# Military Modeling and Simulation (M&S) Future Technologies and Processes

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## *ABSTRACT*

*This paper summarizes the technologies and processes we feel will have applicability to the 2025 timeframe in the use of the Live-Virtual-Constructive (LVC) simulation. The technologies and processes are grouped into two categories: those whose impact is primarily development-focused and those where the impact will be more on the socialization of M&S tools to expand the breadth and depth of their use. Each of the examples provided has a complementary example of a practical application of the technology in a military environment.*

## 1.0 INTRODUCTION

In 2009 the US DOD Modeling and Simulation Coordination Office (M&SCO) funded a High Level Task (HLT) called the Live, Virtual, and Constructive Architecture Roadmap - Implementation (LVCAR-I) which was charged with primarily providing insights, tools, and standards to improve M&S architecture interoperability. While that is the main thrust of the project there was also an implied task to look at future commercial technologies/processes and their potential for use in a military M&S environment. To that end LVCAR-I built SOA prototype architecture, produced a report specifically covering the benefits and barriers of using SOA in a military M&S structure, and examining trends industry is looking at for adoption. The next few pages cover those future technologies and provide examples of how they are being applied.

## 2.0 DEVELOPMENT COMPONENTS

Development components discuss technologies and processes that impact the implementation of Modeling & Simulation (M&S) systems.

### 2.1.1 Mobile Computing and Augmented Reality

Advances in mobile computing will increase the possible user base of M&S significantly, not only in larger exercises but as smaller cells of users leveraging M&S resources down to the tactical level. Projects have begun to put mobile M&S resources in the hands of deployed tactical leaders (Fig 1 Deep Green, RealWorld). These systems could also be nodes on a larger cloud computing network that could allow tactical commanders to

offload processing-intensive mission planning computation to offsite systems. Training or planning coordination could then be open to any other personnel attached to the cloud.


Figure 1: Deep Green Project.

### 2.1.2 M&S Task Benefits

Allows many asynchronous M&S tasks:

- Bottom-up: tactical leaders will be able to put together their own training and planning M&S events.
- Top-down: M&S resources can be generated at anytime, anywhere and distributed all the way down to tactical leaders (or Reserve/National Guard officers). A capability generated anywhere would be available everywhere to all.

Augmented Reality (Fig 2) will place the trainee into a world where the sensory cues more closely match what will be seen in the field where threats can be added constructively. The technology's mobile nature will allow tasks to be practiced in a way that mirrors the way they are performed in the field.


Figure 2: Augmented Reality

Existing techniques for rapid development of virtual 3-D worlds from measured terrain data will be enhanced. Mashing the data collected by Ubiquitous Surveillance with that collected through Crowd Sourcing will result in realistic training environments that are nearly automatically available.

### 2.1.3 Military Application

Recently, the US Army Research Laboratory Human Research & Engineering Directorate Simulation & Training Technology Center Medical Simulation Research Branch in conjunction with the University of Center Florida Institute for Simulation & Training have demonstrated a research project involving a mix between mobile devices and augmented reality technologies. Specifically, they have fused medical information from a physical card game into more digital information by scanning the card. Additionally, they provide the ability to browse data as well as receive 3d demonstrations of medical terms, procedures, etc. Moreover, they are able to update the data in one central location and have all mobile devices pull from this database to facilitate the updating of information.

### 2.1.4 References


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- "Enhancing Tactical Information Access (TIGR)", http://www.darpa.mil/ipto/solicit/baa/RFI-SN-10-35_PIP.pdf
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- Jonietz, E., "Augmented Identity", http://www.technologyreview.com/computing/24639/?a=f


### 2.2.1 Ubiquitous Surveillance and Automated Reasoning

**Future forces are expected to have larger robotic components, allowing for continuous real-time environmental Intelligence, Surveillance and Reconnaissance (ISR) data to be captured. These systems may also have rudimentary reasoning abilities to increase users' data filtering abilities (or allow for some tasks to be automated, allowing users to focus more on other more critical tasks). With M&S capability pushed to tactical commanders (2.0 DEVELOPMENT COMPONENTS**

Development components discuss technologies and processes that impact the implementation of Modeling & Simulation (M&S) systems.

