IDE-Forward: A Persistent Force-On-Force Training Field Test Environment

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ABSTRACT

Project Manager Training Devices (PM TRADE) has committed to an open architecture, component-based acquisition methodology enabled through the Live Training Transformation (LT2) product line, which is built upon a number of open standards & processes. First, LT2 products use the Common Training Instrumentation Architecture (CTIA) to define interoperability standards among training applications to support live training. PM TRADE then developed the Live Training Engagement Composition (LTEC) to provide an open architecture solution for communication for Tactical Engagement Simulation Systems (TESS) components. This flexible architecture will drive innovation and lower acquisition costs by making it possible for systems to operate in the same training environment given an adherence to the LT2 LTEC Interface Control Document. As a result of open standards and a product-line approach, PM TRADE was able to quickly and efficiently develop, field, and operate an instantiation by integrating the open standards, architecture, and applications of the LT2 product line to create the Integration and Development Environment – Forward (IDEF). IDEF (formerly known as L-FITE) is a persistent training environment that enables proof of principle concepts and emerging capabilities to be utilized during Force-on-Force training events for Soldier feedback prior to full implementation into Army "Live" System Programs of Record.

This paper will begin by with a brief history of Force-on-Force training. Then, it will describe the concept, process, and strategy for IDEF development and operations. In addition, the paper will document results and lessons learned from a number of testing and integration events leveraging IDEF in a land navigation course use case. Finally, this paper will discuss the framework created for IDEF to evolve to provide a verification and validation methodology for future training systems, inform future Army source selections and Programs of Record (POR), and provide the capability to continually review the relevance of fielded training systems.

ABOUT THE AUTHORS

W. Cory Bogler has been working in materiel acquisition since his graduation from East Stroudsburg University in 2009. He worked at the U.S. Army's Armaments Research & Development Engineering Center (ARDEC) as a lead Computer Scientist on the M109A6 and M109A7's Paladin Digital Fire Control System. During this time period, he also served as the Executive Secretary of the Ballistic Review Board, a Field Artillery-based consortium of acquisition professionals, and as a U.S. delegate at the NATO Subgroup 2 Shareable Software Suite (NATO S4). He relocated to Orlando, FL in early 2016 to serve as an embedded ARDEC engineer/liaison at PEO STRI, where he provides technical consultation on live training system acquisition efforts.

Jose Rodriguez has served as a Product Assurance and Test Engineer at PEO STRI since 1987. During his time at the PEO, Mr. Rodriguez has handled reliability, maintainability, quality, safety, configuration management and test management for various programs, including CCTT, FSCATT, GF II, ENCATT, and AVCATT.

Gary Hall, senior engineer at General Dynamics Mission Systems, has spent the last 26 years developing live, virtual and constructive training systems for the U.S. Army and Navy. He has been the technical lead in the development of embedded training and the U.S. Army's Live Training Engagement Composition (LTEC) software. He earned an MS degree in Computer Engineering from the University of Central Florida.

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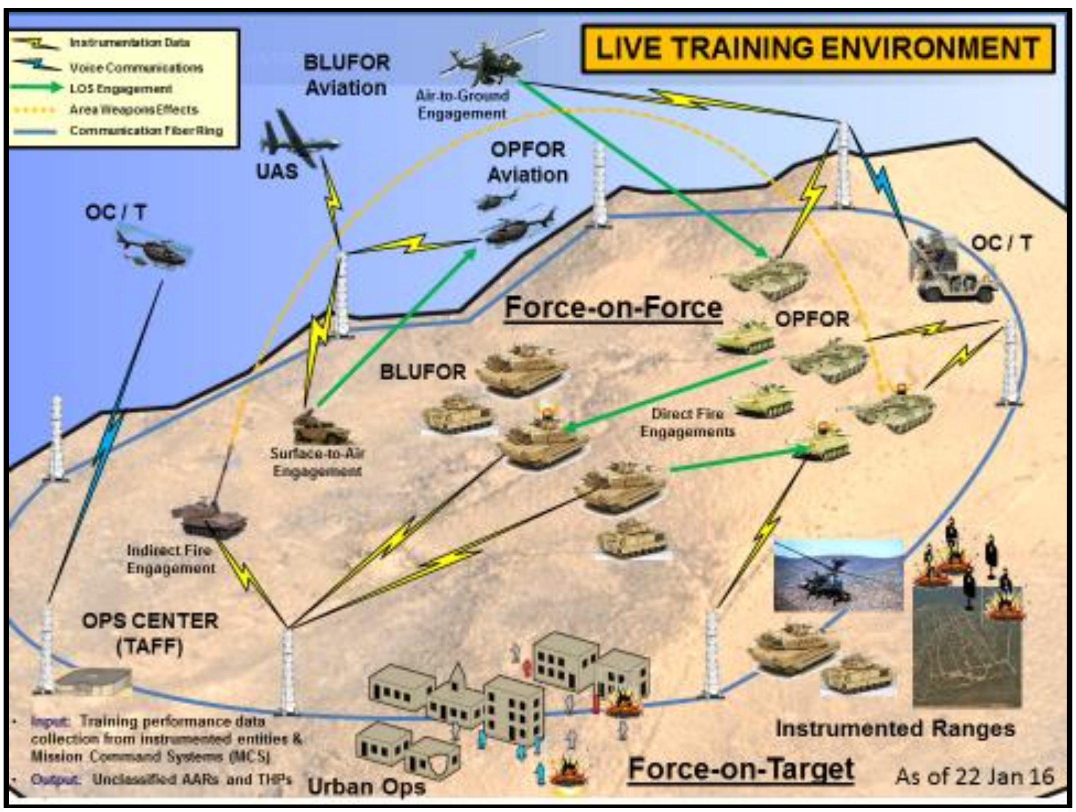
BACKGROUND

