



NATIONAL INFORMATION EXCHANGE MODEL

Annual Report

2021





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Executive Summary

This annual report provides a summary and highlights of the National Information Exchange Model (NIEM) Community, including representations from the Executive Steering Council (ESC), NIEM Management Office (NMO), NIEM Business Architecture Committee (NBAC), NIEM Technical Architecture Committee (NTAC), NIEM Domains, and at large membership.

The NBAC and NTAC continue to be very active committees with effective tiger teams and good representation across the community. During 2021, the NIEM Program updated and published minor release NIEM 5.1.

The NTAC and NBAC both conducted Annual Meetings this year. The NTAC was fortunate to hold a live Face-to-Face in August at the Georgia Tech Research Institute facility in Rosslyn, VA. The NTAC scoped their 2022 efforts which include: Common Model Format and Tool prototyping, Guidance for NIEM Message Specifications and NIEM 6 Architecture improvements. COVID constraints in September required the NBAC to hold its meetings virtually. Feedback from both leadership and the community suggest this year's events were resounding success stories. Donna Roy provided the keynote for the NBAC series including contributions from Ms. Katherine Escobar (NIEM Managing Director,) Ms. Carol Geyer (OASIS), Ms. Maria Cardiellos (IJIS), Mr. Ted Okada (FEMA), Ms. Stacy Wright (Cybercrime Support Network), Mr. Michel Savoie (ESDC), Poewan Lau (Canada Department of National Defense) and NBAC Co-Chairs Mr. Kamran Atri and Mr. Thomas Krul.

The NBAC was instrumental in the establishment of 2 new domains: Learning & Development (L&D) and International Human Services (IHS). IHS Domain represents the first NIEM Domain under stewardship of an international partner – the Interoperability Solution Division within Employment and Social Development Canada. Efforts to offer NIEM in the French and Spanish languages continue to be explored.

The NTAC released the JavaScript Object Notation (JSON) Specifications v5.0 in May 2021. The NTAC continues to mature the NIEM Metamodel with a fully mature version predicted for Release 6.0. The NTAC is introducing an alternative, technology-neutral model representation known as the Common Model Format (CMF). Data models for the NIEM Core, domains, and message specifications can be converted between XML Schema and CMF as needed, and developers can generate the technology-specific artifacts they require from CMF.

The State, Local, Tribal, and Territorial (SLTT) Tiger Team continues to conduct outreach beyond our Federal partners. SLTT has promoted NIEM at major engagements with the State of New Mexico Child Services, SEARCH, IJIS, NLETS among others.

In 2021 the NIEM.gov Website Content Management System (CMS) Drupal 8 was migrated to Drupal 9, providing improved website performance, security, ease of development, and improved user experience. The website incorporates open source user interface (UI) components and adheres to U.S. Federal government websites visual style guidance and community best practices.

In the Fall of 2021, NIEM embarked on a major effort to revitalize NIEM Technical Training. The fruits of that labor culminated in a pilot course in September 21. Community participation in the pilot and subsequent November offering have exceeded expectations and 2022 class quotas are routinely sold out.



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Looking to the future, the NIEM Executive Steering Council endorsed the NIEM Management Office proposal to embark on making NIEM an OASIS Open Project Standard. This new direction sets NIEM on a sustainable path for the future. The bonafides conferred will strengthen NIEMs footprint across the International and Federal landscape as well as opening up NIEM governance and operations to greater state, local, tribal and territorial participation and influence.

2022 should be an exciting time for NIEM as we continue to advance the NIEM model technically and showcase NIEM on the precipice of becoming an accredited Open Standard.

Introduction

The goal of this report is to review National Information Exchange Model (NIEM) 2021 activities and accomplishments, report on NIEM Management Office (NMO), NIEM Technical Architecture Committee (NTAC), and the NIEM Business Architecture Committee (NBAC) 2021 initiatives as well as 2022 Workplans, and outline Executive Steering Council (ESC) deliberations and decisions that shape the way ahead for a sustainable NIEM in the future.

COVID-19 remained a disruptor in 2021 and is likely to impede a return to normal activities well into 2022. Interruption of travel and reliance on virtual meetings and communications to maintain routine operations remains the norm. The reprogramming of travel dollars in 2021 to accommodate virtual collaboration persists with many federal departments seeing 2022 travel funding at a third of pre-COVID levels. NTAC was fortunate to hold its Annual Meeting in August at Georgia Tech Research Institute's (GTRI) Rosslyn, VA facility. However, the NBAC and ESC plans for similar GTRI venues in September reverted to all virtual events as the COVID case load in Virginia increased in early Autumn 2021.

Despite these challenges, NIEM was able to:

- Complete Minor Release 5.1
- Onboard two new domains (Learning & Development Domain and International Human Services Domain)
- Researched Standards Organizations such as National Institute of Standards and Technology (NIST), Object Management Group (OMG), Organization for the Advancement of Structured Information Standards (OASIS) among others and conducted analysis of alternatives to develop possible Courses of Action (COAs) for achieving NIEM as an Open Standard
- Demonstrate a restricted repository capability to the NMO
- Demonstrate the Information Exchange Package Documentation (IEPD) Lifecycle tool to the NMO (ESC demo anticipated Feb 2022)
- Develop new NIEM technical training offerings and present preliminary courseware to target audiences in October and November 2021 and monthly in 2022
- Migrate NIEM.gov to the Drupal 8 Content Management System (CMS), and
- Gain ESC consensus and chart the path of NIEM in terms of governance and transition to an OASIS Open Project Standard putting NIEM on stable footing for the future.

In addition, NIEM has significantly embraced communities beyond our Federal partners. The NIEM State, Local, Tribal and Territorial Tiger Team, co-chaired by Paul Wormeli and Mike Phillips, continues to enjoy success in conducting outreach to these often less served communities. On the opposite side of the spectrum, NIEM continues to encourage greater international participation. Near term plans include approaching Columbia's Chief Information Officer (CIO) as well as counterparts in the United States and Canada to explore areas of cooperation. Each country has formerly established NIEM exchanges, and both Mexico and Canada initiatives are expected to advance and grow as evidenced by the recent stand-up of the NIEM International Human Services Domain under Canadian stewardship. Canada is looking to enhance and elaborate on NIEM exchanges in partnership with Mexico, and we are working toward making NIEM more approachable globally to non-English speaking communities by offering NIEM in French and possibly Spanish as first steps. While due diligence in advancing internationalization continues, NIEM is clearly headed on a path toward internationalization.

Arguably, the linchpin to NIEM's near term continuity and long term success was the ESC's September decision to maintain DoD's ESC leadership role and resourcing as NIEM makes a transition to an OASIS



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Open Project Standard anticipated FY 2024. A NIEM OASIS Transition Tiger Team was established and the OASIS-NIEM Kickoff meeting conducted in November 2021.

This report is both a comprehensive look back at 2021 and a forecast of NIEM in 2022 and beyond.

NMO Executive Director's Perspective



Stuart Whitehead, SES

As the keynote speaker for the 3rd Quarter Executive Steering Council meeting held the 21st of September 2021, Mr. Stuart Whitehead (Deputy Director, Cyber & Command, Control, Communications & Computer Integration, Joint Staff J6, United States Department of Defense & Executive Director – NMO) acknowledged the importance of the overarching goal of improved “Interoperability as a Nation”. He observed that technology continues to make our world smaller and accelerates change. He asserts that data, machine-to-machine interoperability, and our focus on emerging technologies -artificial intelligence, cloud computing, and multi-dimensional data- is at the heart of keeping pace with these tectonic technologies driven changes.

Grounding his discussion in a contemporary example - the recent exit from Afghanistan and accommodating the arrival of Afghan guests to the United States - Mr. Whitehead points to the challenges experienced during current operations:

- Working through interoperability issues between interagency partners
- Thinking through how the interagency manages the data
- Understanding whether or not the data is accurate, and then, more importantly,
- How we use that data to affect.

Thinking through these most recent experiences, we have come to appreciate that it is even harder than expected which implies we are going to need to apply greater due diligence with things like information exchange standards, accessibility to data, and understanding who has access. These are foundational, before exploring the issues associated with emerging technology.

Looking back on 2021, how do we make the model more attractive to international, non-native English speakers; and, how do we make sure the work we have been doing on NIEM remains relevant and is represented in a new and modern way? Not diminishing the challenges, the work of 2021 put NIEM on a solid footing for the future:

- Exploring NIEM becoming a standard
- Progress toward internationalization
- The concept and advancement of the NIEM Metamodel
- Release 5.1
- NIEM content maturation, and
- New NIEM adopters.



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Next Mr. Whitehead offered his thoughts about positioning NIEM for a sustainable future. He encouraged continued exploration, discussion, and potential transition of NIEM to become a standard. He embraced encouraging international partnership, leadership, and orientation and expanding language outreach to support information exchange globally. He acknowledged the importance that with the release of 6.0, the Metamodel should be at full maturity and that the full content of NIEM can be represented in any particular way as the technology itself changes.

NMO Managing Directors Perspective

NIEM's Managing Director is Mrs. Katherine Escobar (Deputy Division Chief, Data and Standards Division, Cyber and Command, Control, Communications and Computers Integration (DD C5I), Joint Staff J6 and NMO's Managing Director). In her presentation to the NBAC Annual Meeting on 18 September, titled *NIEM 2022 Priority Planning*, and briefing to the 3rd Quarter Executive Steering Council and NIEM Plenary meetings on 21 September, Mrs. Escobar provided a summary of NIEM's 2021 activities and achievements, an assessment of the merits of NIEM pursuing transition to an OASIS Open Project Standard, and her perspective concerning what's on the horizon for NIEM in 2022.

Mrs. Escobar stated, "NMO's priority remains to promote NIEM's adoption and growth while putting NIEM on a path to a sustainable future by transitioning NIEM to an OASIS Open Project Standard". Supportive of these goals are a renewed focus on state, local, tribal, and territorial communities' interests, ongoing initiatives to develop, mature and implement the NIEM Metamodel, Initial Operational Capability (IOC) of Registry and Repositories to assist in schema re-use, and by improving existing tools to make implementation of NIEM more user friendly.

2021 saw the onboarding of two new domains - Learning & Development Domain and International Human Services Domain - as well as continued engagement with the Veterans Administration, Defense Manpower Data Center (DMDC), Department of Treasury Data Act Information Schema (DAIMS), U.S. Census Bureau (USCB), Department of State (DOS), General Services Administration (GSA), and Environmental Protection Agency (EPA) among others.

A central focus of our lead developer, GTRI, and NTAC team are decoupling Extensible Markup Language (XML) from NIEM. The first realization of this was launched with the implementation of a metamodel in NIEM 5.0 and is expected to mature over the course of 5.1, 5.2, and ultimately 6.0 releases. The NIEM metamodel is intended to increase NIEM's flexibility, and will allow the development of NIEM conformant message specifications beyond the XML data format. NIEM JavaScript Object Notation's (JSON's) Specifications v5.0, released in May 2021 (<https://niem.github.io/reference/specifications/json/>), established a technical basis for using JSON as a data format. NIEM's TechHub provides the developer community with resources and training. Technical repositories are simplified for ease of navigation and use. The landing page for NIEM Specifications is located at: <https://niem.github.io/reference/specifications/>.

Mrs. Escobar noted, as we move toward NIEM model maturity and improving overall business practices, the goal of instantiating NIEM as a formal standard is on target for standup within the next two years. Along with NIEM becoming a standard, we continue to make progress on our path toward internationalization welcoming our first international Steward - Employment and Social Development



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Canada (ESDC)/ Human Resources and Skills Development Canada (HRSDC) - International Human Services (HIS) Domain (Canada).

NBAC Co-Chair's Perspective

Highlights of 2021 include penetration into the Canadian market and the use of virtual systems to engage domains and users providing advice, training, and assistance. The NBAC has collaborated with Mr. Dave Gajadhar (Resultant Group) to establish a Western Canada Tiger Team focusing its objectives on commercial and private sectors at the Canadian province, territory and local community levels similar to SLTT. Overtures were made to Canada Tax Revenue showcasing the benefits of NIEM. NBAC Tiger Teams have been busy with the State, Local, Tribal, Territorial (SLTT) Tiger Team making the most progress of all teams. NBAC continues to advocate for renderings in additional languages, actively pursuing French and Spanish. In addition to encouraging the formation of new domains (IHS and Learning & Development), NBAC continues to work with the Veterans Administration (VA) and Defense Manpower Data Center (DMDC) to establish pilot projects and add model content.

