 Radar Processor
- Q37 Radar Processors
- Precision Fires Objective Observer Functions (PFOOF)
Advantages

- Build it once, reused, inspected and tested many times on different systems under varying conditions.
- Produces significant engineering cost avoidances and or savings depending on business model used.
- Generates very high quality products for scoped domain.
- Products possess “Unlimited Government Rights” and are available for sharing at the object code level.

Over 1.9M LOC with .053 defects per 1000 LOC