Force-on-force (FoF) training provides the warfighter with arguably the most important skills of his career – the abilities necessary to effectively and efficiently engage enemy forces. As such, a great amount of time and resources are dedicated to force-on-force training systems. In addition, other capabilities such as instrumentation systems and Force on Target (FoT) training enable and prepare warfighters for FoF training. These combined capabilities form the Live Training Environment as captured in Figure 1.

Figure 1. Live Training Environment



The Army's Live Training Environment provides the warfighter with realistic battle-focused, task-based training that provides real-time, actionable feedback, enabling leaders to take immediate steps to improve overall combat performance. The principal focus of all combat training centers is to develop leaders from corporal to colonel. In the past decade (during Operation Iraqi Freedom and Operation Enduring Freedom), Combat Training Centers have also been used to develop unit readiness for deployment to these operational areas. While the instrumented live training environment rests at the core of the Combat Training Center, other components - observer controllers, battlefield effects, and a realistic opponent - contribute to the power of developing future leaders.

The centerpiece of the live training environment is the after-action review. This process is central to the transfer of learning from the live environment to the knowledge of the soldier and leader. Composed of three elements - what happened, why it happened, and how we can fix it – the AAR creates the catalyst for transferring experience to knowledge. The Army continually focuses on how to modernize the after action review.

Utilizing a family of Tactical Engagement Systems (TES) and an integrated Instrumentation System (IS) for communication between systems, the Live Training Environment provides leaders with the ability to conduct FoF (e.g., direct, non-live fire engagement with other live combatants) and FoT (e.g., live fire shooting range) training. The Live Training Environment uses a single voice, video, and data network that collects, reports, stores, manages, processes and displays event data for instrumented players and constructive entities and provides the team of observers/trainers with critical situational awareness for training safety, analysis, and feedback capabilities to conduct timely After Action Review (AARs) with trainees. Common components such as exercise planning, exercise preparation, exercise control, after-action review preparation and presentation, in concert with integrated architecture services, processes, rules and standards, support the full spectrum of training.

Due to the vastly complex nature and constant evolution of capabilities, weapons, and doctrine, the Live Environment requires significant efforts in Verification and Validation.

Verification and Validation

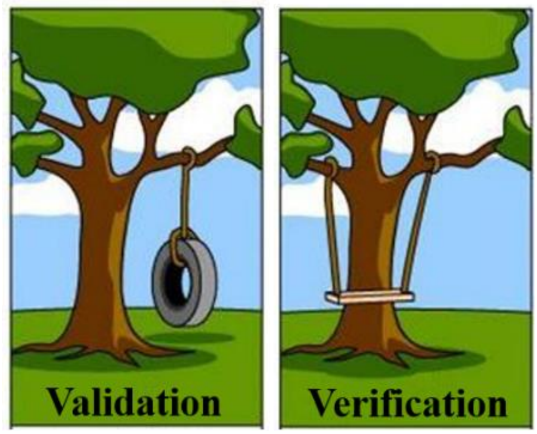
One of the greatest challenges in the Army's Live Training Environment is the required investment of cost & time. Putting on a live training exercise requires a great amount of preparation from the unit being trained as well as the organization that is conducting the training. People, equipment, and training gear need to be transported to specified training areas that have been outfitted with specialized Instrumentation System gear, such as radio towers and Exercise Control (EXCON) stations. This equipment must be periodically serviced and maintained. Contractors are typically hired to provide technical support, operate EXCON equipment, and prepare AARs for review. In the current government budgeting climate, cutting cost and overhead time for training would be a win for both the Department of Defense and tax payers, ensuring that tax dollars could be used for increasing the amount of training given to soldiers or for innovation in current acquisition efforts, both of which lead to increased readiness.