NBAC continues to mature the model with over 1100 code types and 92,000 individual codes. For 2022 the NBAC will continue to rely on the action tracker, leverage the Tiger Teams, work to make NIEM a standard, offer training and provide domain help. Focus areas include incorporating NIEM into contract acquisition, maturing the model, onboarding new domains including the International Human Services Domain and the Learning & Development Domain, and positioning NIEM for transition to the OASIS Open Project Standard.

NTAC Co-Chair's Perspective

The key themes for the NTAC continue to be technology independence and architecture simplification. In 2021 the NTAC developed the technology-neutral Common Model Format, together with the underlying NIEM metamodel, plus software prototypes to support modelers and developers. This is the cornerstone of the NTAC's plan to support many data formats (especially JSON), ontology formalisms (especially World Wide Web Consortium (W3C)¹ Web Ontology Language (OWL))², and modeling languages (especially Unified Markup Language (UML))³. We also continued our efforts to remove unnecessary complexity from NIEM message specifications. Our goal is to make simple things easy and complex things possible, while expanding the scope of NIEM far beyond its original XML foundation.

Way Ahead – Transition to OASIS

Over the last 18 months the NIEM Management Office (NMO) supported by NBAC and NTAC Co-Chairs (Dr. Scott Renner (NTAC), Mr. Mike Hulme (NTAC), Mr. Kamran Atri (NBAC) and Mr. Thomas Krul (NBAC)) and NIEM community partners critically assessed the prospect of NIEM's long term

¹ <https://www.w3.org>

² <https://www.w3.org/OWL/>

³ <https://www.w3.org/wiki/UML>



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sustainability and health. Part of that analysis looked at the advantages and challenges of NIEM becoming an OASIS Open Project Standard and the impact on NIEM of any transition in terms of governance, operations, and resources. The first step in this process was a survey and assessment of the existing NIEM ecosystem.

NMO quickly identified a spectrum of implications associated with NIEM not formally aligned as an accredited standard. At the federal level, the National Technology and Transfer Advancement Act (NTTAA) of 1995⁴ and OMB Circular A-119⁵, Federal Participation in Development and Use of Voluntary Standards and Conformity Assessment Activities promotes coordination between federal, state, and local agencies to adopt voluntary consensus standards and avoid government unique standards. Evidence suggest that NIEM's past avoidance of becoming an accredited open standard:

- Slows government acceptance and adoption of NIEM
 - Government hesitancy to participate in NIEM governance without accreditation *bonafides*
 - Acquisition preference for standards
- Reduces industry interest and enthusiasm, and
 - Perceived as a government only/controlled activity
 - Lacks the agility to keep pace with innovation and technology advances
- Interjects ambiguity in Executive Agency commitment in terms of sponsorship and governance, and introduces funding uncertainties.

Alternatively, pursuing NIEM as an open standard appears to ameliorate many of these issues (Table 1).

Reasons for NIEM as an Open Standard
1. Aligns with NTTAA and OMB A-119
2. Congruent with the National Institute of Standards and Technology (NIST), the government cited assessment body for compliance of systems ⁶
3. Government and industry favor formal standards
4. Inherent interoperability due to rigor in vetting standards
5. Increases awareness of NIEM to larger audience
6. NIEM already meets many of the criteria for becoming a standard
7. Increases visibility and use by open source tool developers
8. Codifies sponsorship and governance expectations and rules

Table 1: Open Standard Benefits

⁴ [National Technology Transfer and Advancement Act of 1995 | NIST](#)

⁵ [Microsoft Word - Revised Circular A-119 as of 1.22.2016 for posting \(nist.gov\)](#)

⁶ [NIST's portfolio of services for measurements, standards, and legal metrology provide solutions that ensure measurement traceability, enable quality assurance, and harmonize documentary standards and regulatory practices. National Institute of Standards and Technology | NIST](#)



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Along with identifying the positives of becoming a standard, due diligence included considerations that focused pragmatically on the impact and tradeoffs on organizational culture, model transition and sustainment, transition costs, changes in governance and existing span of control, processes, effect on existing domains/ stewardship prerogatives, and internal resistance to change. The result of this effort was a decision by the NMO to include NIEM becoming an accredited standard as an option for the NIEM ESC in its overall deliberations concerning governance and funding for FY 2022 and beyond. NMO found a variety of ways to bring NIEM to Open Standards compliance. Options included joining the American National Standards Institute (ANSI)⁷, the Organization for the Advancement of Structures Information Standards (OASIS), the National Institute of Standards and Technology (NIST), and the Object Management Group (OMG)⁸. Research concluded that including NIEM as the overarching project in any of these organizations was the logical option and would include the data model and a collection of specifications.

During the 2021 NIEM Annual Meeting Executive Session on September 21, 2021 NMO presented a series of options and recommendations for the ESC to consider:

- Should NIEM Management Office Pursue NIEM Becoming a Formal Standard?
- Review of NIEM as a Standard Options
- Recommendation to Establish NIEM as an Open Project Standard through OASIS⁹.

The September 21, 2021 executive discussion on the merits of becoming a standard, resulted in ESC consensus to pursue a course of action leading to NIEM as a formal accredited standard. In anticipation, NMO researched pathways to achieve NIEM attaining standard status (Table 2). Of note, the American National Standards Institute (ANSI) oversees standards and conformity assessment activities in the United States and requires submissions by an ANSI/NIST Accredited Standards Developer (ASD). Potential options span establishing NIEM as an ASD to simply self-declaring.

NIEM as a Standard Options
1. Appeal to an existing ASD to submit NIEM as an ANSI Standard <ul style="list-style-type: none">a. Organization for the Advancement of Structured Information Standards (OASIS)b. National Institute of Standards and Technology (NIST)c. Object Management Group (OMG)
2. Establish NIEM as an ASD
3. Coordinate with Stakeholder organization to become an ASD
4. Do nothing – self declare

Table 2: NIEM as a Standard, Options

⁷ [American National Standards Institute - ANSI Home](#)

⁸ Object Management Group - (OMG®) is an international, open membership, not-for-profit technology standards consortium. [OMG | Object Management Group](#)

⁹ [Open Projects Program - OASIS Open \(oasis-open.org\)](#)



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Before assessing alternatives for implementation, a common high-level understanding of the concept of NIEM as a standard is useful. Although each potential instantiation is unique, the proposed NIEM standard includes the harmonized data model and a collection of specifications that work together to support what is collectively understood as NIEM:

- NIEM JSON Specification v5.0
- NIEM Conformance Specification v5.0
- NIEM Data Model/ NIEM Release v5.0
- NIEM Information Exchange Package Documentation Specification v5.0
- NIEM Code List Specification v4.0
- NIEM Naming and Design Rules v5.0
- NIEM Conformance Targets Attribute Specification v3.0.

Additionally, organizational structure, governance, rules, processes, documentation and resourcing would not necessarily align with the chartering party's requirements.

The process of due diligence led by NMO spanned approximately 18 months. Considerations included maturity and experience of potential standard organization or facilitating body, retention of NMO management, transition time, cost sharing as well as congruence with NIEM Community culture, values and norms. A snapshot of key discriminators for Standard Model options as presented to the September 21, 2021 ESC (Table 3) include:

Standard Model Options					
Organization	Experience	Retain NMO Management	Estimated Time	Standard Free to Public	Domains Participate Free
NIST	✓	X	12-18 Months	X	X
OMG	✓	X	12-18 Months	X	X
OASIS	✓	✓	12-18 Months	✓	✓
NIEM Management Office as ASD	X	✓	36-48 months	✓	✓
GTRI ¹⁰ as ASD	✓	?	36-48 months	?	?

¹⁰ Georgia Tech Research Institute (GTRI) – exigent NIEM Lead Developer. [Home](#) | [GTRI \(gatech.edu\)](#)

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Stewards of Change¹¹ as ASD	X	?	36-48 months	?	✓
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Table 3: Standard Model Options Assessment

The NMO in collaboration with the NBAC and NTAC recommended the ESC endorse establishing NIEM as an Open Standard through OASIS with a 12 to 24-month timeline to standard ratification. A deep dive of advantages and “others” associated with aligning with OASIS as ASD includes (Table 4):

OASIS as the ASD		
Advantages		Others
Established/ Experiences ASD	Submitter maintains patent protection and intellectual property	Must comply with OASIS Procedures
Formalized Processes and procedures	Free public access to all deliverables in perpetuity	NIEM Management Office Cost is \$25K (funding applied to cost of project)
Support for the development of open source code and /or related materials and prose specifications	Extensible collection of project collaboration tools	Other organizations can vote on you standard
Formal approval of appropriate content as OASIS Standards	Publicity and promotional activities including press releases, webinars and social media	
Path to International Standard	Shared set cost structure	

Table 4: Benefits of Adopting OASIS as ASD

A depiction of the transition of NIEM governance compliant with the OASIS Open Project Standard and transition timeline is found in Appendix B.

Accomplishments

NBAC

The NIEM Business Architecture Committee (NBAC) is responsible for identifying and shepherding NIEM requirements both business and technical, promoting NIEM growth and adoption, supporting and

¹¹ Stewards of Change Institute - [Stewards of Change Institute](https://www.stewardsofchangeinstitute.org/)



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mentoring Domains and managing the overall business processes of NIEM. The NBAC is led by co-chairs Kamran Atri and Thomas Krul.

Highlights from 2021

- **New Domains:** The NBAC in collaboration with the NMO worked with Advanced Distributive Learning (ADL) and Employment and Social Development Canada (ESDC)/ Department of Human Resources and Skills Development Canada (HRSDC) to onboard Learning & Development Domain and International Human Services Domain. In addition to the administrative requirements for stewardship, NBAC Co-Chairs and NMO worked closely with each domain to identify its first list of attributes which were incorporated into the NIEM model. Additionally, NBAC collaborated with the Veterans Administration (VA) to develop a NIEM Exchange prototype as proof of concept in support of VA's NIEM feasibility study.
- **NIEM Minor Release 5.1:** The NBAC assisted Lead Developer/GTRI with development and vetting of 2021 NIEM minor release 5.1.
- **NBAC Annual Meeting, September 2021:** The NBAC organized, facilitated, and hosted a three-day virtual Annual Meeting this September. Major themes included: NIEM Adoption, NIEM Growth & Outreach, NIEM Stewardship, Importance of Training, NIEM Road to Success, and NIEM Sharing and Collaboration. These sessions were highlighted by guest speakers: Ms. Donna Roy (Strategic Advisor, National security Sector/Greenhouse), Maria Cardiellois (IJIS), Mr. Ted Okada (FEMA), Mr. Mitchel Savoie and Tsegenet Tedla (ESDC/HRSDC), Ms. Stacy Wright (Cybercrimes Support Network), Ms. Carol Geyer & Mr. Chet Ensign (OASIS) and Powan Lau (Canada Department of National Defense). During this event, the building blocks supporting the 2022 Workplan were discussed and the role of NBAC in the evolving NIEM OASIS Open Project Standard.
- **Mentorship:** The NBAC rolled out guidelines for a new mentorship program. This voluntary program seeks to provide support to new domains as they join NIEM as well as introducing “best practices” to the broader NIEM Community.
- **Tiger Teams:** The NBAC remained a strong advocate of the SLTT Tiger Team, promoting participation and hosting discussion during NBAC Monthly Meetings. NBAC Tiger Teams represent the NBAC's outreach in areas of traditionally under represented communities/ (SLTT), Internationalization/ (ITT), and Emerging Technologies/ (ETTT). Recent activities include exploration of establishing a Tiger Team focused on expanding NIEM's footprint in Canada.

NTAC

The NIEM Technical Architecture Committee (NTAC) is responsible for the specifications and tool strategy that comprise NIEM's technical architecture. The NTAC is led by Co-Chairs Mike Hulme (state/local) and Scott Renner (federal).

