

# **NICE Framework Competencies: Moving from Concept to Implementation**

## **Workshop Report**

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## Overview

The National Initiative for Cybersecurity Education (NICE) published its first revision of the NIST Special Publication (SP) 800-181, the [Workforce Framework for Cybersecurity \(NICE Framework\)](#), in November 2020. The NICE Framework is a fundamental reference for describing and sharing information about cybersecurity work. In this revision, Competencies were introduced to put into use the Framework's core building blocks: Task, Knowledge, and Skill (TKS) statements.

Adding Competencies to the NICE Framework is a response to a growing need for skilled workers in this field and is reflective of what is happening in the cybersecurity profession at large—a shift towards a skills- and competency-based approach in recruitment and hiring practices and workforce development. Competencies offer a high-level perspective on cybersecurity work and, importantly, are defined via an employer-driven approach, are learner-focused, and are observable and measurable. Competencies provide a means of assessing a learner's capabilities in a defined space while increasing alignment and coordination between employers, learners, and education and training providers.

NICE partnered with the [CAE in Cybersecurity Community](#) to develop a virtual workshop, entitled "NICE Framework Competencies: Moving from Concept to Implementation," in order to better learn from the NICE community about their goals in using the Competencies, as well as to identify more details on what might still be needed in order to effectively implement their use. This workshop engaged learners in active, participatory sessions as a way to gain insights on how stakeholders expect to utilize the NICE Framework Competencies, including determining the greatest challenges and benefits to implementation. As a result, the community provided perspectives and insights that will inform next steps in the development and support of the NICE Framework Competencies.

Prior to the workshop, the NICE Program Office published the draft NIST Interagency or Internal Report (NISTIR) 8355, [NICE Framework Competencies: Assessing Learners for Cybersecurity Work](#), which provides more detail on what NICE Framework Competencies are, including their evolution and development and example uses from various perspectives. Released in conjunction with NISTIR 8355 is a draft [NICE Framework List of Competencies](#) that provides a proposed list of 54 Competencies for the cybersecurity workforce.

The workshop was held over two days:

### **Day 1: Understanding NICE Framework Competencies**

On the first day of this workshop, participants began by taking a closer look at what competencies are generally, how that translates to the NICE Framework Competencies model, and what gaps competencies can fill when it comes to cybersecurity workforce development. Small group breakout sessions focused on use case development from a variety of stakeholder perspectives, and interactive sessions worked to build consensus around key issues.

### **Day 2: Putting Competencies into Practice**

Building from the outcomes of day one, the second day took a closer look at use cases as a way of shifting from concept to application, focusing on questions around assessment and proficiency levels, to ultimately end with greater clarity around what is needed to put NICE Framework Competencies into practice.

The workshop aimed at attracting broad representation from industry, government, and learning providers. Employers (both industry and government) will be central to helping identify and implement Competencies needed by today's cybersecurity workforce, while higher education, training, and certification providers may create content or assessments for learners in alignment with the NICE Framework Competencies. Sixty-one (61) registrants represented industry (23%), academia (34%), and government (43%).

## Day 1: Understanding NICE Framework Competencies

The first day began with a presentation by Karen A. Wetzel, Manager of the NICE Framework, on "Why Competencies?" This presentation shared information about what Competencies have to offer, as well as the reasoning behind the incorporation of Competencies into the NICE Framework. It then provided more details on how NICE Framework defines Competencies and how they might be used in this context. This presentation provided a lead-in to an active discussion session with participants about how they perceived competencies coming into the workshop, what seems promising about competencies, and to raise any major questions they might have about them before moving forward. This discussion addressed topics such as:

- Competencies and their uses are still fairly undefined; there is need for a common language to help with understanding.
- There is currently a divide between academia and employers around the definition and assessment of competencies; integrating them into the NICE Framework may help bridge that divide.
- There are a number of potential applications of competencies—for instance, in apprenticeships, competitions, and academic programs—and the NICE Framework Competencies will need to work across these, as well as across industries.
- It would be helpful to further clarify how NICE Framework Competencies differ from Work Roles, both in definition and use.
- It would be useful to have the NICE Framework Competencies' associated TKS statements aligned to them (as is intended following the NISTIR public comment period).
- A future goal should be to package NICE Framework Competencies into the ecosystem, for instance in learning and employment records (LERs).