In addition, the Army uses many different training systems for live training, the vast majority of which were developed by private industry. Initially, these systems were wholly proprietary with the exception of the MILES Communication Code (MCC), an industry standard for laser-based data transfer during FoF training. Many contractor systems implemented proprietary "closed systems" for communication and data transfer, immediately limiting the Army's list of compatible systems to a small subset developed by the same contractor. The results of this ideology included reliance on the same few contractors for future development and, in turn, increased cost due to the lack of competition. While this made the most sense at the time, the Army has realized that having different companies develop systems independently limits the possibility for growth and evolution. Systems that use proprietary communication methods are often unable to interoperate with other companies' systems. Because of this, future source selections are forced to consider "interoperability" as a criterion when evaluating prospective systems. This in turn may result in a system being selected for fielding not solely because it is the most effective at the task, but because it is capable of interoperating with other systems.

The Army's Live Training community puts a great emphasis on continuous improvement of its processes, methodologies, and systems. As such, these items are regularly analyzed for potential improvement. Again, this is due to budgetary constraints, evolving requirements, and lessons learned. Due to the nature of Army acquisition, in which requirements drive solutions, it is almost impossible to have requirements keep up with Army needs given the typical 5 year acquisition cycle. For example, a new suppressor on a rifle could require changing systems that were procured 10 years ago. As a result, a capability that can be used to inform solutions within scope of requirements would be a cost avoidance godsend.

Verification refers to testing that proves that a product meets the specification developed for it. There are a variety of verification approaches for systems including inspection, demonstration, and testing. Many current Army verification methods require specialized lab equipment to measure that a product is exhibiting the characteristics laid out in its requirements documents. This equipment is costly and requires a great amount of overhead to procure and operate. In addition, the developer labs or integration labs do not replicate the configurations as seen on the ground at various locations such as the National Training Center at Ft. Irwin, CA, the Joint Readiness Training Center at Ft. Polk, LA, or the Joint Maneuver Readiness Center at Hohenfels, Germany. These unique locations provide their own challenges as similar, but disparate systems come together to provide training, that also while similar are slightly distinct based on conditions and participants.

Figure 2 Validation vs Verification



Validation on the other hand refers to evaluating a system's ability to solve the problem that it was designed to solve. Validating new products involves testing to prove that the product will operate in a relevant environment. The operational "relevant environment" is a broad term encompassing the numerous harsh conditions encountered in wartime –all weather conditions, climates, times of day, and locations make up this ambiguous term. Current validation methods include repurposing existing equipment to "shoehorn" existing technologies to fit new operational requirements. Many times, valid operational requirements may get decomposed into a set of specification requirements that don't necessarily provide a valid solution. As Figure 2 illustrates, what is fielded to the warfighter may not necessarily correspond to what was intended. This is why Army acquisition relies so heavily on an Integrated Product Team (IPT) structure with user representatives. While Live Training does not have egregious instances such as Figure 2, there have been components which did not serve their intended purposes. As we enter a new era where a vast array of new technologies are being considered such as cloud computing, mobile devices, and cellular technologies, a clear mechanism for validation is required that is not tied to the 5 year acquisition cycle, but instead informs it.