2.1.1 Mobile Computing, above) integration with these robotic systems will allow for mission planning against a near real-time operational picture (Fig. 3).


Figure 3: Data Overlay

### 2.2.2 M&S Task Benefits

- This would allow M&S systems tailored to a specific operation to be continuously updated for improved planning and training capability.
- M&S activities such as building scenarios, environments and data exchanges could be offloaded to systems.

### 2.2.3 Military Application

The objective of the Intelligent Networks field of study at the US Army Research Laboratory (ARL) is to augment human decision makers (both commanders and Soldiers) with enhanced-embedded battlefield intelligence that will provide them with the necessary situational awareness, reconnaissance, and decision making tools to decisively defeat any future adversarial threats. The challenge is to find methods that facilitate the development of intelligent and autonomous systems that perceive their environment by means of sensing and through context, and use that information to generate intelligent, goal-directed, desired behaviors. This area of research poses unique challenges for the Army as it involves developing autonomous capability for mixed teams of air and ground vehicles that acts to complement a Soldier's capabilities.

The focus is on developing a formalized mathematical, algorithmic, and practical understanding of perception, control and learning to facilitate the development of intelligent and autonomous systems. This approach requires research in the following areas:

- Integrated Intelligence, where sub-components for vision, knowledge representation, reasoning, and planning are integrated in a synergistic fashion to yield a sum that is more than its parts.

- Robust Reasoning Under Uncertainty, where the ability to adapt or compensate, in reasoning, for the uncertainty inherent in real systems related to modeling error, sensing errors and noise, system failures, and changing dynamic environments, are important.

- Socio-Cultural Modeling/Computing, which brings together elements of Game Theory, Knowledge

representation and Social sciences to reason about groups/societies.

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- "Mind's Eye", http://www.darpa.mil/Docs/TCTO_TA_BAA10-53.pdf
- "Autonomous Real-time Ground Ubiquitous Surveillance - Imaging System (ARGUS-IS)", http://www.darpa.mil/ipto/solicit/baa/BAA-07-23_PIP.pdf
- "Deep Learning", http://www.darpa.mil/ipto/solicit/baa/BAA-09-40_PIP.pdf
- "ASW Continuous Trail Unmanned Vessel (ACTUV)" https://www.fbo.gov/index?s=opportunity&mode=form&id=f5a18f44ab80302146a381cfe3c703af&tab=core&_cview=0
- "Flow-Based Information Theoretic Tracking (FITT)", http://www.darpa.mil/ipto/solicit/baa/BAA-10-05_PIP.pdf
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- "Urban Reasoning and Geospatial Exploitation Technology (URGENT)", http://www.darpa.mil/ipto/programs/urgent/urgent.asp
- US Army Research Laboratory, Network Sciences, Intelligent Networks http://www.arl.army.mil/www/default.cfm?page=482


### 2.3.1 Event Model-Driven Architectures

Instead of having a single point of delivery (in service-oriented architectures, this would be the web-based server) where clients and systems must cooperate, break out the individual events of a service's lifecycle into an "assembly line of information" where clients and systems have designated stations where they interact with the service (Fig 4). These can leverage existing flow control technologies already utilized by industry such as the Business Process Execution Language (BPEL) that allow for the definition and asynchronous orchestration of business process components (and improve on the shortcomings of these technologies).

### 2.3.2 M&S Task Benefits

- Allow for changing participants, environments, data, requirements and computing-on-demand. Live, virtual and constructive components could join and leave M&S activities with the systems managing the substitution and composition of components.
- Reduce the discovery-to-fix time of vulnerabilities and M&S tools[1].