Highlights from 2021



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- **Common Model Format:** NIEM uses Extensible Markup language (XML) Schema as the representation for data models. This works well for XML messages, but is inconvenient for developers working with other data formats (JSON, etc.) The NTAC is introducing an alternative, technology-neutral model representation known as the Common Model Format (CMF). Data models for the NIEM Core, domains, and message specifications can be converted between XML Schema and CMF as needed, and developers can generate the technology-specific artifacts they require from CMF. Progress on CMF in 2021 includes:
 - A simplified, second version of CMF and the underlying metamodel
 - A terminology document providing an introduction to NIEM data modeling with CMF, The NIEM Metamodel and Common Model Format
 - A draft NIEM CMF Primer describing the rationale for CMF and the design choices made during CMF development
- **Tool Prototyping:** NTAC members have contributed a free, open-source prototype tool which converts NIEM-conforming XML Schema into CMF, and vice versa. Work has begun on tools to extract CMF from Unified Modeling Language (UML) models, and to convert CMF into ontology formalisms (RDFS¹²+OWL¹³).
- **Simplified Message Specifications:** Every NIEM-based information exchange has a specification, presently known as an Information Exchange Package Documentation (IEPD), that defines the mandatory and optional content of the message format and provides the meaning of that content. The NTAC is working to simplify the content of these message specifications by applying the modern software approach of "convention over configuration". An explanatory Guide to Message Specifications is in progress.
- **Technical Specification Updates:** Several specifications were revised as part of the NIEM 5.0 major release:
 - IEPD 5.0: A much-simplified version, derived from the Model Package Documentation (MPD) 3.0 specification, retaining only the content related to IEPDs
 - Conformance 5.0: A rewrite of the document providing general conformance guidance, principles, and rules for NIEM
- **NIEM JSON Specification v5.0:** Establishes conformance criteria for NIEM JSON messages
- **High-Level Version Architecture:** Removed as a separate specification, with its content distributed into web pages
- **CMF to simplified XML Schema Definition (XSD):** An XML schema that is not used as a model representation can be greatly simplified and optimized for other purposes: XML binding (e.g.

¹² <https://www.w3.org/2001/sw/wiki/RDFS>

¹³ <https://www.w3.org/OWL/>



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JAXB¹⁴), EXI serialization¹⁵, validation within a cross-domain solution (i.e. a security domain guard), etc.

- **Simplified Message Specifications:** Complete the Guide to Message Specifications; define rules and conventions for NIEM message specifications (if needed).
- **Migration to OASIS:** The NTAC will contribute to the development of the OASIS charter and committee procedures. Existing specification documents may require format change. The existing toolset for generating specification documentation may require change or replacement.

Best of NIEM

2021 marks the tenth anniversary of the Best of NIEM awards. This year NIEM sought out projects which highlighted community accomplishments emphasizing contributions in the areas of creating NIEM exchanges, expanding NIEM model content and new adopters of NIEM. It is noteworthy that this years' winners achieved success in spite of the constraint of virtual teaming arrangements imposed by COVID protocols. Four nominees were presented Best of NIEM 2021 awards at this years' NIEM Annual Plenary Session held in September. These organizations exemplify excellence and their contributions to NIEM will serve the long-term interest of their stakeholders well into the future.



BEST OF NIEM 2021 WINNERS

¹⁴ The Java™ Architecture for XML Binding (JAXB) provides an API and tools that automate the mapping between XML documents and Java objects.

The JAXB framework enables developers to perform the following operations:

- Unmarshal XML content into a Java representation
- Access and update the Java representation
- Marshal the Java representation of the XML content into XML content

JAXB gives Java developers an efficient and standard way of mapping between XML and Java code. Java developers using JAXB are more productive because they can write less code themselves and do not have to be experts in XML. JAXB makes it easier for developers to extend their applications with XML and Web Services technologies.

¹⁵ [Efficient Extensible Interchange Working Group Public Page \(w3.org\)](http://Efficient%20Extensible%20Interchange%20Working%20Group%20Public%20Page%20(w3.org))



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Government of Canada **Contribution to the NIEM Community**

**Employment and Social Development Canada
(ESDC)
Interoperability Solution Division (ISD)
Innovation, Information and Technology Branch
(IITB)**

National Electronic Interstate Compact Enterprise (NEICE) **Best Implementation of NIEM**

**Association of Administrators of the Interstate
Compact on the Placement of Children (AAICPC)
and the American Public Human Services
Association (APHSA)**

U.S. Department of Homeland Security **Exceptional Domain Stewardship**

Office of Biometric Identity Management (OBIM)

U.S. Department of Homeland Security **Improving the NIEM Model**

Cybersecurity and Infrastructure Agency (CISA)

Figure 1: Best of NIEM

NIEM and NATO

The NIEM community has been engaging NATO on potential adoption of NIEM for several years under the moniker of NATO Core Data Framework (NCDF). The three primary accomplishments during 2021 include:

- The demonstration of an NCDF data lake during the Coalition Warrior Interoperability Exercise (CWIX) 2021 in June;
- The entry of the draft NCDF Standardization Agreement (STANAG) into the NATO STANAG ratification process; and
- The drafting of a Service Instruction for Cross Community of Interest (X-COI) Information Sharing for the Federated Mission Networking (FMN) Spiral 5 Specification.

By leveraging NCDF, NATO will be able to institutionalize the use of data lakes—aggregating data from various nations/systems, tagging it for future use, and making it available through a common interface to support improved decision-making. A prototype data lake was developed and demonstrated at CWIX 2021 as depicted in the diagram below (Figure 2).

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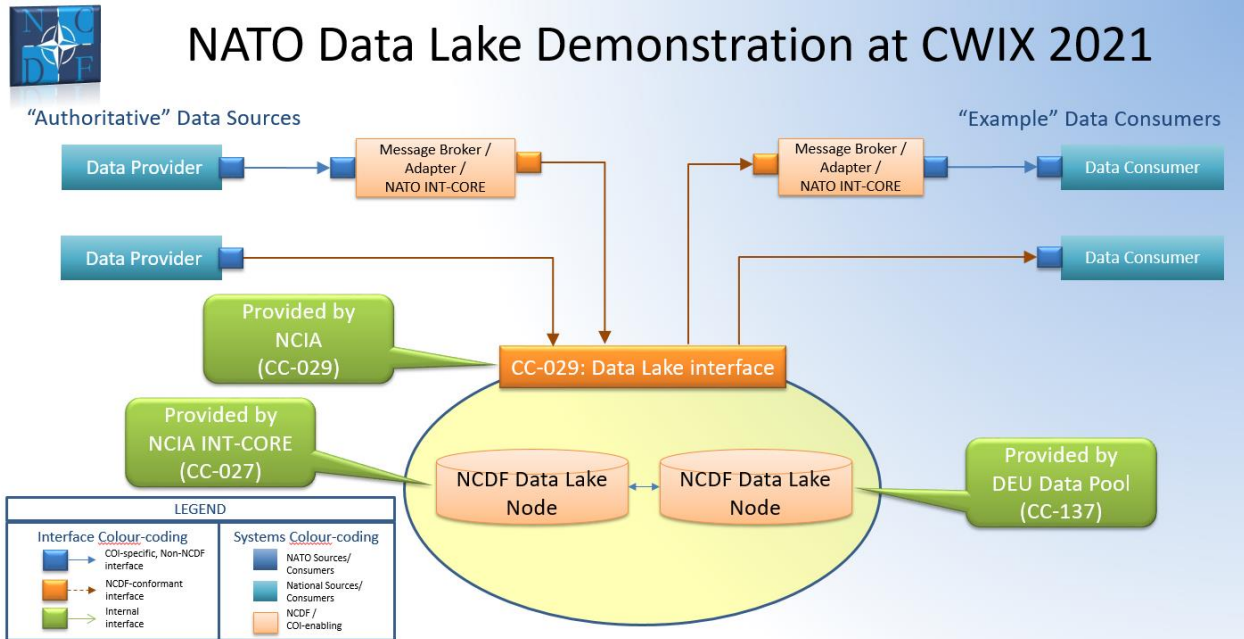


Figure 2: CWIX 2021 Data Lake Demo

NCDF mirrors the NIEM technical architecture including the following technical specifications: XML Naming and Design Rules; Conformance Specification; Conformance Target Attribute Specification, Code List Specification; and the Information Exchange Package Documentation Specification. These artifacts are all included in the NCDF STANAG. As NATO begins to implement NCDF, data interoperability across NATO, especially exchanges between various communities of interest, will significantly improve.

Domain Highlights

Many of the working domains that have committed to using the NIEM framework for the creation of specific information exchange standards have made extensive use of NIEM and continue to create new applications. New domains continue to emerge that span the international, federal, state, tribal, and territorial domain space. There are 17 domains engaged in the use of NIEM, ranging from justice to biometrics, and the newer domains of Cyber (2019-2021), International Human Services (2021), and Learning & Development (2021). Below is a snapshot of notable domain 2021 activities.

NIEM International Human Services (IHS) Domain

The International Human Services Domain is the first domain to be managed by a steward outside the U.S., as Canada has stepped up to take responsibility for this domain and to make it international in scope. This domain will concentrate on aspects of human services that will be more sharable for topics such as benefits and the delivery of services across agencies and even countries. The diagram below illustrates the progress Employment and Social Development Canada (ESDC) made in 2021 in becoming a NEIM Domain and preliminary plans for 2022 (Figure 3).

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Figure 3: IHS Milestones

A – Opportunity of creating new International Humane Service Domain Emerged

B – Completed the Value Proposition and Initial Data Concept Candidates Analysis for International Human Service Domain.

C – NBAC Annual Meeting 2021

- ESDC Presented the NIEM tooling and standard development processes used at the organization
- Approval obtained to establish the IHS Domain. ESDC is committed to be the Steward for the domain.

D – 2022 Objectives and Plans

- Establish and grow the Community of Interest for the Domain
- Create Domain Charter and Define Governance Processes
- Establish the framework to build the IHS Content Model:
 - Identification of tools and communication plans to support collaborative development between COI members
 - Identification of initial IHS data modeling requirements and establishing common understanding on identified data concepts
 - Propose initial content model and start harmonization processes with other NIEM domains
 - Defining iterative content model development and governance processes to address the ongoing data modeling requirements.

IHS intends to continue to work with NBAC, NMO and COI members to promote and facilitate NIEM adoption by leveraging emerging technologies and sharing best practices.

NIEM Learning & Development Domain (L&D)

What a year! Conversations about a Learning & Development (L&D) domain from the end of 2020 between Ms. Katherine Escobar, J6's Deputy Division Chief Data and Standards Division and the NIEM Managing Director, and Dr. Sae Schatz, the Advanced Distributed Learning (ADL) Initiative Director, came to fruition in 2021.

In January of 2021, the NIEM team shared the processes and documentation necessary to become an L&D Domain. At this point, ADL was pretty committed to leading this effort, but did need to work out the logistics in order to complete the administrative tasks associated with establishing a domain.

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In March, the ADL and NIEM teams collaborated to share requirements and templates for the necessary forms that establish the value proposition, Charter, and Business Needs for ADL to establish the L&D Domains. ADL began to work on these documents. However, due to delays, ADL could not get the documents completed by the April NIEM Executive Steering Council Meeting, so the sights were recalibrated to July.

In July, the ADL submitted the necessary forms and had a very positive experience in justifying the need and value for an L&D Domain. The benefits included:

- Broaden accessibility of information to the NIEM Community about learning data standards and best practices
- Improve data and information sharing within Federal Government and between Federal Government and stakeholders
- Enhance interoperability across numerous disparate industry standards for the gamut of learning and development data, including formal, informal, and non-formal learning

ADL's position as both a policy maker and a creator and facilitator of the creation and management of many data specifications and standards provided an opportunity to enhance both the L&D domain of NIEM as well as NIEM in its entirety.