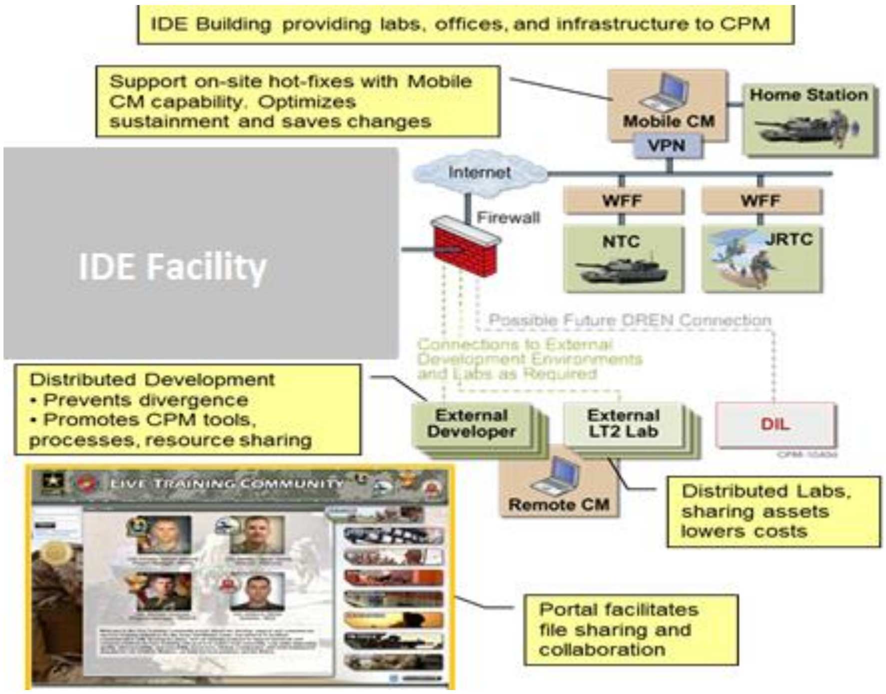
There is an increasing demand for exportable instrumentation systems to accompany US and Allied forces to remote locations for training. The Army has developed one exportable system currently located in Hawaii and dedicated to supporting operations in the Pacific region. With increasingly common exercises in Europe there is a demand for exportable instrumentation systems across Europe. Several commercial firms are in the process of offering instrumentation systems along with a menu of combat training center capabilities for these exercises.

THE INTEGRATION AND DEVELOPMENT ENVIRONMENT (IDE)

In order to deal with verification challenges, PM TRADE leverages the Integration and Development Environment (IDE). The IDE is a government run development facility providing an integrated lab for development and sustainment as illustrated in Figure 3. Programs either have resident labs in the IDE facility or leverage its capabilities remotely. As a facility that accommodates multiple contractors, the IDE provides improved collaboration, software product line management, a co-located workforce, and significant cost reductions due to shared lab space, shared licenses, information technology (IT) equipment, reduced facilities overhead, and resource sharing.

For contractors that use the IDE facility, the government saves ~25% through off-site rates. For 44 Full Time Equivalents (FTE) per year that's ~$1.5M saved which more than offsets the facility's operational costs. Additional savings come from consolidated configuration management (CM), IT management, backup strategies, decreased configuration time for builds and testing, and reusable lab spaces. Products leveraging the capabilities of the IDE remotely are able to gain savings for CM, some IT management, backups, and even builds and testing, albeit to a lesser degree than those projects that are run exclusively from the IDE. Migration to tools that specifically support remote development like SVN, CQ2SVN and greater use of the LT2 portal are essential for remote development to be successful. These tools are all hosted and administered by the IDE and its staff.

Figure 3. IDE Configuration



Adoption of the IDE by more projects has caused some contention for space. In order to gain a greater ROI, the footprint of the current projects had to shrink. This was done through the use of virtualization and more efficient use of lab space through technologies such as virtual desktops and virtual labs. These allow more efficient sharing of lab space while allowing non-resident developers to participate in critical activities which generally required co-located staff.

Centralized staffing is not required for a product line but constant communication between teams is required and the IDE fosters a sense of community though shared office space and labs as well as shared meeting spaces for face-to-face collaboration such as Core Asset Working Group (CAWG) and Product Review Board (PRB) meetings. This coordination between resident teams causes a “collaborative ethos” which extends beyond the physical IDE and touches remote development teams as well.

IDE-Forward (IDEF)

While the IDE provides great services and value, recent changes in programs have demonstrated a need for a capability between the IDE and the final fielded configuration. For example, programs go from passing integration tests to scaling of thousands of devices at a fielded site. Additionally, capabilities are fielded and upon use by the warfighter are re-worked, which causes schedule and cost impacts. As a result, a new effort was initiated, termed the Integration and Development Environment-Forward (IDEF). The IDEF is a testbed and framework for testing out new training systems, technologies and training concepts. The IDEF allows PEO STRI to test prospective training systems in a relevant environment and get feedback from the warfighter. Figure 4 captures the initial IDEF capability, which is located at Ft. Benning, GA. The IDEF system will inform future STRI source selections and provide a capability to review the relevance of fielded training systems.