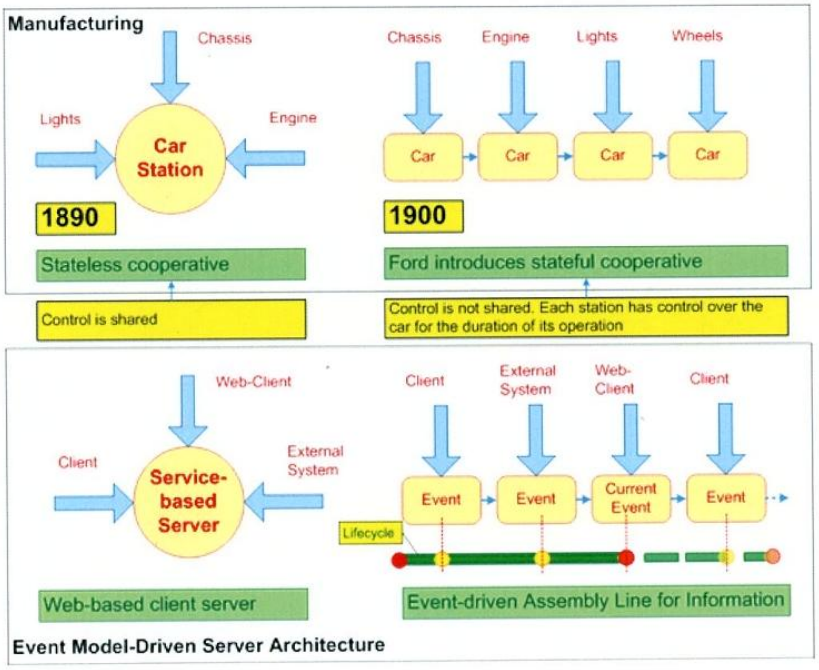


Figure 4: Event Model-Driven Server Architecture

### 2.3.2 M&S Task Benefits

- Systems and clients are no longer competing for a single resource. Instead, multiple services are streamed into an assembly line (similar to processes on a CPU processing pipe).
- Failure of a service request does not need to be extricated from a single point, instead it can be pulled off the assembly line and dealt with individually (possibly even reintroduced at a later time) without impacting the handling of other service requests in the pipeline.
- New stations/components could be swapped into the assembly line without producing downtime in the services (e.g. a low-fidelity environmental server could be processing bathymetry requests, but once a high-fidelity sea floor capturing space-borne LADAR is in place, its server could be swapped into the modeling pipeline without a break).
- Secondary, parallel stations could be added for testing prototype systems into the stream, again allowing for rapid deployment as well as uptime in the face of component failure

[1] Research by Symantec has found that on average it takes a month for human engineers to come up with a fix for a bug.

### 2.3.3 Military Application

The DOD Data & Analysis Center for Software sponsors numerous projects in this area such as support for command and control. The projects focus on the Model-Driven Architecture (MDA) as a framework for model-based development being standardized by the Object Management Group (OMG) that addresses these problems. In MDA, developers and analysts focus on the problem domain and create platform independent models (PIMs). These models can then be leveraged by using a platform specific model (PSM) to transform the business objects, rules, and system constraints into code for a targeted architectural platform.

### 2.3.4 References


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### 2.4.1 Self-Healing and Self-Managing Systems

There is a drive in current software development to build self-managing, self-healing, self-optimizing, self-configuring and self-adaptive systems. Software will have the ability to "examine its failures and to take appropriate corrections." As computing becomes more pervasive and distributed, the limited pool of human system administrators (especially for M&S where the tools would be in the hands of users globally distributed, far from any substantive IT staff) will require the systems themselves to handle many of these tasks themselves. Adapting to changes in the system, improving performance, recovering from mistakes and resolving security intrusions will need to be handled all or in part by the systems. A side benefit for M&S is that these same system capabilities could be specialized to M&S activity needs such as the run-time managing of data exchanges and agreements between participants.

### 2.4.2 M&S Task Benefits

- Allow for changing participants, environments, data, requirements and computing-on-demand. Live, virtual and constructive components could join and leave M&S activities with the systems managing the substitution and composition of components.
- Reduce the discovery-to-fix time of vulnerabilities and M&S tools.

### 2.4.3 Military Application

In an effort to realize the concept of self-healing and self-managing systems, the US Army Research Laboratory Human Research & Engineering Directorate Simulation & Training Technology Center Advanced Simulation Branch has a research effort titled Next Generation Architectures for Modeling & Simulation. Through this effort, they are demonstrating the idea of a distributed simulation environment with run-time management of data exchanges, ad hoc simulation entry and departure and overall automation of the simulation environment. The effort has conceptually shown this concept and a full prototype is in development. A key goal will be to show metrics of how this approach provides benefit compared to the more formal process of distributed simulation systems engineering.