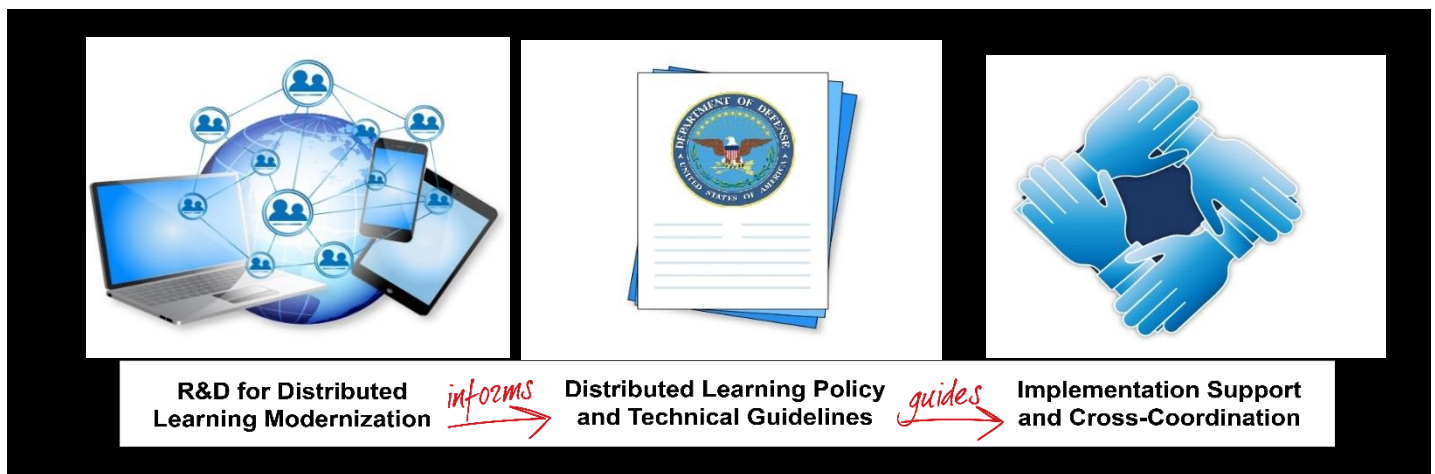


Figure 4: The Core Functions of the Advanced Distributed Learning (ADL) Initiative

ADL presented to the Executive Steering Council in July and the NBAC Monthly in August and was very much welcomed by the NIEM Community.

Just before the NBAC Annual Meeting, ADL presented to the NIEM Community about the Outreach efforts that ADL Performs as well as the core functions and principles of the ADL and how Outreach enhances those aspects (Figure 3). ADL Outreach shared best practices it found in years of serving government in this presentation.

At the NBAC Annual Meeting in September, the L&D Domain spoke about the excitement and benefits of this new Domain and committed to leading this effort. Andy Johnson, a Systems Engineering and



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Technical Assistance (SETA) Contractor for ADL, will be acting as the Facilitator for the Chairs of the L&D Domain, which currently has only the DoD represented by Dr. Sae Schatz. ADL is actively seeking Co-Chairs.

Prior to the NBAC Meeting, ADL had begun preliminary work to identify specific attributes it saw across DoD implementations, data standards, and through research efforts. By early October, at least 40 attributes were identified. In November, the “top 100” were established and it was sent to the NIEM team for early analysis and recommendations. We continue to collaborate on this effort today.

In 2022 ADL will formally kick off the Domain with our first meeting. Recruitment efforts will be heavy in January as people return from their holidays and vacations. ADL hopes to also find at least one Co-Chair from a non-DoD Government Department. Both the Department of Education and Department of Personnel and Management would be great fits.

ADL will formalize and iterate on the original set of 100 attributes that we established in 2021 for the base of the L&D Domain. ADL will separately seek alignment to the NIEM version 5.1 Release Candidate 2 and continue to work L&D attributes into the formal releases of NIEM. The first step will be making sure the 100 attributes are actually not covered in the current version of NIEM. Let’s all work together to build NIEM and the L&D Domain stronger in 2022!

NIEM Biometrics Domain (NBD)

The NIEM Biometrics Domain (NBD) continues to be very active member within the NIEM Community. The governance of the Domain is a partnership between Department of Homeland Security (DHS) Office of Biometric Identity Management (OBIM), Department of Justice (DoJ), Department of Defense (DoD), and the National Institute of Standards and Technology (NIST):

- Domain Steward – DHS OBIM
- Co-Chairs – DoJ & DoD
- Ombudsman – NIST.

Together, these organizations form the NBD Executive Committee (NBDEC).

NBD Launched a “new” Biometrics GitHub site (<https://niem.github.io/community/biometrics>) in 2021 providing documents, newsletters and other updates for the biometrics Community of interest. Additionally, NBD established a GitHub repository for a fsax open source project for collaboration between NIST, NIEM, SME’s, and DNA vendors.

The NDB Working Group (NDBWD) meets bi-weekly and supported a variety of NIEM and Community activities throughout 2021 that included: Deoxyribonucleic Acid (DNA) kinship verification project, Human Language Technology, Person Centric Capability as well as continued support to the NTAC in maturing the NIEM Metamodel.

Several initiatives are identified for focus in 2022. These include:



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- Advancement of the NBD model, maturing DNA and Human Language Technology (HLT)/Voice biometric modalities
- Face Image Quality Standards
- Model Based Systems Engineering (MBSE) tool development

NIEM Biometric data standardization implementation throughout the DHS Biometrics Community.

NIEM Military Operations (MilOps) Domain

2021 was a productive year for the NIEM MilOps Domain. Our discussion will focus here on 2021 highlights, 2022 objectives, and recommendations for MilOps and the broader NIEM Community.

2021 accomplishments include:

- **Systems Engineering and Technical Assistance (JNKE)** - In 2019 the Joint Non-Kinetic Effectiveness Joint Technical Coordinating Group for Munitions Effectiveness Product Team built a fully NIEM conformant Joint Non-Kinetic Effectiveness (JNKE) Information Exchange Package Documentation (IEPD). The team established a data standard for improving interoperability and information sharing between the U.S. Service Components and other federal agencies. In 2021, an additional 485 JNKE cyber-related data objects were added to the MilOps model.
- **United States Message Text Format (USMTF)** - Phase I work involved adding United States Message Text Format to MilOps Domain as a sub-namespace adding 481 elements and types to the model. Phase I is expected to continue in CY 2022 completing in the Q3/Q4.
- **Transition to Docker** - Military Operations Mission Specific (MOMS) restricted content tools, NIEM Schema Subset Generation Tool (SSGT) and NIEM Conformance Testing Assistant (ConTesA) were migrated from *virtual machine* to Docker¹⁶ containers.
- **NATO STANAG 5653** – NATO Core Data Framework (NCDF) was submitted as a NATO Standardization Agreement (STANAG) integrating into Federated Mission Networking FMN) Spiral 5. The formalization of NCDF as STANAG is a major achievement in the advancing NIEM tenants, syntax, definitions and rules into NATO data exchanges.
- **VA/DMDC Engagement** - MilOps continues to work with the Veterans Administration (VA) and Defense Manpower Data Center (DMDC) to explore adding model content and create IEPDS. Specifically, work progressed on developing a DMDC IEPD for the DD-214¹⁷. Additional IEPDs

¹⁶ **Docker** is an open source containerization platform. It enables developers to package applications into containers—standardized executable components combining application source code with the operating system (OS) libraries and dependencies required to run that code in any environment. A virtual machine is a file (often called a hypervisor) that acts as a physical computer. A virtual machine uses the physical resources of the device it is operating on to replicate the environment of a physical device. Docker requires less computing resources than virtual machines and delivers a better experience inside the application. The Docker engine resides over one Linux instance and can sustain over five times the amount of server application instances available with a virtual machine.

¹⁷ The **DD Form 214**, Certificate of Release or Discharge from Active Duty, generally referred to as a "DD 214", is a document of the United States Department of Defense, issued upon a military service member's retirement, separation, or discharge from active duty in the Armed Forces of the United States. Information shown on the

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related to modernizing military servicemember and separation information sharing are planned, e.g., a standard IEPD for the DMDC feeder systems.

As MilOps focuses on 2022, objectives include:

- **NCDF** – showcase Improved NCDF capabilities at Coalition Warrior Interoperability Exercise (CWIX) 2022, to include:
 - Exploration and experimentation of Federated Mission Networking (FMN) Spiral 5 Service instructions for cross-COI information exchange and federated data sharing (data lake).
 - Experimentation with the provision, search, and retrieval of different kinds of data to the NCDF data lake using the NCDF semantic reference model (SRM).
- Experimentation with the federated searching/retrieval of battlespace objects (BSO) provided to the NCDF Data Lake, including COI specific metadata.
- **USMTF Phase II** - Complete converting USMTF, by adding 16117 elements and types to the MilOps data model in Release 5.2 and 26007 in Release 5.3. Figure 5 illustrates the percent contribution of USMTF to MilOps Release 5.1 and forecasts planned/anticipated growth of product objects associated with converting USMTF to NIEM in Releases 5.2 and 5.3. The graph assumes that the non-USMTF product objects remain constant in 5.2 and 5.3. Figure 6 Illustrates the sequencing of MilOps CCBs/ICPs and USMTF CCBs/ICPs with MilOps and USMTF cutoffs.

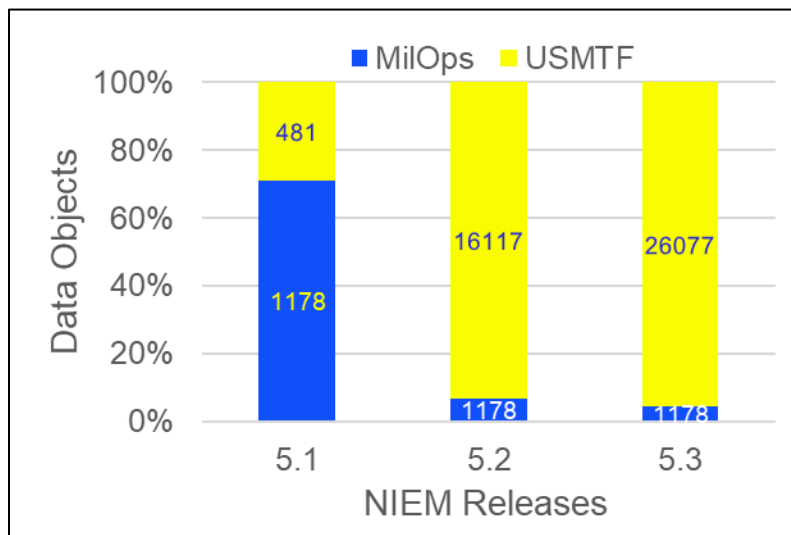


Figure 5: USMTF Percent Contribution to MilOps Data Model

Report of Separation may include the service member's: date and place of entry into active duty, home address at time of entry, date and place of release from active duty, home address after separation, last duty assignment and rank, military job specialty, military education, decorations, medals, badges, citations and campaign awards received, total creditable service, foreign service credited, et al.

