Prototyping a Modernized Navy Personnel Qualification Standard (PQS) System

iFest conference presentation, **29 August 2018**

Dennis Mills, Naval Education and Training Command (NETC)

J.T. Folsom-Kovarik, Soar Technology, Inc. (presenting)

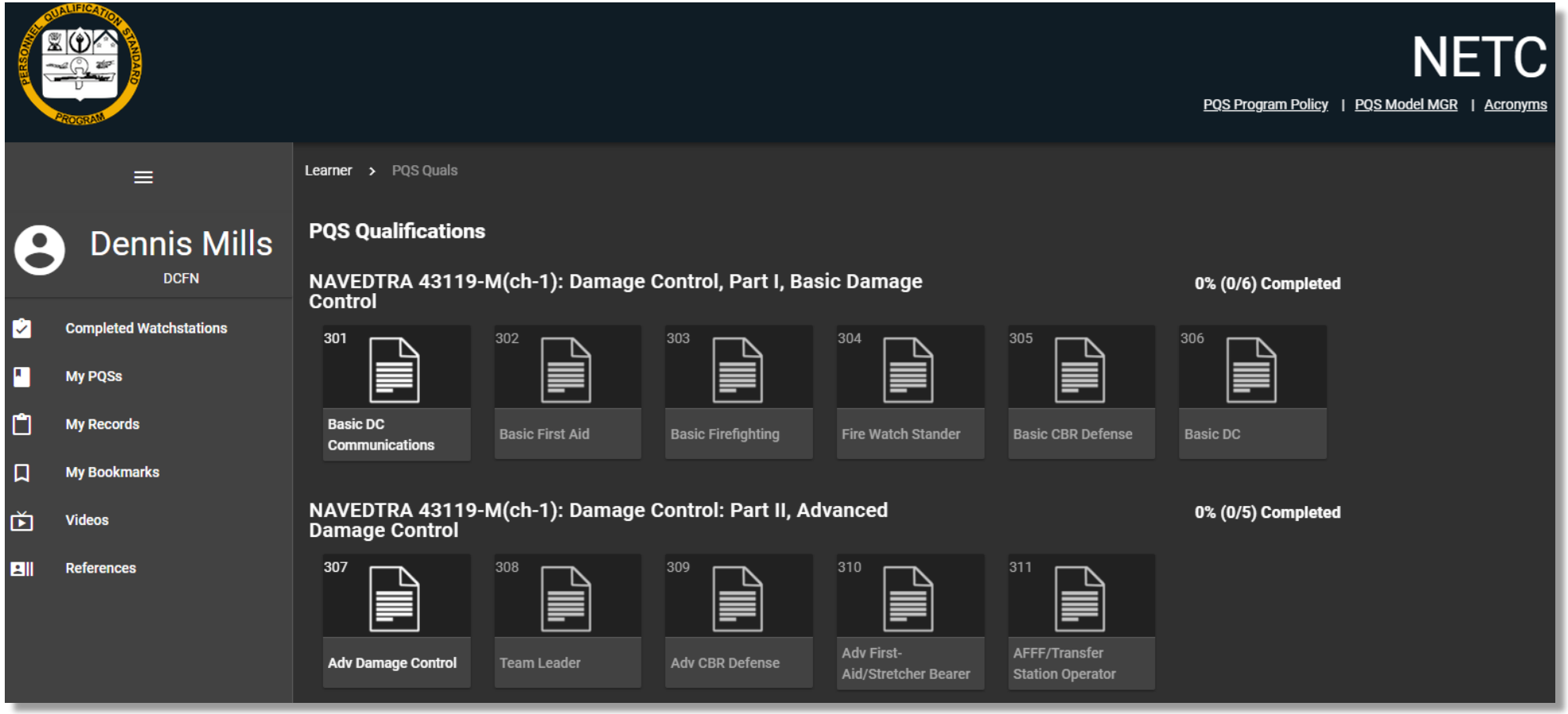
Overview

- Navy's **Personnel Qualification Standards (PQS)** system is ripe for modernization
  - There is a need for standardized and centralized learning material
    - Rather than ad-hoc or distributed across locations
  - Sailors expect digital systems
    - Rather than paper-based and manually coordinated
  - Modern science of learning tools could monitor qualifications
    - Sailor readiness and skill progression
    - Effectiveness of all content over time
- What would a modernized digital PQS look like?