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### 2.5.1 M&S Social Graph

Similar to Self-Healing Systems (**Error! Reference source not found.**) but rather than focusing on individual systems and even systems of systems, the entire dynamic social network of a community (and their usage of a system, such as Facebook and all of its derivative applications) is considered. Metadata on the Internet began with manual artefacts like Yahoo! Keywords. This was then replaced with information generated from analysis of the explicit structure of the Internet (i.e., Google PageRank generating implicit authority of sources through the explicit linking of websites). The Social Graph is the next step of examining the next order of information within the community. The M&S Social Graph would go one step further and not just examine the taxonomy of the M&S Tools but possibly the tools themselves and how they interoperate (using the similar introspection techniques described in Self-Healing Systems).

The core difficulty is that a tool using the Social Graph is only as good as the Social Graph itself. And the Social Graph is probably the aggregate of many Social Graphs, which are often walled off. So the compromise of transparency for exposure would require consideration.

### 2.5.2 M&S Task Benefits

- By being able to graph not only M&S Tools, but their usage, data artifacts, hardware, networks, associated documents, a comprehensive understanding about the state of the M&S art could be achieved. Expertise of M&S could be pushed out to the very edge of the user space. This would allow for:

- Dynamic understanding of tools that are substitutes or complements for existing systems (without the user having prior knowledge).
- Gap analysis: discovery of 'holes' in the current Graph along with well defined specifications of this gap.

- User needs could be mapped to known/previous needs and federations of tools could be generated to support their activities.
- Tool usage could be monitored so maintenance and contract information could be scaled close to the actual dynamic use of systems (similar to the pricing of cloud systems like Amazon EC2 or the Google App Engine).

### 2.5.3 Military Application

Although not a pure M&S Social Graph, many of the concepts in the Army Research Laboratory Network Science Collaborative Technology Alliance are in line with this reasoning. Specifically, this collaborative research alliance between the U.S. Army Research Laboratory, other government researchers, and a Consortium of four research centers: three Academic Research Centers focused on social/cognitive networks, information networks, and communication networks, complemented by an Interdisciplinary Research Center focused on interdisciplinary research and technology transition. The Alliance unites research across organizations, technical disciplines, and research areas to address the critical technical challenges posed by the complex web of interacting networks within which the Army mission must be performed. Its purpose is to perform foundational cross-cutting research in network science, resulting in greatly enhanced soldier performance and in greatly enhanced speed and precision for complex military operations. As the basic and applied research in this alliance matures, we will see application to the M&S Social Graph concept.

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## 3.0 Use Components

Use components revolve around aspects of technology that are applied in a social context (e.g. Facebook, Twitter, etc) or inspire the adaptation of technology to support a interpersonal communication (e.g. Snapbucket or games).

### 3.1.1 The Paradox of Nudge and Choice

Research has found that the proliferation of data and options can lead to several undesirable results:

- The slow adoption of an improved technology as it cannot be distinguished through the body of existing choices.
- The application of a viable mental model to the wrong problem set, which slows the adoption of technologies further through misuse.
- Choice paralysis.

Creating a breakthrough technology is seen as building 90% of the bridge with the socialization of the technology being only 10%. Even with revolutionary technologies the above hurdles can happen.

Efforts are now being done to find the best way of informing users so they are 'nudged' towards better behavior (as coercion can often prove to be counterproductive).

### 3.1.2 M&S Benefits

- This is more of a lead-in for the rest of the section but the focus is to gain the maximum benefit from M&S for the sponsor that is possible given constraints of time, staffing and resources.
- Reduce the efforts required of individuals by harnessing the long-tail and offload tasks to automated systems when possible.
- Create an environment where, through improving feedback and aligning M&S tools to existing computing tools already heavily in use by the larger population, users get more from each use and are "nudged" into using the technology more.