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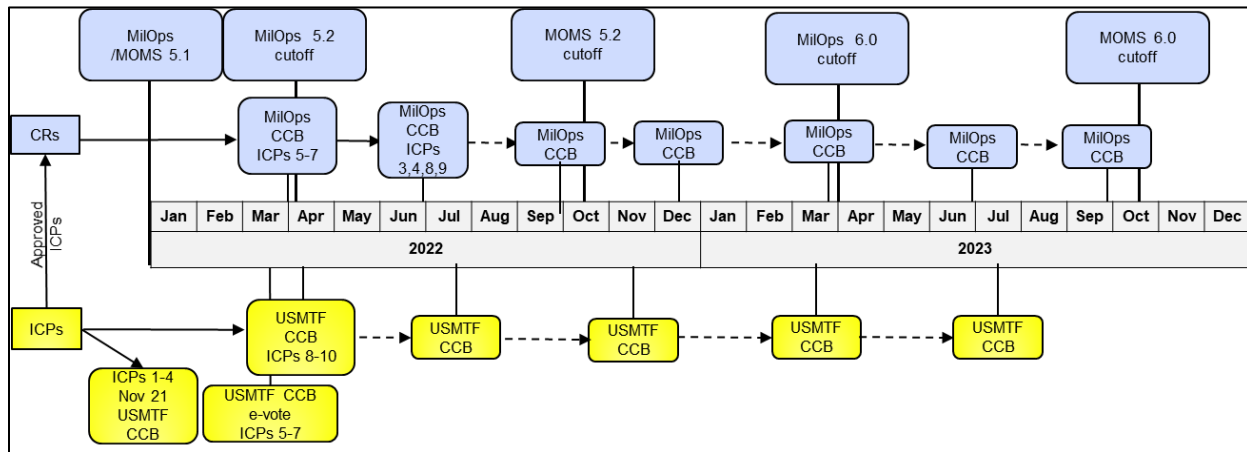


Figure 6: MilOps/USMTF CCB Process Timeline

- MilOps Engagement/ NIEM Adoption - Continue to work with the MilOps Community to advance adoption of NIEM:
 - Support continued VA and DMDC IEPD development initiatives
 - Support Joint All Domain Command and Control (JADC2) enterprise stakeholders defining how NIEM in conjunction with other recognized voluntary consensus standards will be leveraged as the semantic layer of the data centric architecture
 - Explore the role of NIEM in Universal Command and Control (UC2)¹⁸, Multi-X Security (MXS)¹⁹, and Defense Incident Based Reporting System (DIBRS)
 - Establish MOMs as a Chairman of the Joint Chiefs of Staff Instruction (CJCSI) and formally establish as a recognized cross-domain interoperability enabler.

As MilOps focuses on the future and in light of NIEM's planned transition to an OASIS Open Project Standard themes, objectives, and recommendations continue to emerge:

- The importance of MilOps and NIEM to engage newly assigned DoD and Federal Agency Chief Data Officers

¹⁸ Fully Networked Command, Control, and Communications (FNC3) Universal Command and Control (UC2) is the common language (Interface Control Document) for the interfaces between systems and subsystems, as well as the common functional software architecture. NIEM/MilOps representatives attend weekly UC2 meetings and quarterly technical interchange meetings (TIM) assisting with the development of NIEM based exchanges.

¹⁹ The Multi-X (Multi-Level, Multi-Compartment, Multi-Nation) Security (MXS) effort intends to develop a security data labeling model, standard, software development kit (SDK), and unclassified cloud-hosted prototype demonstrating the utility of the MXS architecture. This prototyping effort will assist third party software developers to quickly create next-generation, cloud-hosted applications with requirements for tracking data and users at multiple classifications and compartments for the Special Access Program (SAP) community. NIEM/MilOps representatives provide technical support to monthly and ad hoc MXS meetings.



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- Continue focused collaboration with U.S. and Coalition Partners Executives on enterprise data efforts such as JADC, Open Data Act²⁰, and UC2
- Improve user-friendly tools for browsing NIEM
- Mature JSON tools and associated training, and
- Provide end-to-end IEPD Lifecycle tool capability to trace information exchange requirements from scenario planning architecture artifacts with automated mapping and extract transform load (ETL) services.

While much was accomplished this past year, MilOps remains steadfast in embracing growth and new adopters focusing on a sustainable NIEM MilOps Domain for the future.

NIEM Emergency Management (EM) Domain

Emergency Management Domain 2021 highlights include:

- Continued extending outreach to FEMA and other State, Local, Tribal, and Territorial (SLTT) stakeholders
- Assisted FEMA with creating new data exchanges
- Identified new attributes for inclusion in 5.0 Release
- Supported DHS Acting CDO to define DHS “As Is: state and next steps.

2022 efforts include continuing to assist DHS Federal Emergency Management Agency (FEMA) and Science & Technology (S&T) in defining NIEM attributes for data exchange, promote EM Domain internal NIEM training sessions, support SLTT initiatives in the area of emergency management and prepare for a transition of NIEM to an OASIS Open Project Standard.

NIEM Cyber Domain

2021 Highlights:

Developed new content as part of NIEM 5.1 Release:

- Federal Incident Reporting content developed by MITRE and in collaboration with Cybersecurity and Infrastructure Security Agency (CISA) and GTRI
- State, Local, Tribal, and Territorial Cyber Incident Reporting Content developed by Cybercrime Support Network (CSN) and in collaboration with CISA and GTRI
- Community engagement
- Conducted December 2021 Cyber Domain Symposium.

2022 preliminary planning includes Message Exchange development for incident reporting for Federal and SLTT exchanges.

²⁰ <https://www.congress.gov/bill/114th-congress/senate-bill/2852>




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NIEM SLTT Tiger Team


The State, Local, Tribal and Territorial (SLTT) Tiger Team was created in 2020 and remains a NIEM priority for the future. This year's outreach and accomplishments include:

- Outreach – New Mexico CDO, Child Welfare Dept. (Summer/21) 
- CompTIA Sharkbytes Podcast (5/13/21) 
 - Interview hosted by Alan Shark, Executive Director of the Public Technology Institute(<https://www.pti.org>) with Katherine Escobar, managing Director of the NIEM Management Office, Paul Wormeli, and Mike Philips, Co-Chairs SLTT.

“WHY INFORMATION SHARING MATTERS”

- Segment 1 (May 13) <https://blubrry.com/comptiasharkbytes/77183439/why-information-sharing-matters-and-what-is-niem-doing-about-it-part-1-if-2/>
- Segment 2 (May 27) <https://blubrry.com/comptiasharkbytes/77688528/why-information-sharing-matters-and-what-is-niem-doing-about-it-part-2-if-2/>
- SEARCH Symposium (7/13/21) Brief – Justice Information Sharing 
 - [SEARCH | The National Consortium for Justice Information and Statistics](#)

- IJIS Mid-year Briefing (7/15/21) 
- NIEM and Childcare Presentation (8/18/21)

- NLETS Webinar (10/21//21) 

SLTT's 2022 focus is to continue executive level briefs, promote new domains to SLTT, share NIEM news with the community, promote reference exchanges between justice and behavioral health, reverence exchanges between education, justice and social services, and development of NIEM ontology in OWL and RDF.

NIEM.gov

NMO oversees the development of the new U.S. Web Design System (USWDS) compliant NIEM.gov website, launched in March 2021. The website incorporates open source user interface (UI) components and adheres to U.S. Federal government websites visual style guidance and community best practices (i.e., Worldwide Web Accessibility Standards (W3C), USWDS compliance, Americans with Disabilities Act (ADA)-Section 508 compliance, etc.)

The Content Management System (CMS) Drupal 8 was migrated to Drupal 9, providing improved website performance, security, ease of development, and improved user experience for front-end and



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administrative users. Additional organization of the new website's page content is planned for 2022, to include input from the ESC, NBAC, NTAC and NIEM user community.

The Department of Homeland Security's (DHS's) Web Content Management as a Service (WCMAaS) Team provides NIEM.gov website development and support to the NMO. The team provides:

- Subject matter expertise with United States Web Design System (USWDS) requirements for agency websites
- Network access for content management capabilities
- Assists with the analysis of the NIEM IEPD registry requirements analysis, including developing an initial IEPD Registry proof of concept
- Dedicated guidance and support for the NIEM.gov website Drupal 8.0 migration.

The NMO monitors key metrics, including user traffic, user acquisition, and perceived popularity of content. NMO reviews and engages with the community on YouTube, Twitter, and LinkedIn. An overview of 2021 website analytics for NIEM.gov and NIEM.github.io follows.

Key aspects of the new NIEM.gov website include:

- Automated slider of 'featured' news content consisting of new NIEM release versions, training opportunities, and promotion of future upcoming community events
- "Tools Catalog" consisting of both third-party developer tools and NMO-sponsored applications (i.e. MEP Builder v1.0) used to assist users with searching/browsing NIEM release content and/or designing an IEPD
- "Success Stories" highlighting exemplary implementations at the federal, state, tribal, local level and/or contributions to the NIEM model.

Future objectives for 2022 of the NIEM.gov website include:

- Creating new content areas for:
 - "NIEM in the News" – content related to NIEM in various news resources
 - "Policy/Law Library" – content related to NIEM referenced in various federal, state, local, and tribal policies
 - "Best Practices / Implementation of NIEM" – a searchable library of successful implementations of NIEM and best practices to supporting the NIEM model
 - Public Registry & Repository – supporting the public reuse and contribution of IEPD's considered approved for public distribution.

A screenshot of the home page is previewed as Figure 7.

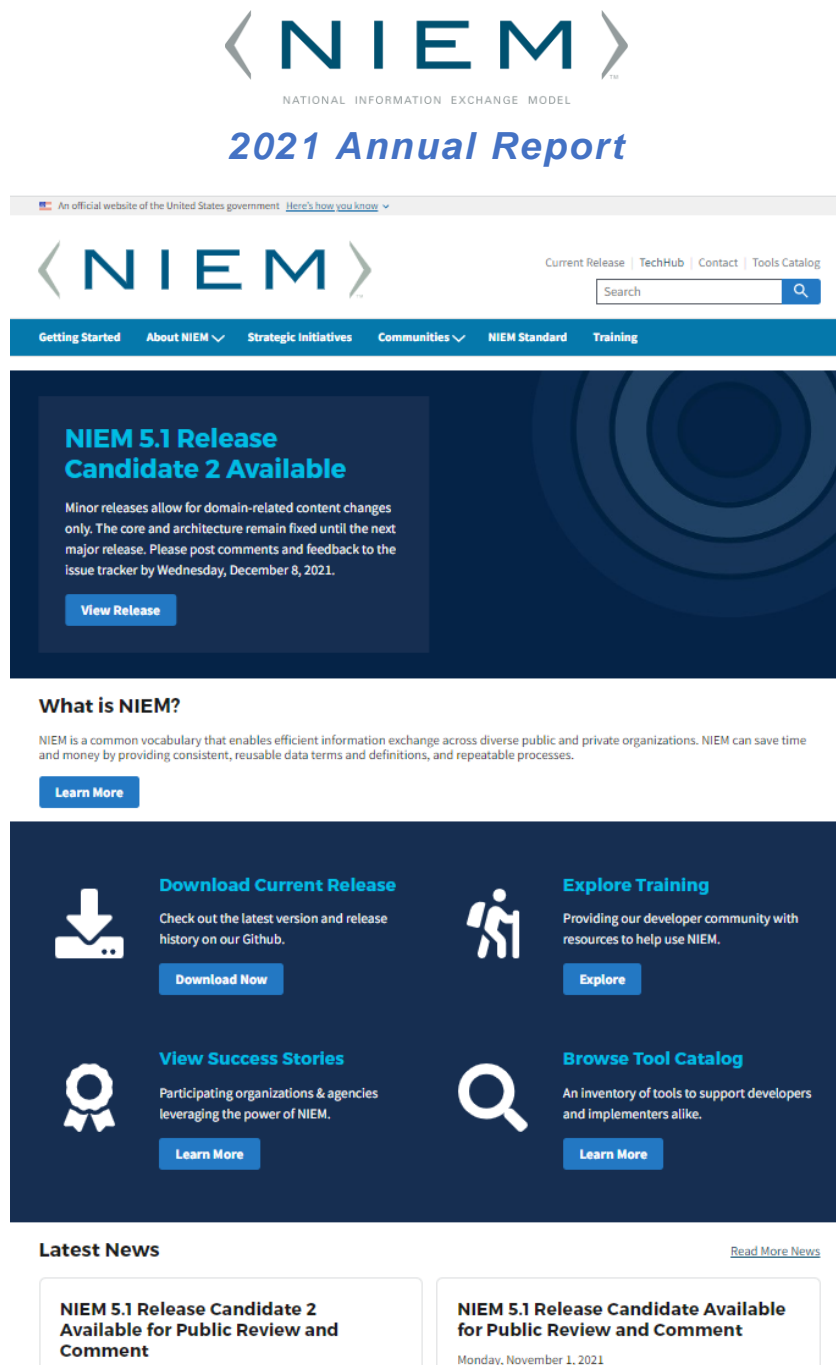


Figure 7: NIEM.gov Mockup

Registry/ Repository (R&R)

During 2021, considerable progress was made with the IEPD Registry and Repositories (R & R) initiative.

The Department of Homeland Security agreed to host the Public IEPD R & R using the niem.gov web site. That effort is just beginning, recently completing a requirements review, and initial layout of the page layout. The Public R & R is forecasted to go live in summer of 2022.