## Day 1 Breakout Sessions: Identifying Stakeholder Use Cases

Breakout sessions led participants through the consideration of top Competencies use cases for each of three primary stakeholder groups: employers, learners, and education and training providers. Each breakout group was assigned a single stakeholder perspective and conversations were led by workshop facilitators with support from NICE staff. Each group was asked to identify several top use cases and then select one in order to walk through it in more detail in order to understand how NICE Framework Competencies will likely be used, what benefits implementation might provide, and what work is still needed to reach success.

### Employers

Top scenarios identified by this group included use of the NICE Framework Competencies for the following:

- Drafting job descriptions that will attract qualified candidates, as well as evaluating new hires
- Establishing a system to identify workforce capabilities in order to determine where training opportunities are needed for upskilling

- Specifying team requirements via staff skills evaluated by human resources and management
- In strategic planning to diversify ways of thinking and increase innovation
- In the evaluation of vendors in order to outsource cybersecurity work

Ultimately, this group determined to focus on the scenario around specifying team requirements. When asked to describe what victory might look like in this scenario, the group described it as: “Streamlined team and agility and distributed leadership.” Additionally, the group indicated that success would increase productivity, improve morale, and decrease turnover. These would be enabled in part by the more successful onboarding and retention efforts that a competencies-based hiring and workforce management process might enable.

The group also identified many challenges that would need to be addressed to reach this success stage. When looking at the list of challenges that this breakout group provided, they could be sorted into the following broad categories:

- Additional Effort Required
  - Too complex
  - Too time consuming
  - Lack of comprehension
  - Difficulty compiling globalized dictionary
- Established Processes Needed
  - Lack of standardized assessments
  - Inability to measure results
  - Inability to measure ROI
- Existing Problems
  - New technology needs
  - Employee turnover
  - Lack of executive buy-in
  - Cost of hiring permanent employee vs contractor
  - Experience requirement new graduates face

Ironically, the list of existing problems here are identified as challenges but could possibly also be considered through a different lens: many of these might actually be *addressed*, if not resolved, by a coordinated and systematic implementation of Competencies. For instance, employee turnover might be lessened if Competencies are used to align applicant capabilities (either through Competencies-aligned coursework or via other assessment) with position requirements, ensure more rewarding and successful performance while in a position because of better career fit, as well as establishing career growth paths in the organization (including offering training) in areas identified by Competencies.

Regardless, the list that this group identified does indicate that a shift in this direction will need support—both internal (e.g., with executive buy-in) and external (via resources to help encourage buy-in, including recommended processes). The breakout group was directly tasked to identify what supports might be needed to deal with the identified challenges. This group indicated that the following would be required before reaching success; they have been sorted here into broad categories.

- Tools
  - Standardized assessments (including self-assessments)
  - Standardized job description template
  - Development of micro-credentials and learning and employment records (LER)

- Workforce Management Adjustments
  - Provision of training opportunities (and time to take advantage of these) for staff
  - Organized career pathways
- Promotion
  - Conferences
  - Visibility and marketing for cybersecurity
  - Addressing lack of knowledge about job roles in cybersecurity

And, overall, the group agreed that the path toward success would need to be flexible while also establishing an up-to-date process for stakeholders who want to engage.

### Education and Training Providers

Top scenarios included the use of NICE Framework Competencies for the following:

- Use of Competencies in courses for students to learn from
- Learning assessments tied to NICE Framework Competencies
- Competencies to provide guidance to both educators and industry to bridge the gap between the two when matching for apprenticeships

Ultimately, this group determined to focus on the scenario that focused on how NICE Framework Competencies could be used with cybersecurity apprenticeships. When asked to describe what victory might look like in this scenario, the groups shared that a successful integration of NICE Framework Competencies with apprenticeship programs would bring industry and training providers to a consensus on what demonstrable skills are needed, would establish commonly agreed-upon language that could be used for job descriptions, and would integrate both soft and essential skills. In addition to these top indicators of success, other factors included a better understanding of cybersecurity workforce needs in various industries and stronger correlations between knowledge units (KU's) for the Centers of Academic Excellence (CAE) in Cybersecurity and NICE Framework Competencies.