### 3.1.3 Military Application

The United States Assistant Secretary of Defense for Research & Engineering (ASD(R&E)) has recently created a research thrust known as Engineered Resilient Systems (ERS). As part of ERS, research is being conducted into the concept of resilience, which is defined as effective in a wide range of situations, readily adaptable to others through reconfiguration or replacement, graceful degradation of function. These research activities are looking to transform engineering and provide efficiency, robustness and options with adaptable designs, more efficient engineering iterations and decisions informed by mission needs. Of particular interest to the M&S community are technology enablers:

- Cross-Domain Coupling
    - Interchange of information across "incommensurate" models. Models may be incommensurate because of different temporal or physical granularity within a given discipline, multi-scale/multi-physics issues across different engineering disciplines, or factors arising from differences in intended audience, e.g., abstracting a slower-than-real-time engineering model to drive a real-time gaming system for end users. Cross-Domain Coupling thus subsumes work on interoperability, conversion, abstraction, summarization, and capturing assumptions.
- Data-Driven Tradespace Exploration and Analysis
    - Managing the complex space of potential designs and their tradeoffs through:
        - Tools for generating alternative designs and conducting tradespace analysis
        - Algorithms for selective search

        - Tools for performing cost- and time- sensitive design of experiments, and planning of engineering activities to efficiently assess and quantify uncertainty
        - Tools for evaluating results
- Collaborative Design and Decision Support.
    - Tools, methods, processes and environments that allow engineers, warfighters, and other stakeholders to share and discuss design choices. This spans human-system interaction, collaboration technology, visualization, virtual environments, and decision support.

As ERS research matures, expect to see much application to the M&S domain.

### 3.1.4 References


- http://www.ted.com/talks/barry_schwartz_on_the_paradox_of_choice.html
- http://www.ted.com/talks/sendhil_mullainathan.html


### 3.2.1 Crowd-Sourcing and Automated Reasoning

Collaboration costs historically have required institutions to be created to satisfy business cases. The cost of this is that, since an institution cannot include all possible contributors, a portion of the long-tail of contributors is excluded, which could mean the loss of a critical contribution (e.g. the developer who only contributes to the Linux kernel source once… but it's a patch to a massive security overflow in the standard libraries). The rise of technologies with collaboration built in (Flickr, Wikipedia) has allowed for tasks to benefit from the wisdom of crowds and exploit everyone on the long-tail.

### 3.2.2 M&S Benefits

- For M&S, crowd-sourcing can benefit in two ways: development tasks and data tasks that may still require human capabilities.
    - In development users could add incremental micro-functionality throughout systems for the benefit of all users.
    - Human crowd-sourcing could be used in filtering tasks, such as those used on earthquake crisis reporting and the rapid development of high level environmental data in Haiti.
        - 40 volunteers in four days of activity were able to map an Indian city. Collaborators were changing the data in real time.
        - Twitter micro-contributions in a crisis aggregated together have been shown to produce results beyond a news-gathering cell focused singularly on the task.

### 3.2.3 Military Application

The proposed but not yet funded project Rapid Situational Awareness (RapidSA) is an activity where the deployed future warfighter, equipped with mobile computing technology and tethered to a global information network, can crowd-source fellow personnel with requests for digital intelligence (such as photographs taken of individuals or items meeting specific criteria) or participate as a contributor of such intelligence. Through RapidSA, future deployed US forces would then be a roaming real-time intelligent sensor network that

commanders could leverage to quickly create, direct and satisfy intelligence requests.

### 3.2.4 References


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### 3.3.1 Mashup Software and Fast, Inexpensive, Simple and Tiny (FIST)

By providing simple modular software components and widgets, businesses can allow the community of developers and users to quickly build tools to satisfy needs (such as visualization).

### 3.3.2 M&S Benefits

- Reduces the requirement for high-fidelity use cases. Developers can focus on low-fidelity cases and services provided, allowing for users, through use and experience, to close the gap with software.
- Exploits the wisdom of crowds and the long-tail of untapped development and design effort (similar to Crowd-Sourcing, **Error! Reference source not found.**). The Army has its existing "Apps for the Army" project.
- Allows M&S to work in FIST environments:
    - The FIST approach looks for cheap "75%" solutions that get the systems up with minimal development lag (with improvements coming later).
    - The FIST approach also looks for "empty shell" systems that can quickly be modified to achieve the 75% solution.

