



Problem statement: How can NPS utilize TENA and JMETC?

CPT Justin Frank and Capt. Joshua Keeven

08 September 2021

Naval Postgraduate School Mission: The Naval Postgraduate School provides defense-focused graduate education, including classified studies and interdisciplinary research, to advance the operational effectiveness, technological leadership, and warfighting advantage of the Naval service.

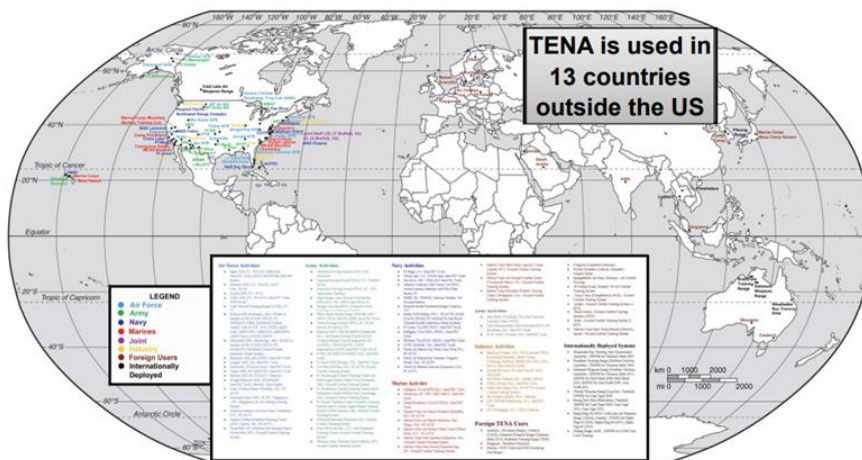
MOVES Mission: Enhance the operational effectiveness of joint and coalition forces by providing superior education and research in the field of modeling and simulation

What is Test and Training Enabling Architecture (TENA)? The purpose of TENA is to provide the necessary enterprise-wide architecture and the common software infrastructure to: Enable interoperability among range, C4ISR, and simulation systems used across ranges, HWIL facilities, and development laboratories. Leverage range infrastructure investments across the DoD worldwide to keep pace with test and training range requirements supporting the warfighter. Foster reuse of range assets and reduce the cost of future developments.



Distribution Statement A: Approved for public release. Distribution is unlimited.

Worldwide Use of TENA



One of the best qualities of TENA is that all its software and support is free to users and is the most capable and sophisticated interoperability solution. TENA claims high reliability and frequent testing to ensure a quality product. TENA uses Auto-Code

Generation in its middleware to provide straightforward application and automation of making various kinds of software interoperable. TENA comes with the TIDE Tool that manages installation and configuration, upgrading, and maintenance. TENA can catch errors at compile time rather than at run time, ensuring that issues are caught early in the development process.



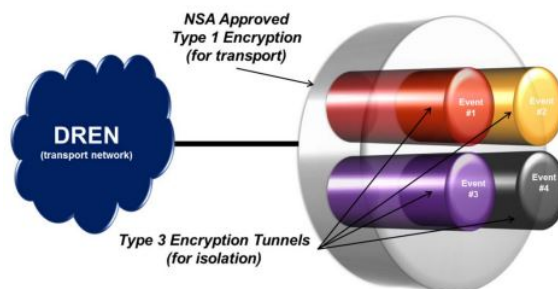
Auto-coded interface software can be standard TENA Object Models that the community has designed and agreed upon or designed for unique user requirements. TENA Object Models are auto-code generated software interfaces that include data formats, data definitions, and standard algorithms. This is how TENA can connect multiple software packages with different protocols. TENA already has a library of developed traditional Object Models: 1 Time, TSPI, Coordinate Systems (including conversions), GPS, Radar, Telemetry, Event Control, Video Distribution, Weather. This means that developers already have working examples to reference when creating their standard Object Models specific to the interoperability function they are trying to facilitate.

What is the Defense Research Engineering Network (DREN) and (SDREN)?

DREN III is currently underway of implementation. DREN's mission: to provide robust, high-capacity, low-latency connectivity between the HPCMP DoD Supercomputing Resource Centers (DSRCs) and user sites. DREN III also supports DOD scientific research and development. In addition, it supports test and evaluation missions. DREN III provides secure data transfer with NIPRNET, and academic research networks within the continental United States and Hawaii. SDREN is a virtual private network overlay of the DREN using service Delivery Routers and NSA Type 1 encrypted with a common key. SDREN is not synonymous with classified communications across the DREN backbone using keys other than the common SDREN key.

What is Joint Mission Environment Test Capability JMETC? The JMETC mission is to provide a persistent capability for linking distributed facilities, enabling DoD customers to develop and test warfighting capabilities in a Joint Context. JMETC provides a test infrastructure consisting of the components necessary to conduct Joint distributed test events by cost-effectively integrating live, virtual, and constructive (LVC) test resources that are configured to support the users' needs. Additionally, the JMETC program provides its warfighters with a support team to assist with JMETC products and distributes testing. The JMETC MILS Network (JMN) provides secure distributed testbeds to support unconstrained cyber activities and user access to enterprise resources across multiple classifications.

JMN employs Multiple Independent Levels of Security (MILS) using the Defense Research Engineering network (DREN) backbone, which allows for data segregation by stream by protocol, system, event CIO. It can also support multiple events at multiple classifications concurrently and can create isolated Sandboxes.