As with the employer-focused breakout group, numerous hurdles must be addressed prior to achieving success. The list of challenges they provided could be sorted into the following broad categories:

- Employer Buy-in
  - To get employers to buy into apprenticeship
  - Only a few employers have signed up for this model
  - Need employers to adopt common taxonomy (Work Roles or Competencies) when describing a position's requirements
- Establish Processes Needed
  - Prescription to use Competencies, get them adopted
  - Need to map CAE curricula to not just KU's but concrete elements of NICE Framework
  - Need to develop learning assessments for CAE students that validate a learner's ability in Competency areas and that, most importantly, employers will trust
  - Facilitated coordination between key players

In addition to the above, the group also noted the impact of the pandemic on apprenticeships, as work-from-home situations have eliminated, or at least suspended, many internships. It is generally expected that many organizations will likely be more flexible with work-from-home or hybrid work models in the future and may have a continuing impact on the availability or structure of apprenticeships and

internships. Finally, one item that the group listed as a challenge is in fact more of a success outcome: “Adopting these [Competencies] helps assessing outcomes, qualifying for a job.”

This group identified three items needed to move toward success:

- Clear ways to assess Competencies
- Strategies to deepen and enhance ties between education, training providers, and industry
- An ability to use the NICE Framework as a tool for training

### Learners

The NICE Framework defines learners broadly, as all those performing cybersecurity work—including students, job seekers, and employees. The breakout group that was tasked to consider NICE Framework Competencies from this perspective identified the following top scenarios:

- Employee-based self-assessment against established role expectations
- To help in candidate expectations
- Establishing organization role and proficiencies
- Skills maturity assessment
- To identify relevant training

Ultimately, this group determined to focus on self-assessment. When asked to describe what victory might look like in this scenario, they described the following:

- Human resources looks beyond traditional, degree-based measures to open up opportunities and broaden applicant pools
- Business units, managers, and employers can better fit learners to career paths
- Learners better understand what employers want
- Learners have the opportunity to self-assess and accurately measure against Competencies

In order to reach this stage, however, the group identified the following challenges that will need to be addressed: a clear understanding of Competencies that can be used across internal business units (e.g., for human resources and for managers) and that trust needs to be built so employers know students are developing Competencies that truly meet today’s cybersecurity workforce needs. The breakout group identified the following solutions:

- Increase use of the NICE Framework
- Provide more support to how the NICE Framework can be used by both small and large businesses
- Define a process for organizations to define expected Competencies that can then be incorporated into curricula

### Sharing Out

Following the breakout sessions, the groups came together to share what they discussed and reflect on common themes. One significant area of agreement was the need for common language in order to unite academia, industry, and government—the goal of the NICE Framework. Overall, themes that came to the top for benefits, challenges, and solutions were shared out and are summarized in Table 1: Day 1 Breakout Summary.

*Table 1: Day 1 Breakout Summary*

Benefits	Challenges	Solutions
<ul style="list-style-type: none"> <li>• Enhanced connection between stakeholders</li> <li>• Modularity: ability to scale across organization sizes and types</li> <li>• Greater understanding of position needs</li> <li>• Improved assessment and efficiency</li> <li>• Increased employability and better hires, improved teams</li> <li>• Improved capabilities—including soft skills and strategic thinking (not just technicians)</li> </ul>	<ul style="list-style-type: none"> <li>• Processes:               <ul style="list-style-type: none"> <li>○ How to align assessment with varying industry demands</li> <li>○ Need to develop established metrics, proficiency levels, and ongoing and dynamic assessments</li> <li>○ Need to maintain Competencies for currency and relevance</li> </ul> </li> <li>• Acceptance and Buy-In               <ul style="list-style-type: none"> <li>○ NICE Framework Competencies are not yet fully understood</li> <li>○ Need for improved trust and enhanced relationships between stakeholders</li> <li>○ Slow adoption or refusal to adopt Competency approach by employers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Competencies should be prioritized for educational requirements</li> <li>• Use Competencies to:               <ul style="list-style-type: none"> <li>○ Connect challenges to course outcomes</li> <li>○ Help define exit exams</li> <li>○ Align with CAE KUs and certifications</li> <li>○ Use as part of the job interview process</li> </ul> </li> </ul>

## Day 2: Putting Competencies into Practice

The second day of the workshop looked more closely at proficiencies and assessment in the context of the NICE Framework Competencies. In order to focus the conversation, breakout groups were asked to consider these topics from the perspective of a specific use case, pulling from day one.