IDEF was designed to be a persistent system, able to provide on-demand test services for Army acquisitions. This flexibility reduces risk for acquisition programs by being able to accommodate changes in schedule. In order to provide this capability, IDEF was designed to leverage mature technologies where possible while developing others to serve its specific use cases.

IDEF is currently instantiated thusly: Instructors will log-in to a cloud-based “portal” website, setting up a training event by specifying information about the event such as the number of players, the type of event, and the location. In addition, the instructor will set up user accounts for trainees. Before the event begins, trainees are issued a ruggedized smartphone running the Mobile Training App (MTA) which will be carried among the rest of their gear. Trainees will use the phones to log-in to the app using the account information created in the portal. As they train, the app continually sends player status and location data (as governed by the Live Training Engagement Composition (LTEC) message format) via a secure LTE connection to a fully accredited cloud computing environment. Player information is served to instructors or leadership from the cloud to ruggedized instructor tablets or even desktop PCs through a secure login page. The exercise executes as designed and when complete the system is turned in. Exercise data is stored for after action review. The exercise is intended to be executed entirely by warfighters without on-site contractor support. There is technical support provided at the physical IDE building in Orlando, Florida, but the system is intended to validate organic training strategies.

During planning stages and execution, IDEF offers capabilities that observers can utilize to teach trainees specialized knowledge by providing specific training scenarios. Events such as indirect fire strikes and localized chemical events can be implemented on the map, affecting trainees in those areas. In addition, health status effects, such as gunshot wounds, can be represented on trainees' user accounts. This functionality could be an asset for limited field medicine instruction in the future.

IDEF ENABLING TECHNOLOGIES

The IDEF is an innovation that PEO STRI has developed that provides both verification and validation capabilities for programs of record such as I-MILES, CTIS, and RCS. This recent capability has been achieved due to the convergence of specific technologies and the introduction of those technologies to the live training environment.

Cloud Computing

Cloud computing is defined by the National Institute of Standards and Technology (NIST) as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources" (Fang et al., 2011). Cloud computing is the key to making IDEF a persistent & on-demand training capability. The flexibility, scalability, and availability of the IDEF system are thanks to a new design paradigm called Training as a Service (TaaS). The idea behind this philosophy is to provide the capability to train and review whenever and wherever, with as many or as few trainees as needed.

To support the TaaS philosophy, IDEF utilizes cloud-based computing and storage. A cloud-based solution provides numerous benefits, including on-demand expandability, increased reliability, and reduced cost – being able to scale the amount of resources needed eliminates wasteful spending on unnecessary storage or computing power. All connections to the cloud are made via a Virtual Private Network (VPN), which enables users to communicate with the cloud as if they were connected to each other via a private network, safeguarding communications from unintended recipients.

Training as a Service

Training as a Service has two distinct interpretations. First, it can represent a business model of procuring training capabilities from a contractor as a service (as opposed to having organic capabilities in-house). The US Army National Guard effectively uses this model. The second interpretation is to build organic training capabilities as a software service in a Service-Oriented Architecture (SOA) on a cloud-computing platform. The latter concept is what IDEF is based upon. PEO STRI defines Training as a Service (TaaS) as an on-demand training delivery model in which training & simulation software and its associated data are hosted centrally (typically in a cloud) and are accessed by users using a thin client (Lanman & Kapadia, 2014).

Microsoft provides a loose definition of SOA as the following: "A loosely-coupled architecture designed to meet the business needs of the organization" (Microsoft, 2017). The idea of SOA is difficult to define, as its form will change according to the goals of the organization utilizing it. The main defining characteristic of an SOA is the passing of messages between programs (defined as services from now on) through a well-defined exchange medium to achieve a goal, as opposed to invoking methods on remote objects, as is the case with an Object-Oriented Architecture (OOA).

Training as a Service applies an SOA to meet PM TRADE's business goals –

- Persistence – IDEF provides services can be used to track progress across exercises
- On-demand service – services are available with little to no prep time
- Point of need availability – services are available (and served with little to no variation in quality) regardless of location

- Expandability – new services can be added to the existing system to build upon existing capabilities or develop new ones.

The following SOA design principles support these business goals (O'Brien, Bass, & Merson, 2005):

- Services are reusable – services are designed to support reuse by other services or requestors.
- Services are autonomous – Services have autonomy (within a defined boundary) and do not depend upon other services for execution within their boundary.
- Services are discoverable – Services are well-defined and easily accessible to users and service users.
- Services are location transparent – Services can move to other locations on a network without affecting requests.