Defense Intelligence Agency (DIA) has accreted the JMETC to operate from Unclassified to Top Secret with Special Compartmental Information (TS//SCI). It also includes National Security Agency (NSA) Red Team assessment.



What does NPS currently use? Distributed Interactive Simulation (DIS). DIS is designed to be used peer to peer without the need for a server. It sends a series of formats for packets oriented for military simulation use based on the precision of the PDUs that are commonly used to communicate precise positional data. DIS uses the IEEE standard that individuals developed to create a common language for sending PDUs

What should NPS change to utilize TENA best? First, TENA's ease of use and automated development tools make it more favorable compared to DIS. DIS relies on



users to follow the IEEE standard, which could change periodically without enforcing the changes across all systems using DIS. TENA's automatic updates ensure that all users use the same standard and maintain interoperability as new versions and updates come out. Second, NPS research countless topics that are not necessarily military simulations. DIS has a strong focus on military simulations, where TENA allows developers to create standard object models that may be more appropriate for other academic research applications. Finally, DIS is designed for peer-to-peer, while TENA is designed for interoperability anywhere in the world. Although web-based server reliance can create its own list of issues, TENA provides a much more flexible and user-friendly solution to facilitate interoperability.

What are the benefits that NPS could achieve from using TENA? First, NPS research and thesis projects could be used with the rest of the DOD that also uses TENA by using a common architecture. A student and the organization they are supporting with thesis research could work together simultaneously over the TENA network. TENA has many tools that allow resources located far from each other to be integrated promptly, which would be especially important for military LVC simulations. TENA can filter out classified information and segregate it.

Specific example: NPS does frequent robotic tests at Camp Roberts, which is 2 hours away from the campus, and at NPS SLAMR located on Del Monte beach. NPS should be conducting a simulated test before physical tests. If NPS used the TENA software on an unclassified JMETC network, then NPS could become a JMETC test range that would support NPS NEXT's intent. Also, if NPS could get access to the secret JMETC network, NPS would conduct meaningful research on all data collected from DOD robotic experiments. With TENA being free and open source, the implementation of this scenario has a very high payoff to effort ratio. To support the mission of NPS NEXT, strengthen our joint military aspirations, increase our impact, and enhance our competitiveness, we recommend that NPS. Connect the NPS SIPRNET to SDREN and JMETC and align the virtual networks for field experimentation with JMETC requirements for CUI/UNCLAS and seek certification. Additionally, mainstream long-term NPS capability by exposing students and faculty to LVC robotic experiments and test ranges.

There are countless opportunities across the military services to create interoperability between networked simulations for both academic and military purposes. By implementing TENA and JMETC capabilities at NPS, we become a more integrated part of DoD research and expose service members to its capabilities when they move on to their follow-on billets.

References

- Brutzman, D. P. (n.d.). *Savage / networkedgraphicsmv3500*. TENA and JMETC References. GitLab. Retrieved September 10, 2021, from https://gitlab.nps.edu/Savage/NetworkedGraphicsMV3500/-/blob/master/presentations/10_TENA_References.md
- JMETC Enables Distributed Testing*. <https://www.tena-sda.org/>. (n.d.). Retrieved September 9, 2021, from <https://www.tena-sda.org/attachments/JMETC-OverviewFS-2020-03-16-DistA.pdf>.
- Joint Mission Environment Test Capability (JMETC) Program Overview*. <https://www.trmc.osd.mil>. (n.d.). Retrieved September 9, 2021, from <https://www.trmc.osd.mil/attachments/JMETC-OverviewBrief-2019-06-05-DistA.pdf>.
- Joint mission environment test capability*. JMETC introduction. (n.d.). Retrieved September 10, 2021, from <https://www.trmc.osd.mil/jmetc-home.html>.
- Powell, D. E. T. (n.d.). ITSEC 2017. In *TENA/JMETC: Live-Virtual-Constructive Integration for Test and Training* (pp. 1–56). Orlando, Florida.
- TENA is Establishing the Foundation for DoD Range Systems Interoperability*. (n.d.). <https://www.tena-sda.org/attachments/TENA-OverviewFS-2020-03-16-DistA.pdf>.
- Test and Training Enabling Architecture (TENA) and the Joint Mission Environment Test Capability (JMETC)*. (n.d.). <https://www.trmc.osd.mil/attachments/TENA-JMETC-ITEA-Tutorial-2016-05-DistA.pdf>.
- Test and training enabling architecture*. TENA introduction. (n.d.). Retrieved September 8, 2021, from <https://www.tena-sda.org/>.
- Test and Training Enabling Architecture (TENA) Overview*. <https://www.tena-sda.org/>. (n.d.). Retrieved September 9, 2021, from <https://www.tena-sda.org/attachments/TENA-OverviewBrief-2019-10-15-DistA.pdf>.
- Test resource Management Center*. TRMC introduction. (n.d.). Retrieved September 10, 2021, from <https://www.trmc.osd.mil/>.
- User. (n.d.). *Defense Research Engineering Network (DREN)/Secret Defense Research Engineering Network (SDREN) Network capabilities and Technical Overview*. HPC. Retrieved September 10, 2021, from <https://www.hpc.mil/program-areas/networking-overview/dren-sdren>.
- Wikimedia Foundation. (2021, January 15). *Test and training enabling architecture*. Wikipedia. Retrieved September 9, 2021, from https://en.wikipedia.org/wiki/Test_and_Training_Enabling_Architecture.