SOARTECH

Vendor Perspective

- Demonstrate "art of the possible" with an **agile, six-week development** effort to depict and win buy-in on what a digital PQS system would look like.



Ready Relevant Learning (RRL)

- Today, RRL is fundamentally changing how Sailors learn
  - All aspects of RRL are focused on making a Sailor an optimal performer
- **Learning Continuum**: how could PQS provide the right training at the right time?
  - Shorten the time throughout a career between training and on-the-job need
- **Modern Delivery at Point of Need**: How can PQS leverage digital technology?
  - Incorporate modern capabilities like linked systems, authoritative data
- **Integrated Content Development**: How do we ensure training is valid & relevant?
  - Manage change and mitigate obsolescence in an evolving environment

Prototype Design Goals

- Ensure safety and mission completion never falter
  - Must earn trust in the digital system
- Minimize human-system disruption
  - Will continue 50 years of tradition and culture
- Minimize disruption in Fleet workflows
  - Keep clear correspondence with existing paper process
- Preserve existing Qualifier-Sailor interactions
  - Maintain or increase accountability within the system

SOARTECH

Rapid Development

- Six week total development cycle
  - Agile engineering approaches in a DoD setting
- First week
  - Kickoff and domain selection: Damage Control
  - Three full days of face to face design meetings between stakeholders and vendor engineers
- Weekly engineering sprints
  - Weekly status updates to all stakeholders
  - Weekly remote demos of current functionality
- Fast feedback from subject-matter experts
  - Quick and collaborative software changes
  - Continuous learning and improving the product

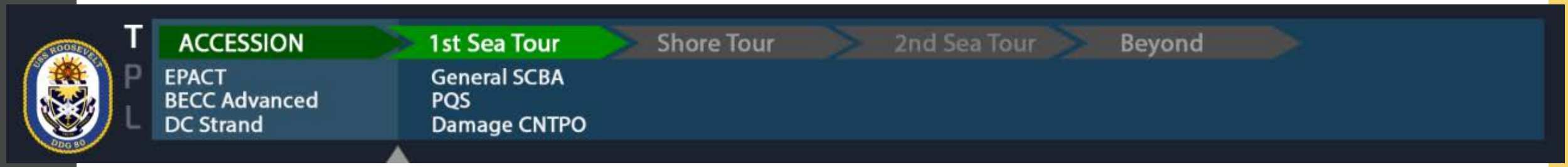
SOARTECH

Developed Features

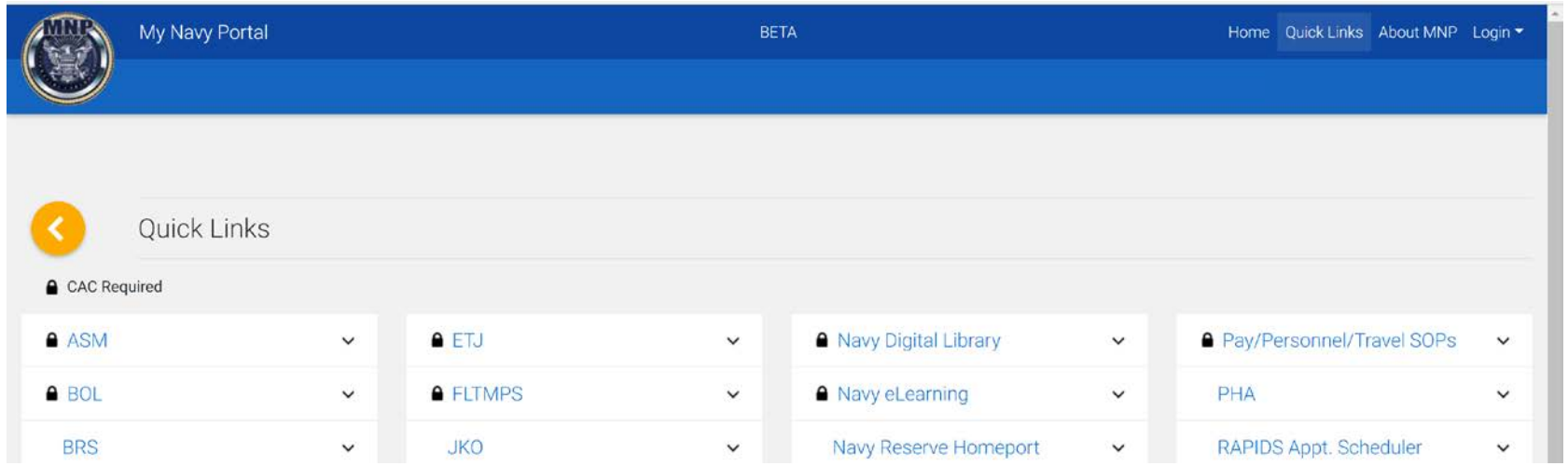
- Learning Continuum Display
- Learning Continuum Portal
- Learning Resources
- Qualifier Interface
- xAPI Integration
- Backend / Learning Data Stack
- Web Architecture