Figure 4. Integrated Development Environment-Forward: Instantiating Training as a Service (TaaS)

Our strategy is to bring together CTIA 4 / SOA, TIGR, LTEC, the Mobile Training App and a self-serve Training Portal as a persistent capability available to soldiers starting at MCOE to prove out Training as a Service.

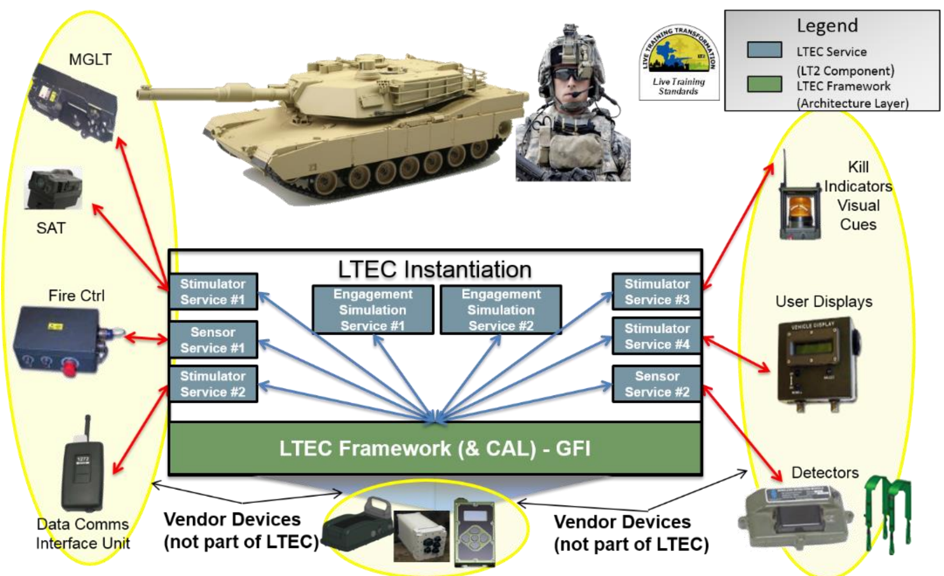
One of the key components of the Army's Training as a Service (TaaS) paradigm is the latest version of the Army's Common Training Instrumentation Architecture, version 4 (CTIA4), a software package that enables training products to interoperate via a common set of services. CTIA4 was designed to be a true SOA that can be easily deployed and expanded to multiple different computing environments including the cloud. In order to achieve true TaaS capability, CTIA4 needed to be deployed to the cloud with a persistent training management portal called the LT2 TaaS Portal. The LT2 TaaS Portal allows the users to plan, create, manage and execute a training exercise from any location that has internet connectivity. An exercise can be planned and created at one location, executed at another, and supported/management from a totally separate location. With this paradigm, training exercise support personnel do not have to travel or be stationed at remote training locations. The TaaS Portal manages the executing training exercises and starts and stops the required CTIA4 services along with mapping and mobile services based on the type and size of the training exercise. This is important when CTIA4 SOA services are running in a cloud computing environment such as Amazon Web Services (AWS) government cloud - service fees are based on the computing size and number of Virtual Machines (VMs) that are required. The TaaS Portal manages the Virtual Machines running CTIA4 by mapping services and automatically starting/stopping VMs and services as training demand changes.

The combination of IDEF's cloud computing environment and service-oriented architecture gives users a robust test capability that requires minimal preparation for operation and reduces risk when adding future capabilities.

Live Training Engagement Composition (LTEC)

LTEC is a government-owned software package that provides a set of Tactical Engagement Simulation System (TESS) capabilities for use by live training hardware components as illustrated in Figure 5.

Figure 5. Live Training Engagement Composition



LTEC is an enabling technology for the Army's goal of Component-Based Acquisition, a materiel acquisition strategy that focuses on acquisition at the lowest level (the component) in order to maximize overall system capability. LTEC provides an open software standard for communication & set of common functionality for training device components. LTEC was designed to be platform-agnostic - implementing it on a TESS component does not require the component to run a certain operating system or use a specific processor. This flexibility in implementation drives innovation and lowers acquisition costs by making it possible for any company's systems to operate in the same training environment (given that they've adhered to the LTEC standard). For example, a new LTEC-enabled laser detector, which has been proven more effective than the currently fielded one, could easily integrate with an existing LTEC-enabled system when the time came to replace the old detector. Due to LTEC's open standards and service-based functionality, LTEC operates as a Service-Oriented Architecture for TESS (Janisz, Sowden, Platt, Grosse, Hall, 2013). To support the TaaS architecture required by IDEF, new LTEC communication services were added to support direct communication with new mobile services within CTIA. This allows, for example, LTEC running on an internet connected mobile Android device to directly communicate with CTIA services running in a cloud computing environment such as the aforementioned Amazon Web Services.