### 3.3.3 Military Application

The US Marine Corps (USMC) has developed a tool known as the Framework for Assessing Cost and Technology (FACT). FACT embodies the FIST concept in order to provide a composable capability to enable rapid exploration of trade space and alternative analysis while enabling rapid exploration of trade space and alternatives analysis. They have built an M&S Systems of Systems Engineering framework that is model agnostic, has a common language for data interchange, supports collaboration and integrates analysis and cost models to support vehicles throughout the vehicle lifecycle. Data and models can be added to this framework without the developers having to focus on how they will be used with other systems. Instead, they provide a lightweight solution that can be quickly and easily expanded.

### 3.3.4 References


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### 3.4.1 Cloud Encapsulation

While there are many benefits to leveraging the wisdom of crowds there are however critical drawbacks that need to be addressed. While crowd sourcing can provide fast and cheap optimizations (e.g., guessing the weight of a bull in a market) it doesn't answer innovation (e.g., deciding to bring a bull to market). Further it may produce business disincentive by putting too much pressure on new entrants and starving existing developers (Fig. 5, the music industry and digital piracy).

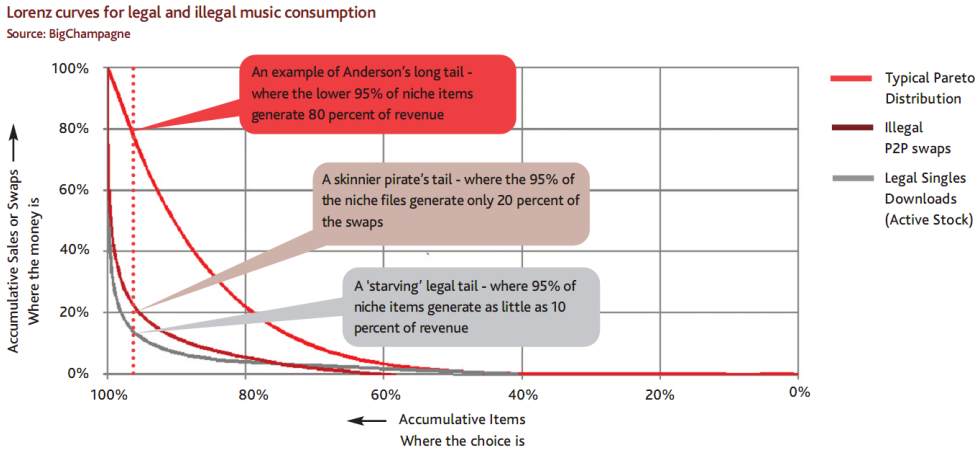


Figure 5: Lorenz Curves

The idea of encapsulation is to provide protection mechanisms, similar to the membrane of a cell, which can allow for complex interactions with outside agents without having the risks of complete openness. This can result in viable business models that can drive the creation of the micro-development tasks described above (e.g., developers of $4.99 iPhone applications in the Apple-controlled iTunes Store). A DoD user base of mobile systems to a cloud would be able to leverage approaches similar to Apples as they too have a monopoly on the users and the devices that developers would seek access to.

### 3.4.2 M&S Benefits

- If the iPhone/iTunes Store is used as a model, the encapsulation comes from being the bridge between users and developers.
    - To get contractors and developers to "fill the shelf" of M&S products, especially small ones like mash-ups, providing a viable pricing model is necessary.
        - By placing the user base on a cloud that is managed and controlled, sponsors can be assured payment equal to the use of their software (this also would go to eliminate individual users and contractors becoming too tied to each other).
    - DoD users would be enticed to use the system as it would provide computational power and systems.
- This system could work with a cloud system like the Google App Engine so contractors could be

brought in by providing gratis (up to a certain level) cloud computing for development.

- The cloud/encapsulation infrastructure could also be defined in an open way so contractors could stand up their own clouds and do development internally and "open" their cloud to the greater DoD cloud.
- This could also be the mechanism through which the Social Graph (described **Error! Reference source not found.**) could be expanded to include artifacts which are usually behind a walled garden: development documentation, test cases and environments, etc.
- Encapsulation also provides a higher-granularity way of managing multiple-user privileges (by service, active/reserve, US/foreign, government/contractor).