Learning Continuum Display

- Present learning material on a continuum
  - Sailors see the connection to their Naval careers
- Track and guide Sailors at all stages of career life cycle:
  - Time
    - Accession, First Sea Tour, Shore Tour, Second Sea Tour, and Beyond
  - Competencies
    - Technical, Professional, and Leadership development



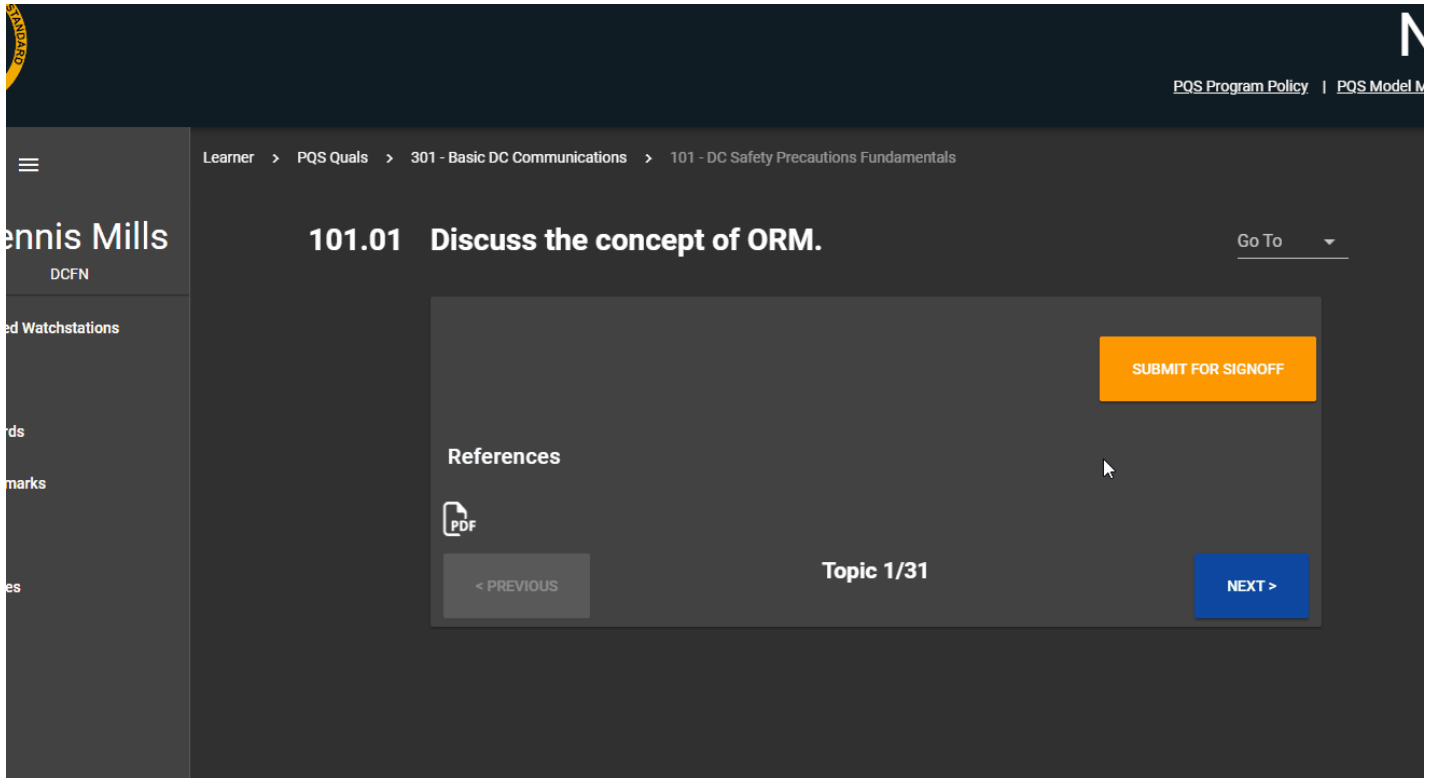
Learning Continuum Portal



- Single access entry into learning topics and resources
- Research character can support long-term relationship
- In the future, will facilitate directing sailors through myriad of training resources and suggest personalized “next steps” for learning