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The Restricted R & R capability will be hosted on the DoD Warfighting Mission Area – Architecture Federation and Integration Portal (WMA-AFIP) managed by the Joint Staff J6 and hosted in by Microsoft Azure Government, supporting IL5²¹ on the unclassified router network (NIPRNET) and IL6²² on the secret router network (SIPRNET). This portal underwent a major upgrade in 2021, and the Restricted R & R awaits the inaugural launch of this new portal, which is expected to launch in February/March 2022. Final user assessment testing was completed in November for the NIPRNET instance and December for the SIPRNET instance.

The Restricted R & R is expected to migrate from milCloud²³ to Amazon Web Services (AWS) GovCloud²⁴ in 2022, which will bring enhanced functionality to include access for all Federal agencies holding a federal PIV PKI token. Appropriate business and technical processes have been drafted to support management and maintenance of the Registry and Repositories, including a user's guide and a checklist for validating individual IEPDs before they are published for potential reuse. These guides will be updated based on user feedback.

NIEM social media platforms will be used to increase awareness, information, and encourage involvement within the NIEM community and prospective users as the capabilities become available for use.

Tool Development Effort

The NIEM Management Office continues the process of automating the IEPD Lifecycle Development Process by analyzing and constructing applications, connected application to application, to provide a seamless IEPD generation experience for both users experienced with IEPD development as well as new and novice users. Progress on the deployment of a comprehensive tool set and the continued way ahead is outlined subsequently.

²¹ **Impact Level 5** data includes controlled, unclassified information (CUI) that requires a higher **level** of protection as deemed necessary by the information owner, public law or government regulation. **Impact Level 5** data is inclusive of unclassified National Security Systems.

²² **Impact Level 6** data is defined as classified information up to Secret.

²³ DISA's milCloud 2.0 portfolio includes an integrated suite of cloud-based infrastructure services. Connecting commercial cloud service offerings to Department of Defense (DoD) networks in a private deployment model, the solution provides mission partners the latest cloud technologies at competitive prices, with uncompromising performance. Approved to support Impact Level 5 data (IL6 authorization is in progress), milCloud 2.0 includes a central cloud portal which provides real-time visibility, payment, and workload provisioning.

²⁴ AWS GovCloud (US) solutions comply with the FedRAMP High baseline; the DOJ's Criminal Justice Information Systems (CJIS) Security Policy; U.S. International Traffic in Arms Regulations (ITAR); Export Administration Regulations (EAR); Department of Defense (DoD) Cloud Computing Security Requirements Guide (SRG) for Impact Levels 2, 4 and 5; FIPS 140-2; IRS-1075; and other compliance regimes.

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NIEM Tools v1.0 Development

The Tools Development Team made significant progress over the last year with development and deployment of NIEM Tools V1.0. This initial version of the toolset provides IEPD development capability in the first four steps on the message building cycle and included improved user experiences in the Scenario Planning, Analyze Requirements, Map and Model, and Build and Validate phases of the Lifecycle (Figure 8).



Figure 8: MEP BUILDER "Message Building Cycle"

The following are highlighted capabilities available to message exchange developers:

- **Scenario Planning** – Allows developers to name the message exchange, upload supporting documents using either a drag and drop procedure or browse files within the computer subdirectory. Once a file or files have been selected the system notifies the user visually the files have been attached.
- **Analyze Requirements** – In this phase the tool provides the ability to download a mapping template, upload supporting documents, and import existing mapping spreadsheets. The tool also provides the capability to modify imported mapping spreadsheets within the tool. Once the mapping spreadsheet is imported to the tool and modified, if required, the data can be exported in multiple formats.
- **Map and Model** – In this phase, developers can edit the mapping sheet within the workspace and, through a machine-to-machine interface, access the Subset Schema Generation Tool (SSGT). This will present a searchable dialog format allowing the developer to review the results of the SSGT query and load them into the mapping spreadsheet.

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- Build and Validate - This phase will allow the developer to generate the wantlist and subset schema. Here the developer can set default values and decide to include documentation with/for the schema. The developer will be notified when the subset schema has been generated and when the schema and wantlist populate the message exchange artifacts. Immediately after generating the subset schema the package can be downloaded and available to open.

Examples of the user interface are included below (Figures 9 & 10).

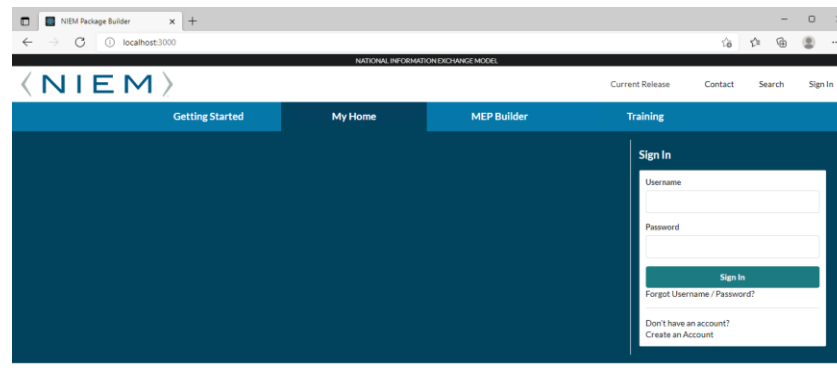


Figure 9: User Interface Example #1

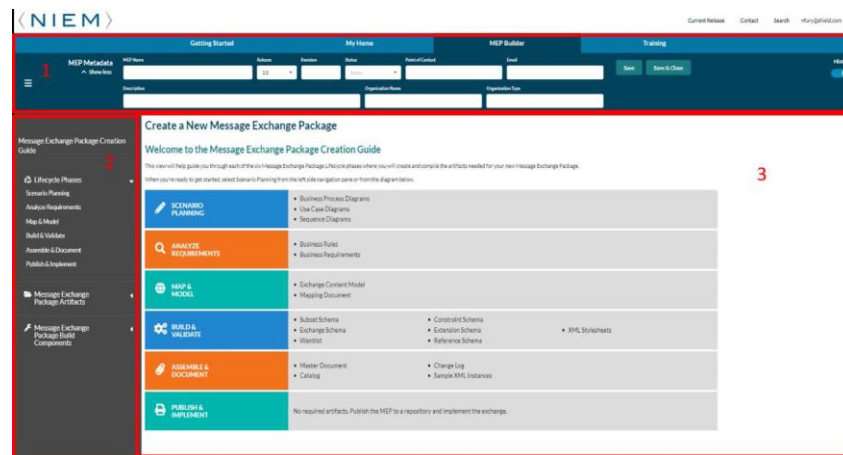


Figure 10: User Interface Example #2

NIEM Tools v2.0 Development

The NMO and contract team has explored courses of action (COA) for follow on development pending additional funding. Three COAs are under consideration. COA 1 continues the enhancement of the NIEM Lifecycle Tools Suite providing additional functionality in the four development steps provided in version 1.0 as well as expanding building capability in the Assemble and Document and Publish and Implement phases. COA 2 concentrates on consolidating the capabilities found in SSGT and the ConTesa conformance tool into the NIEM Lifecycle Tool Suite. Limited additional capability would be developed for the Tool Suite with this COA. COA 3 involves moving the NIEM Lifecycle Tools Suite to an enterprise solution.



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Limited additional capability would be developed within the Lifecycle Tools Suite but, new team skills would be required to move the Tools to the enterprise (i.e. Amazon Web Services, Platform One, etc.). These COAs are estimated to cost \$1.3-\$1.7M and take between 12 and 17 months to deploy.

Training

The purpose of the “new” NIEM Technical Training initiative is to revitalize the NIEM Training Program, providing quality technical training to the NIEM community. This effort reflects a refactoring of older training efforts. It combines much of the content from earlier programs, updated to NIEM 5, with a new structure organized around the process of building an IEPD/Message Specification. The target audience is NIEM developers who need a technical understanding of the mechanics of NIEM. The training covers both XML/XML Schema and JSON, albeit still centered on XML Schema as the underlying foundational technology.

Earlier versions of NIEM training separated out the technical information from the process of building an IEPD/Message Specification. By combining the two, attendees now learn about technical details in context of building an actual IEPD/Message Specification. As a class moves through the process, they eventually learn all the major details of how NIEM works.

The training syllabus contains the following high-level sections (Table 5):

Logistics
Introduction to NIEM
IEPD/Message Spec Development <ul style="list-style-type: none">• Scenario Planning• Requirements Analysis• Mapping<ul style="list-style-type: none">○ Mapping to Existing Objects○ Creating New Objects○ External Standards• Creating and Validating Schemas• Assembly• Publishing• Implementation

Table 5: Training Syllabus

A more detailed syllabus is available in the GitHub repository for the training program:
<https://github.com/NIEM/NIEM-Training/blob/main/NIEM%20Training%20Syllabus.md> .

Development and Pilot - The first offering of the redeveloped training program was delivered live as a pilot to an actual class on September 28-30, 2021.

During this pilot class, NIEM first attempted to demonstrate live, in-class, the actual IEPD/Message Specification development process. That approach proved to be an overwhelming task, and

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consequently, some materials were pre-staged for remainder of the training. When surveyed, attendees appreciated the attempt at creating artifacts live, but preferred the less frantic pace and easier to follow format of pre-staged artifacts.

Based on these lessons learned, new content is now combined with existing content to create a master NIEM training document which includes substantially all the training materials, absent a few artifacts such as the mapping spreadsheets. This includes XML, XML Schema, and JSON examples, as well as extensive hyperlinking to other materials.

The master NIEM training document is available to attendees throughout training and is updated contemporaneously as mistakes are found or if something is confusing to attendees. It is available at all times in the GitHub repository for the training program: <https://github.com/NIEM/NIEM-Training/blob/main/Master%20NIEM%20Document/Master%20NIEM%20Training%20Document.md>.

A second live training session was conducted November 16-18, 2021, using these revamped materials. Evaluations for both sessions, September and November, were very positive. A snapshot of training demographics is illustrated in the following 3 graphs (Figures 11-13). The September pilot was dominated by DoD and Canada by design. The November class earmarked Canada participants but SLTT attendees represented a stronger cohort than expected.