### 3.4.3 Military Application

In an effort to realize the concept of cloud encapsulation in the context of M&S, the US Army Research Laboratory Human Research & Engineering Directorate Simulation & Training Technology Center Advanced Simulation Branch has been researching Executable Architecture Systems Engineering (EASE). This research has included leveraging Virtualization Technologies to provide integration, configuration and execution relief of M&S event planning, instantiation and analysis. This is achieved through a single service that is used to deploy and execute stand-alone applications as well as separate, but cooperative, applications on a dynamic virtual machine-based cloud. This use of virtualization technology shows significant cost savings in reducing the human effort for integration, test and execution by providing a powerful virtual machine environment that combines new and existing applications and their configurations. The effort eliminates the time needed to manually configure and execute these applications on physical hardware once they are captured in the system. Moreover, the user interface exposes the power of disparate M&S while protecting their integrity.

### 3.4.4 References


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### 3.5.1 Everything is a Game

Virtual worlds and games are already used throughout the DoD (America's Army, Army 360, Virtual Iraq) but game design has begun to focus on less of video games as a medium and more as a mechanism to stimulate use. By creating micro-achievements, leaving a game "uncapped" (i.e., the game never ends) and allowing users to measure themselves against each other, designers have found that users, especially those outside of what is considered the usual hard-core gamer demographic, will spend inordinate amounts of time perfecting strategies in a game (Farmville is the example given by Schnell. An earlier example is Tetris, a game that could not be beaten but challenged players to maximize their skills to achieve the highest score before losing.)

Schnell takes this further and says that by building technology into all things from our toothbrush to the bus all aspects of our lives could become like a game: we earn points for brushing our teeth, for books we read, money back from our car insurers for taking the bus to work, etc.

### 3.5.2 M&S Benefits

- While much of the technology and processes described above could get many high quality tools into the hands of users all the way down to the tactical level, it does not guarantee the M&S tools would be used to their full potential. But if the tools were built into a system so that their use would entice the sort of behavior Schnell describes, the full untapped potential of M&S could be realized.
- Such a system could be piggybacked on existing commercial hardware and achievement systems (e.g. the Xbox360 and its achievement system) expanding out the widest possible audience (reserves, contractors).
- Games could be made to crowd sourcing activities (as described **Error! Reference source not found.**) as well as usage data that would be useful for applications that leverage the Social Graph.
- Games have also shown the ability to aid in skill and knowledge retention.

### 3.5.3 Military Application

In January 2011, the US Army Training and Doctrine Command (TRADOC) published the "Army Learning Concept for 2015 (ALC 2015)," describing sweeping changes in the way Soldiers will be trained in the future. Noting that digital age learners are comfortable with technology, ALC 2015, now known as the Army Learning Model (ALM), describes how current and future technology can be leveraged to "make learning content more operationally relevant, engaging, individually tailored, and accessible." The concept moves away from instructor-led training using hundreds of presentation slides to 1) small group, collaborative problem-solving environments; 2) learning tailored to the individual's experience level; and, 3) a blended learning environment, using live, virtual, and constructive simulations and games.

In line with the everything is a game vision, the US Army Research Laboratory Human Research & Engineering Directorate Simulation & Training Technology Center Advanced Simulation Branch and the Army Research Institute are conducting research into the development of advanced technology-enabled training methodologies. They are developing an integrated learning environment and prototype instructional materials, and assessing their effectiveness as tools to develop, deliver, and track training and education. Consistent with ALC 2015 concepts, the Soldier-Centered Army Learning Environment (SCALE) provides a prototype data-driven architecture to support training and education across multiple hardware platforms (personal computer and mobile devices), using mobile applications, virtual classrooms, and virtual worlds. Ultimately, SCALE aims at a more engaging training experience that may cater to this "gamer" crowd.

### 3.5.4 References

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### 3.6 Conclusion

The future of applying technology to military modeling and simulation environments depends on looking to the information technology industry and social adoption of media in order to identify capabilities that may prove useful. This paper has presented a compilation of various technology trends that are developing currently and provided examples of how those trends are being adapted to meet emerging military requirements. In order to stay relevant in providing needed capabilities to our forces the various military M&S communities will need to continuously look to the future and be early adopters of the technologies and processes that support global enterprises.