The day was kicked off by a session on “Understanding Proficiencies and Assessment” with guest speakers Lisa Dorr (Senior Talent Management Strategist, Cybersecurity and Intelligence Talent Experience (CITE) Division, Office of the Chief Human Capital Officer, Department of Homeland Security) and Max Shuftan (Director, CyberTalent Programs, SANS Institute). Ms. Dorr provided context as to how proficiencies can be used in setting targets and measuring capabilities for Competencies. Mr. Shuftan then shared with attendees promising practices in cybersecurity talent assessments for recruiting, upskilling, and retraining.

### Day 2 Breakout Sessions: Proficiencies and Assessment

Following this introduction to how proficiencies and assessment might be used to forward the applicability and outcomes enabled by Competencies, the attendees were again split into three breakout groups. For this day, each group was assigned a specific use case that they were asked to use as the foundation for their conversations, one for each of the three stakeholder perspectives introduced on the first day; these were then fleshed out by each group. They included:

- **Employer Perspective: Tracking Workforce Capabilities.** This use case includes NICE Framework Competencies integrated into performance plans, talent acquisition forms, interviews, continual learning programs (and non-standard learning), employee assessment, and capability gap analysis.
- **Education and Training Provider Perspective:** Tying curriculum to NICE Framework Competencies. This use case is about using the NICE Framework Competencies as a curriculum framework from which programs of study and courses can be developed. By tying courses to one or more Competencies, students can be sure to develop necessary knowledge and skills and demonstrate their ability to perform tasks.
- **Learner Perspective: Self-Assessment.** The breakout group for this perspective narrowed down this topic to focus on adult reskilling, where NICE Framework Competencies are used in applying aptitude for entry-level skills.

Each group was asked to consider how proficiencies and assessment would play a role in their use case. For proficiencies, the groups brought forward the following concepts summarized in Table 2: Proficiencies Breakout Groups Summary, below.

Table 2: Proficiencies Breakout Groups Summary

Proficiencies Questions	Employers	Education and Training Providers	Learners
How can they benefit the use case?	<ul style="list-style-type: none"> <li>Establishing expectations</li> <li>Determining priority of work and micro vs macro baselines</li> </ul>	They can be used to assess proficiency in performing a singular task or for a specific knowledge or skill in a particular Competency	They can help learners develop strong problem-solving skills, encourage interest in learning new things, help develop specialized study, provide an inventory of areas someone is interested in, and help determine programs for a student to go into
What scale (or levels) would be needed and why?	5-tier scale: <ul style="list-style-type: none"> <li>Interested</li> <li>Foundational</li> <li>Intermediate</li> <li>Advanced</li> <li>Expert</li> </ul>	3-tier scale: <ul style="list-style-type: none"> <li>Basic (foundational)</li> <li>Intermediate</li> <li>Advanced</li> </ul>	A scale that accommodates both technical and managerial skills and that works with a matrix of capabilities into careers for applicants
Would proficiencies apply to the NICE Competency overall, at a component (e.g., statement) level, or both, and why?	There are benefits to a macro and micro approach: <ul style="list-style-type: none"> <li>Macro allows more flexibility, avoids assessment exhaustion</li> <li>Micro can provide more averaged assessment but may create assessment exhaustion</li> </ul>	Evaluations should prove competency overall, while also drill down to align to TKS.	Component level is a more easily understood concept and provides granularity needed to talk across the field.
What kind of proficiencies scale would be useful? <ul style="list-style-type: none"> <li>A standard scale</li> <li>A suggested, adaptable model</li> <li>No model; created case-by-case</li> </ul>	A model that allows for flexibility and adaptability is needed, as users will vary; for instance, government has more “red tape” than private industry, and some organizations may be more mission driven while others are more process driven	A license model would be most useful	A standard scale that will be adopted in the same way across the board would be most useful in this use case

As can be seen by the above table, although there are some similarities in answers, there is not complete agreement. However, looking at proficiencies through the lens of a specific stakeholder use case provided some clarity that will be used as next steps are taken and additional resources in support of the NICE Framework Competencies are developed.

A similar approach was used to consider the all-important topic of assessment. Results can be seen in the Table 3: Assessment Breakout Groups Summary, below.