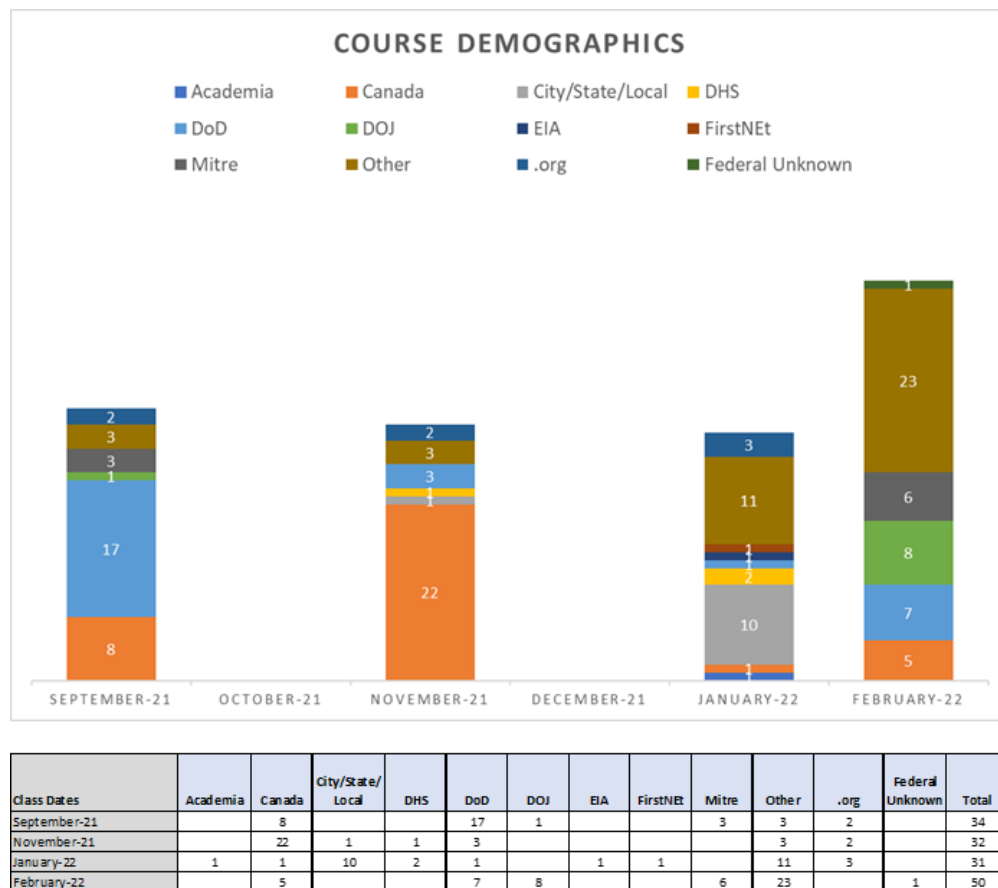


Figure 11: Sep & Nov 21, Jan 22 Participants & Feb 22 Registrants Totals

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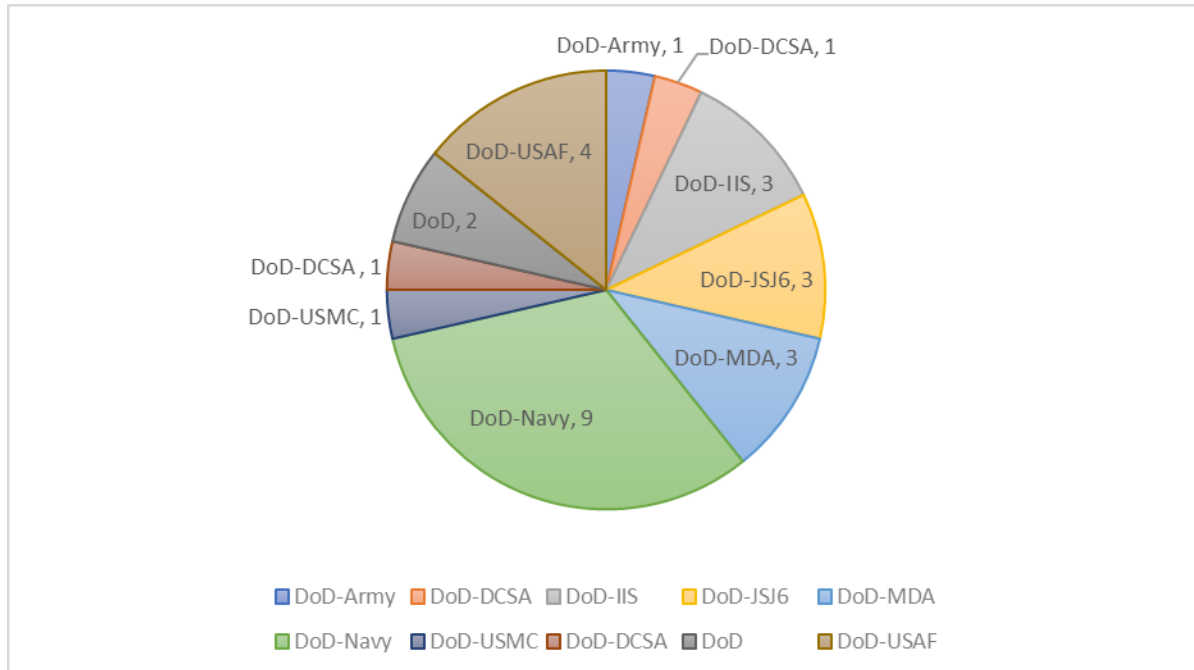


Figure 12: Sep & Nov 21, Jan 22 Participants & Feb 22 Registrants - DoD

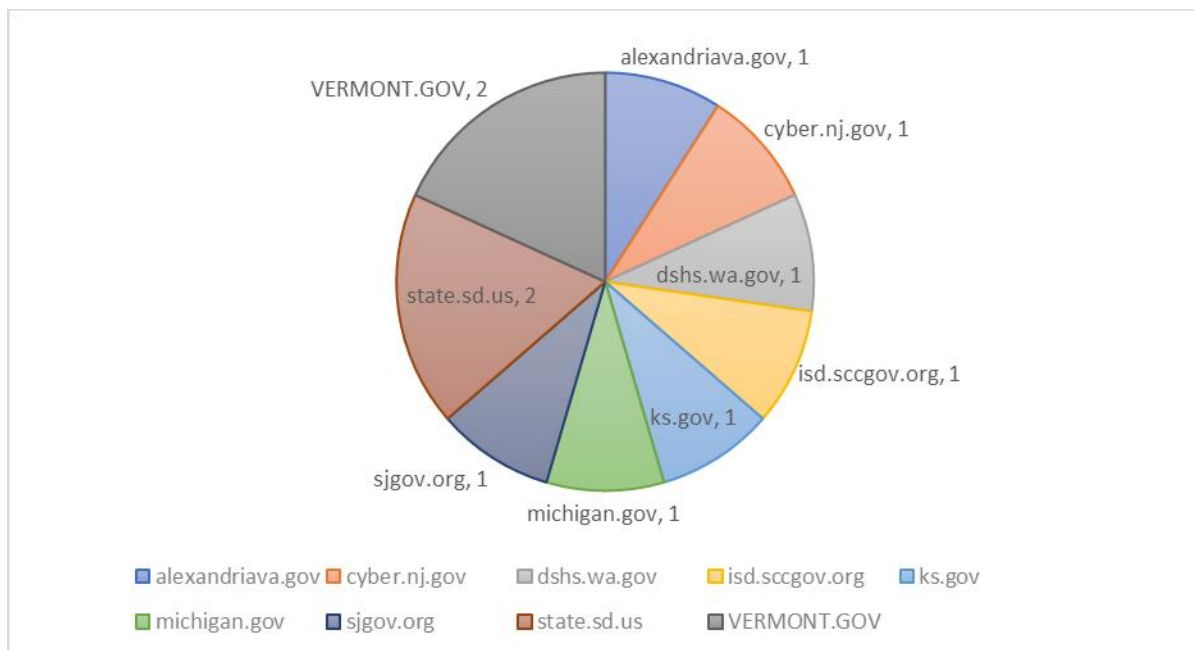


Figure 13: Sep & Nov 21, Jan 22 Participants & Feb 22 Registrants - SLTT

Near & Long Term Plans - The NIEM Management Office(NMO) has a multi-plan approach for long-term, sustainable training solutions. For 2022, NMO intends to host monthly online training opportunities open to the public. However, with only one instructor available space and offerings are limited. The longer range plans include:



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- Establish hybrid pre-recorded, instructor monitored online classes
- Formalize training material with the intent to recruit and train additional instructors within multiple organizations
- Work with commercial online training provider such as LinkedIn Learning, Udemy, Dataversity, and Skillsoft to provide training within their catalogues
- Publish NIEM Books.

NIEM 5.1 Minor Release

The NIEM 5.1 minor release was published in December 2021 and introduces the new Cyber domain. The following is a list of key content changes:

Biometrics domain

- Added additional DNA and pedigree content

CUI

- Split the single Limited Dissemination Control (LDC) code set into separate document marking and portion marking LDC code sets

Cyber domain (new)

- Added Federal Incident Reporting Requirements (FIRR) content
- Added State, Local, Tribal, and Territorial (SLTT) Agency Cyber Incident Reporting Requirements (CIRR) content

Emergency Management domain

- Added flood damage claim content from OpenFEMA

Justice domain

- Moved Justice elements with a National Crime Information Center (NCIC) data type to the NCIC namespace

Military Operations domain

- Added content from the Joint Non-Kinetic Effectiveness (JNKE) IEPD

NCIC codes

Re-added 4.2 code sets that were removed from the 5.0 release due to harmonization efforts across the Federal Bureau of Investigation (FBI) and Justice code sets for legacy support.

Updated codes for NIEM 5.1, with changes to the Gun “make” (manufacturer) – (MAK), Vehicle “make” (VMA), and Vehicle “model” (VMO) code sets and removed the BOAT “make” – (BOAT) code set (no longer in use)

In 5.1, NIEM has grown by 813 properties. Property counts from the model, broken down by namespace, appear in Table 5:



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Property counts	5.1
Core	1,810
Domains	
Agriculture	64
Biometrics	1,094
CBRN	592
Cyber	268
Emergency Management	950
Human Services	806
Immigration	445
Infrastructure Protection	31
Intelligence	56
International Trade	530
Justice	3,953
Maritime	333
Military Operations	704
Screening	577
Surface Transportation	64
Auxiliary	
CUI	23
Statistics (GSIM)	520
Code table properties	146
Total	12,962

Table 5: Release 5.1 Property Counts

NIEM 5.2 and 6.0 Planning

Preparations for the next minor release, NIEM 5.2, are already underway. Two new domains, Learning & Development, and International Human Services, have been approved. The schedule for the 5.2 release will be similar to the schedule for 5.1, with the public beta review scheduled for the summer and the final release scheduled for fall / end of 2022. NIEM 6.0 will follow in 2023. As a major release, Core and cross-domain harmonization activities will resume and the model architecture will be updated as specified by changes to the NIEM Naming and Design Rules (NDR) 6.0 specification, to be produced by the NTAC.



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NBAC 2022 Workplan

The NBAC hosted their Annual Meeting in September 2021. Similar to the 2020 event, the venue was conducted virtually. Part of their deliberations included preliminary planning for CY 2022. Their planning efforts were shaped in anticipation of approval of NIEM's transition to an OASIS Open project. What follows is a listing of those actions planned for CY 2022 (Table 6).

NBAC 2022 Major Goals
Support Transition to OASIS Open Project Standard
Develop NBAC OASIS Transition POA&M
Develop 2022 NBAC Action Tracker
Conduct Planning for Minor Release 5.2
Assist Standup of L&D and IHS Domains
Conduct NBAC Document Review (NBAC Charter, Domain Stewardship Agreement, NBAC SOP) in lieu of Transition to OASIS
Advance Mentoring Program
Advance Translation of NIEM.gov into French Language.
Advance NIEM Adoption (VA, EPA, DMDC)
Revisit 2021 Domain Onboarding Efforts (Census Bureau, Treasury (DAIMS), JPO-CIED)
Re-envision Emerging Technology Tiger Team
Explore New Domains
Support State, Local, Tribal, and Territorial Engagement
Plan, Execute NBAC 2022 Annual Meeting

Table 6: NBAC Workplan

NTAC 2022 Workplan

The NTAC met at the GTRI facility in August 21 for their Annual Meeting. Part of their deliberations included preliminary planning for CY 2022. Their planning efforts were shaped in anticipation of approval of NIEM's transition to an OASIS Open project. What follows is a listing of those actions planned for CY 2022 (Table 7).

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NTAC 2022 Major Goals

Version 6 Architecture: The NTAC has developed a list of possible changes to simplify and streamline the naming and design rules for XML. These will be reviewed in collaboration with the NBAC and implemented as part of the next major release in 2023.

CMF and Tool Prototyping: Several additional CMF conversions are planned. The CMF will be revised as these conversions expose new requirements.

- **CMF to JSON Schema:** Suitable for validating content of NIEM JSON messages
- **CMF to/from RDFS+OWL:** Direct mapping from NIEM data components to ontology formalism
- **CMF to/from UML models:** UML class diagrams define the essential aspects of the metamodel: types, properties, and generalizations. It should be possible to extract those from a UML model.
- **CMF to simplified XSD:** An XML schema that is *not* used as a model representation can be greatly simplified and optimized for other purposes: XML binding (e.g. JAXB), EXI serialization, validation within a cross-domain solution (i.e. a security domain guard), etc.

Simplified Message Specifications: Complete the *Guide to Message Specifications*; define rules and conventions for NIEM message specifications (if needed).

Table 7: NTAC Workplan

NMO 2022 Workplan

The NIEM Work Plan is approved by the ESC as part of the Annual NBAC-NTAC/ESC meeting series. This year the NTAC and NBAC each met in August and September respectively. Discussion during those events framed the broad outlines of the NBAC, NTAC, and NIEM overall Workplans. The NMO's 2022 Workplan was briefed to the ESC on 21 September and subsequently approved.