Long-Term Evolution (LTE)

IDEF utilizes 4G Long-Term Evolution (LTE) connections for data transfer to/from IDEF phones and instructor tablets. All IDEF users send data through the IDE's VPN to ensure secure communications. IDEF has experienced success operating on both commercial and government-owned networks. Both options are attractive as they allow IDEF to leverage these networks' existing nationwide communications infrastructures instead of building & maintaining one from scratch.

FirstNet is a government-owned, nationwide "public safety" broadband network being developed to provide first responders with an uninhibited means of communications & data transfer during emergencies. An initial partnership between PM TRADE and the Department of Commerce allowed initial experimentation using this network. Though its infrastructure is still being developed, IDEF has had success leveraging FirstNet's capabilities & hardware for data transfer during training exercises. Further experimentation with this government asset is planned once FirstNet becomes more mature, as partnering with another government agency will yield cost benefits as compared to commercial carrier rates.

IDEF USE CASES

As IDEF is a PM TRADE capability, there are many applications and use cases that vary from training use to capability verification & technology maturation.

Reconnaissance & Surveillance Leaders Course (RSLC)

Testing of IDEF has proven successful during Recon & Surveillance Leader's Courses (RSLCs) in late 2016 and early 2017. The RSLC is a 29-day program conducted by Delta Company, 3d Squadron, 16th Cavalry Regiment at Fort Benning, GA that teaches the fundamentals of dismounted reconnaissance, surveillance and target acquisition to Soldiers, Noncommissioned Officers, and Officers (U.S. Army Maneuvers Center of Excellence, 2016). Instructors utilized IDEF during the land navigation tests that occur at the beginning of the course. They were able to track all of their students via ruggedized tablets, ensuring that no one broke the rules or got lost. Up until now, this level of accountability has never been possible without a considerable amount of overhead.

IDEF enables PEO STRI to use training exercises such as the RSLC as use cases for testing new LTEC-enabled hardware. As the LTEC standard is adopted and implemented in future training devices, these exercises will be used to test new devices in an operational setting. Additional use cases will be necessary to test the wide spectrum of test devices; PEO STRI hopes to extend IDEF's repertoire to include training exercises involving mounted and dismounted Force-on-Force combat or aviation, allowing PEO STRI to test LTEC-enabled trainers for these platforms.

Gainey Cup

The Army's Maneuvers Center of Excellence (MCoE) utilized IDEF to track participants in the 2017 Gainey Cup, an international military scout competition that takes place annually at Fort Benning, GA. Organizers were able to track soldiers in real-time, allowing them to monitor teams' progress and make sure that no one became lost. The Army has other soldier-tracking systems that could have worked in this situation, but the ease of use and low overhead costs made IDEF the most attractive option.

Teams were outfitted with a small bag containing two MTA devices (for redundancy), which were connected to external battery packs, as there were few windows where MTAs could be charged. The MTAs were already logged into a TaaS exercise, so the only action required from the participants was to keep the MTA bag in one of their packs.

Location data was transferred from the MTAs to the TaaS portal hosted on IDEF's Amazon Web Services cloud via VPN. This information was then served down to the observers' laptop at the control center. Observers used teams' location data for tracking and adjudicating during a land navigation test.

IDEF experienced minimal operational failures during Gainey Cup. The most significant failure occurred when IDE network hardware failed back in Orlando, FL. This cut the VPN connection between the MTAs and the cloud, requiring MTAs to be re-logged-in. This kind of event is essential to fielding programs of record by identifying issues in bringing-in new technologies. As a result of Gainey Cup lessons learned, the IDEF team is looking at ways to provide redundancy for VPN communications.

Vehicle Tactical Engagement Simulation System (VTESS)

As LTEC is incorporated into fielded future training systems, IDEF's test capabilities will expand to facilitate testing of training devices for additional platforms, such as ground vehicle and aviation systems. As mentioned previously, a major goal of IDEF is to test future training systems, most notably LTEC-enabled systems. The first such system is the Vehicle Tactical Engagement Simulation System (VTESS).