Table 3: Assessment Breakout Groups Summary

Assessment Questions	Employers	Education and Training Providers	Learners
<p>How can they benefit the use case?</p>	<p>Assessments provide a multitude of benefits. They:</p> <ul style="list-style-type: none"> <li>• Provide a baseline</li> <li>• Categorize where they are in the NICE Framework</li> <li>• Help project future needs</li> <li>• Increase employee retention through growth and direction</li> <li>• Improve employee reallocations</li> <li>• Establish current gap analysis</li> <li>• Identify in-demand Competencies and top hiring needs</li> </ul>	<p>Assessment can be formative or summative (of the learning program, course, or student), as well as self-assessment</p> <p>It offers assurance of consistency of ways assessment is done</p>	<p>Provides a student perspective and can show an organization what the person has achieved so far</p> <p>Revisiting assessments and regular testing can provide additional information over time</p>
<p>How would you determine what type of assessment to use in this use case?</p>	<p>This would need to be done at the employer level, depending on the motivation of the assessment, and may be factor based and circumstantial; assessments may be separated by phase (e.g., during recruitment phase, promotion)</p> <p>However, a rubric is needed as guidance to help organize subjective and objective assessments. Guidance could be provided to employers on how to use assessments and validate which assessments have merit and value</p>	<p>Assessments will vary depending on what is being assessed; for instance, knowledge-based vs. performance-based assessment; skills maturity assessments; or multiple assessments used to diversify the portfolio of information on a candidate</p>	<p>Assessments may vary depending on what is being assessed, for instance, aptitude vs. knowledge vs. achievements</p> <p>Useful tools for assessment might include:</p> <ul style="list-style-type: none"> <li>• Recurring assessment tool to be used over time (e.g., annually)</li> <li>• Desirability test</li> <li>• Automated set of tests that are updated regularly</li> </ul>

Table 4: Assessment Breakout Groups Summary, Continued

Assessment Questions	Employers	Education and Training Providers	Learners
<p>What is needed to ensure effective, credible assessment?</p>	<ul style="list-style-type: none"> <li>• Defined criteria for common circumstances (e.g., internal vs external assessment, recruitment vs development phase, etc.)</li> <li>• More information about which assessments create trust internally vs externally</li> <li>• Increased validity brought by technical expertise needed to develop the assessments</li> <li>• A balance of subjective and objective assessments is needed</li> </ul>	<p>Access to tools and assessment approaches that are:</p> <ul style="list-style-type: none"> <li>• Reliable</li> <li>• Validated</li> <li>• Standardized</li> <li>• Scalable</li> </ul> <p>Assessment tied to accreditation</p>	<p>Access to:</p> <ul style="list-style-type: none"> <li>• Best practices unique to academia, industry, government</li> <li>• Timely, triangulated research</li> <li>• Qualitative tool (critically reflective)</li> <li>• Community of interest</li> </ul>
<p>How would assessment results be used by the organization?</p>	<p>In this use case, assessment outcomes would be used to: provide training, fill gaps, identify trends, promote staff, etc.</p>	<p>In this use case, outcomes could influence student decisions on which programs to attend, provide documentation students can present to employers for proof of ability (via a portfolio or LER), and identify individual or curricular areas for improvement</p>	<p>In this use case, outcomes can help learners decide a program of study, for personal or professional growth, and in tracking development and gaps</p>

Some additional common threads were identified when the groups came together to share their conversations with other participants, such as if there could be a recommended approach to proficiency or an adaptable assessment model that could be revisited, evolve, and be tailored for local circumstances. At the same time, assessment-related recommendations include: assessments should be repeatable in order to gauge change over time; a variety of assessment types and their strengths and weaknesses should be outlined; and assessment results should be used to increase their value, potentially through story-telling.

## Next Steps

The information shared in this workshop, from presenters and participants alike, will inform future steps that the NICE community can take to further refine and advance understanding of the NICE Framework Competencies and how they can be used. Along with comments received on the draft [NISTIR 8355, NICE Framework Competencies: Assessing Learners for Cybersecurity Work](#) and the draft NICE Framework List of Competencies, these community insights will help ensure that the Competencies are developed with the guidance and support needed to ensure that they are useful and effective implementations of the NICE Workforce Framework for Cybersecurity.