The NMO's Workplan is a dynamic document which matures within the current year and forecasts future work over the next calendar year. The process begins by identifying those events and tasks which extend into the next year's work and beyond. The NMO synthesizes the Workplan and solicits ESC approval as elements are identified throughout the year.

A major focus of this year's NMO Workplan centered on ESC deliberations on NIEM governance, continuity, and transition to a formal standard organization (Table 8).



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NMO 2022 Major Goals
Plan and execute deliberate transition to OASIS Open Project Standard
Develop OASIS Transition POA&M
Draft NIEM-OASIS Charter
Secure DoD OASIS Contract and Funding
Identify and Encourage Federal and Commercial Partners to Join NIEM-OASIS Governing Board
Update NIEM Governance Congruent with OASIS Open Project Standard
Plan & Execute 5.2 Minor release
Plan 6.0 Major Release
<p>Advance MilOps Domain Implementation of NIEM</p> <ul style="list-style-type: none"> a. NIEMifying USMTF <ul style="list-style-type: none"> i. This will be fully realized in 2023 adding ~26K elements to the NIEM model. Currently there are ~13K elements in the entire model so this will triple the size of the entire model. ii. Working with DISA to convert the 325 USMTF Messages. These will be published as IEPDs to the Restricted Repository. b. Rebooted Domain with a January kickoff <ul style="list-style-type: none"> i. Goals: identify who in DoD are using NIEM, Increase adoption and participation. ii. How: Provide training, implementation support and marketing
<p>Training</p> <ul style="list-style-type: none"> a. Hosted monthly virtual classes monthly since Oct. 2021. b. Intent is to refine materials to make available to stable of instructors and build fully virtual training capability c. Exploring hosting of training on commercial and government venues (LinkedIn, Skillsoft, Coursera, JKO and DAU)
Implement International Localizations to use NIEM
Translate NIEM.gov into French
Investigate/ Encourage Feasibility of NIEM Spanish Translation (SLTT Initiative)
Encourage Standup of Western Canada Tiger TEAM



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IOC Restricted Repository
IOC New NIEM Tools
Continue & Formalize New NIEM Training Offerings started in 2021
Establish persistent NIEM and NCDF Data Lake instantiation
Explore new domains
Encourage new adopters: VA, DMDC, EPA
Strong State, Local, Tribal and Territorial engagement

Table 8: NMO Workplan

Summary

Notwithstanding the continuing burden of doing business under the pall of COVID, 2021 proved to be a highly successful year for NIEM. The ESC decision to pursue NIEM as an OASIS Open Standard and the opportunities afforded through standard accreditation and the new bonafides conferred set NIEM on the path to a sustainable future. 2021 also saw the addition of 2 new NIEM domains: Learning & Development Domain (L&D) and International Human Services (IHS) Domain. While International IEPDs have been created in the past, the introduction of IHS clearly earmarks NIEM as an international organization. Momentum continues to grow to expand NIEM offerings in French and Spanish and to tune the model to accommodate international partners' content and protocols.

Progress continues on maturing the Metamodel and decoupling NIEM from XML. Version 5.1 was released in December 2021 and a fully mature Metamodel is expected with completion of Major Release 6.0 in 2023.

The State, Local, Tribal and Territorial Tiger Team was very active this year continuing outreach to a host of state and local partners.

Training and Domain mentoring will be dominant themes in 2022. NIEM training will expand on the success of our technical training rollout in 2021 making the offerings more automated and available to larger audiences.

The NIEM Community looks forward to 2022 and the work that lies ahead in implementing NIEM as a standard.



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Appendix A: Acronyms

A

ADA	American Disabilities Act
ADL	Advanced Distributive Learning
AF	Air Force (US)
ANSI	American National Standards Institute
APHSA	American Public Human Services Association
ASD	Accredited Standards Developer
AWS	Amazon Web Services

B

BOAT	Boat “make”
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C

CIRR	Cyber Incident Reporting Requirements
CDO	Chief Data Officer
CIO	Chief Information Officer
CISA	Cyber & Infrastructure Security Agency
CJCSI	Chairman of the Joint Chiefs of Staff Instruction
CMF	Common Model Format
CMS	Content Management System
COI	Community of Interest
ConTesA	Conformance Test Application
CSN	Cybercrime Support Network
CWIX	Coalition Warrior Interoperability eExercise
CY	Calendar Year



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D

DAIMS	Data Act Information Model Schema
DCSA	Defense Counterintelligence and Security Agency
DD-214	Certificate of Release or Discharge from Active Duty
DD C5I	Cyber and Command, Control, Communications and Computers Integration
DHS	Department of Homeland Security
DIBRS	Defense Incident Based Reporting System
DMDC,	Defense Manpower Data Center
DNA	Deoxyribonucleic Acid
DOD	Department of Defense
DOJ	Department of Justice
DOS	Department of State
dshs.wa	Washington State Department of Social and Health Services

E

EPA	Environmental Protection Agency
ESC	Executive Steering Committee
EIA	Energy Information Administration
ESDC	Employment and Social Development Canada
ETL	Extract Transform Load
ETTT	Emerging Technology Tiger Team
EXI	Efficient XML Interchange

F

FEMA	Federal Emergency Management Agency
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FIRR	Federal Incident Reporting Requirements
FMN	Federated Mission Networking
FNC3	Fully Networked Command Control and Communications

G

GTRI	Georgia Tech Research Institute
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H

HLT	Human Language Technology
HRSDC	Human Resources and Skills Development Canada

I

ICD	Interface Control Document
IEPD	Information Exchange Package Documentation
IHS	International Human Services
IOC	Initial Operational Capability
IIS	Intelligence Information System
IITB	Information Innovation and Technology
IJIS	Integrated Justice Information Systems
IL5	Impact Level 5
IL6	Impact Level 6
Isd.sccgov.org	Information Services Department Santa Clara County
ISO	International Organization for Standardization
ITT	Internationalization Tiger Team

J

JADC2	Joint All Domain Command and Control
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JAXB	JSON Architecture for XML Binding
JNKE	Joint Non-Kinetic Effectiveness
JPO-CIED	Joint Program Office for Countering Improvised Explosive Devices
JSJ6	Joint Staff J6
JSON	JavaScript Object Notation

K

ks.gov	State of Kansas (Government)
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L

L&D	Learning & Development
LDC	Limited Dissemination Control

M

MAK	Gun Make (manufacturer)
MBSE	Model Based Systems Engineering
MDA	Missile Defense Agency
MilOps	Military Operations
MOMS	Military Operations Mission Specific
MPD	Model Package Documentation
MXS	Multi-X (Multi-Level, Multi-Compartment, Multi-Nation) Security

N

NATO	North Atlantic Treaty Organization
NBAC	NIEM Business Architecture Committee
NBD	NIEM Biometric Domain



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NBDEC	NIEM Biometric Domain Executive Committee
NBDWG	NIEM Biometric Domain Working Group
NCDF	NATO Core Data Framework
NCIC	National crime Information Center
NDR	Naming and Design Rules
NEICE	National Electronic Interstate Compact Enterprise
NIEM	National Information Exchange Model
NIPRNET	Non-classified Internet Protocol (IP) Router Network
NIST	National Institute of Standards and Technology
NLETS	International Justice and Public Safety Network
NMO	NIEM Management Office
NOAA	National Oceanographic and Atmospheric Agency
NTAC	NIEM Technical Architecture Committee
NTTAA	National Technology and Transfer Act

O

OASIS	Organization for the Advancement of Structured Information Standards
OBIM	Office of Biometric Identity Management
OCIO	Office of the Chief Information Officer
OMB	Office Management and Budget
OMG	Object Management Group
OWL	Web Ontology Language

P

PIV	Personal Identity Verification
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PKI	Public key Infrastructure
R	
RDFS	Resource Description Framework Schema
R&R	Registry & Repositories
S	
SAP	Special Access Program
SDK	Software Development Kit
SEARCH	The National Consortium for Justice Information and Statistics
SETA	Systems Engineering and Technical Assistance
SIPRNET	Secret Internet Protocol (IP) Router Network
sjgov.org	San Joaquin County California (Government)
SLTT	State Local Tribal Territorial
SME	Subject Matter Expert
SSGT	Schema Subset Generation Tool
STANAG	Standardization Agreement
state.sd.gov	South Dakota State (Government)
T	
TIM	Technical Interchange Meeting
U	
UC2	Universal Command and Control
UML	Universal modeling Language
USCB	United States Census Bureau
USMC	United States Marine Corps



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USMTF United States message Text Format

USWDS United States Web Design System

V

VA Veterans Administration

VIBES Voice Identity Biometrics Exploitation Services

VMA Vehicle “make”

VMO Vehicle “model”

W

W3C World Wide Web Consortium

WCMaaS Web Content Management as a Service (DHS)

WMA-AFIP Warfighting Mission Area – Architecture Federation and Integration Portal

X

X-COI Cross-Community of Interest

XML Extensible Markup Language

XSD XML Schema Definition

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Appendix B: OASIS Transition Governance & Timeline

NIEM OASIS and Relationships to Current NIEM Structure/ Governance

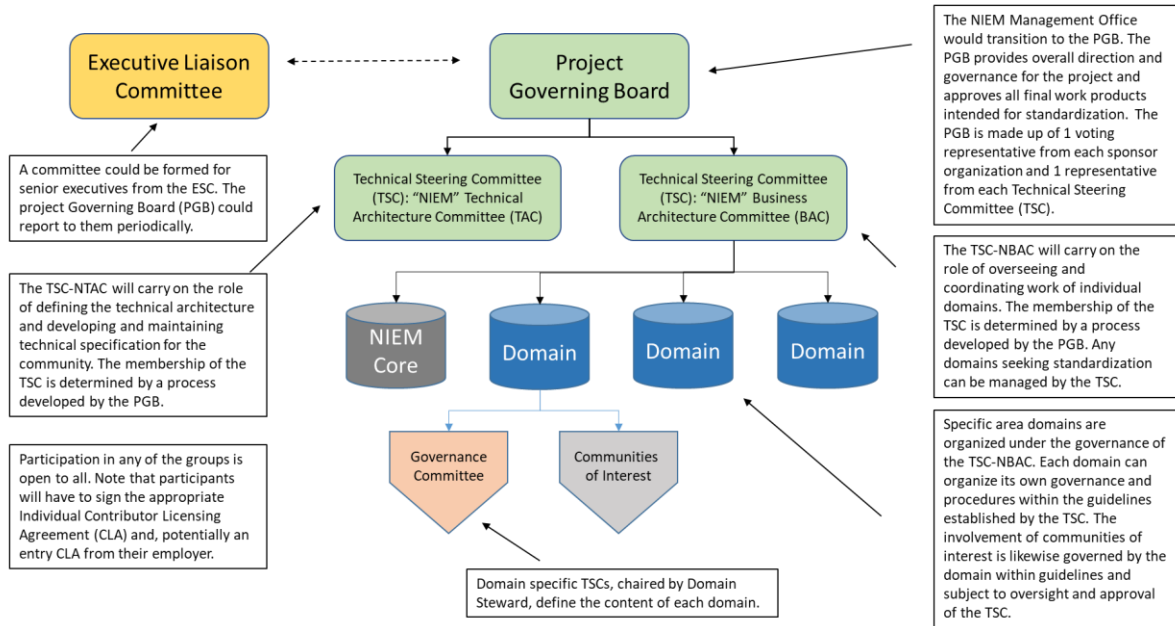


Figure 14: OASIS NIEM Governance Model

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Phased Approach Open Standard 24 Months

- Phase 1 (12 months): Preparation (Governing Documentation and Sponsor Commitments)
- Phase 2 (12 months): Formal
- Transition to OASIS (NMO)



Figure 15: OASIS Transition Timeline



NATIONAL INFORMATION EXCHANGE MODEL

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NIEM.gov

GitHub

<http://niem.github.io/>

 **YouTube**

www.YouTube.com/NIEMConnects

LinkedIn

<http://www.linkedin.com/groups/1903175>



www.twitter.com/NIEMConnects