VTESS provides the first MILES acquisition that will enable component-based acquisition by defining open component interfaces and allowing testing and replacement of components by independent vendors. Since the VTESS acquisition includes the ability to communicate via the LTEC standard, new functionality can be added quickly to the capability and evolved for specific use cases as for Operational Testing or Medical domains. IDEF will enable PEO STRI to test the system out in the field with other LTEC-enabled systems during an IDEF-enabled training exercise, ensuring that VTESS is providing positive training experiences for *all* trainees – the vehicle operators, their allies, and OPFOR participants. Furthermore, it will allow this testing and feedback to occur much earlier in the process and build a testing approach that can be more effective as well as refining design decisions and the path forward.

In addition to VTESS, providing LTEC-enabled instrumentation radios for vehicles would ensure that current MILES-enabled vehicle systems, such as the Combat Vehicle Tactical Engagement Simulation System (CVTESS) and Tactical Vehicle System (TVS) could participate in IDEF-enabled training exercises as well. These systems are planned to incorporate LTEC in the future.

Small Business Innovation Research (SBIR)

The Small Business Innovation Research (SBIR) program is a federally-funded program that provides small businesses with the support needed to participate in federal research & development programs. The government makes these partnerships attractive by not only providing the seed money for SBIR efforts, but also by allowing participating businesses to keep data rights for future commercialization of the products developed.

PM TRADE has been a longtime participant in the SBIR program, working side-by-side with small businesses to develop enabling technologies that could inform future acquisitions. As these new technologies continue to mature, IDEF will provide an organic test capability, allowing STRI to test out technologies in real-life force-on-force situations.

PEO STRI is currently working on multiple live training-related SBIRs. These technologies vary from a new Small Arms Transmitter (SAT) for laser-based engagement to an augmented reality-based combat casualty care simulation system. STRI's ultimate goal for these programs is that successful development efforts would yield products that could be integrated into a future military acquisition program. To prove their readiness for wartime environments, these technologies would be tested in relevant environments using IDEF. With the addition of the component-based acquisition paradigm, systems such as VTESS will be able to incorporate new technologies into their baseline. In the case of SBIRs, IDEF provides a two-fold benefit. First, it can validate the requirement and design such as the benefit of a 904nm/1550nm wavelength laser for I-MILES-enabled FoF engagements. Second, it can verify the SBIR innovation successfully meets the requirements of the base program, such as a new I-MILES hardware component that could be used in conjunction with a fielded VTESS.

FUTURE CAPABILITIES / TEST CASES

Future Capabilities

IDEF's expandable design philosophy aims to reduce risk & development time when integrating new features. This ease of integration makes IDEF an attractive test capability when developing new training tools/features. For example, the Universal TESS Adapter (UTA), which interfaces with dismounted TESS equipment, presents exciting new capabilities for Combat Lifesaver and Buddy Aid training. The MTA app's Battle Damage Assessment (BDA) feature provides a mechanism that allows combat medics to train in treating relevant combat injuries with all the stressors of a battlefield setting. When a student is "shot" during an exercise, their man-worn training device will communicate information about the shot, such as the weapon that was used and location of the shot on the player's body, to the MTA app. BDA can then generate an injury (and associated "casualty card") based on this input, notifying the player that they've sustained, for example, a gunshot wound to the leg. Medics can take this information and simulate treatment of the injury accordingly. This capability would be leaps and bounds above current "casualty card"-based medic training. In addition, the capability can be more accurate, simulating a time to incapacitation and actual treatment consistent with Squad Overmatch capabilities.

Many of the possible future capabilities will be coming from the future program Army – TESS (A-TESS). A-TESS is slated to replace current I-MILES systems and provide additional capabilities in the areas of indirect fire, aviation, and new weapons such as counter-defilade and energy weapons. Using IDEF to test possible A-TESS solutions will be incredibly beneficial in defining proper performance requirements and defining the art of the possible. This includes validating the use of medical treatment devices, augmented reality devices, and more realistic battle effects.

CONCLUSION

Over the past two years, the Army has emphasized the importance of readiness – to be ready, prepared, trained, manned, and equipped for future challenges. The Chief of Staff of the Army went so far as to call readiness his number-one priority in 2016 (Hale, 2016). One of the first steps to ensuring readiness is to supply the warfighter with training equipment that has been proven both realistic and effective.

The key to verifying & validating new military technologies is making sure that they can perform according to their requirements in an environment representative of what the warfighter will encounter. The Integration and Development Environment-Forward fills an Army testing gap by providing a persistent & on-demand testbed for live training devices at a much lower overhead cost than was previously possible.

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