Learning Resources

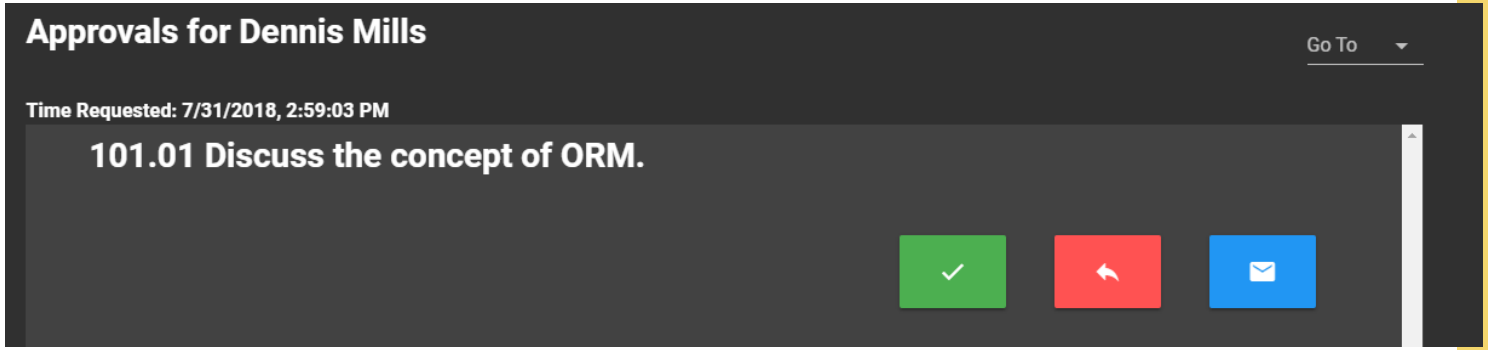
- Repository of validated learning material supplied at the point of need
- Supports multiple media formats including future augmented reality
- Links to resources embedded directly in the question itself

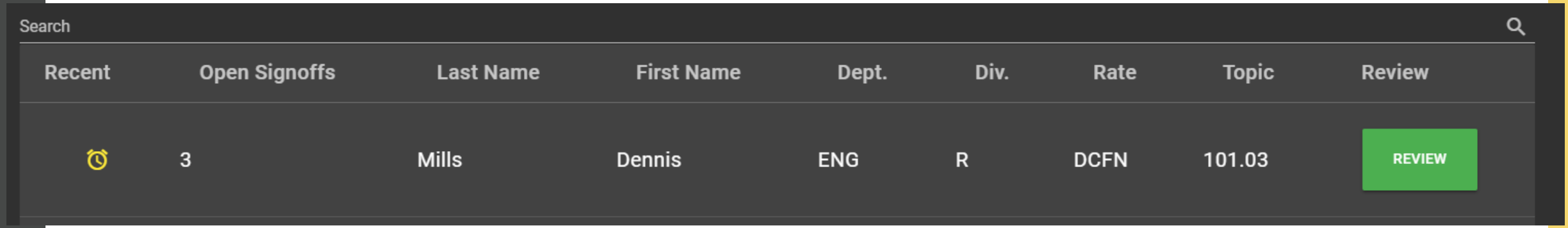


SOARTECH

Qualifier Interface

- Follows Sailor progress as evidence of readiness for assessment
- Dashboard of progress and open signoff requests
- Qualify students on particular PQS topics
- PQS section-level signoffs





SOARTECH

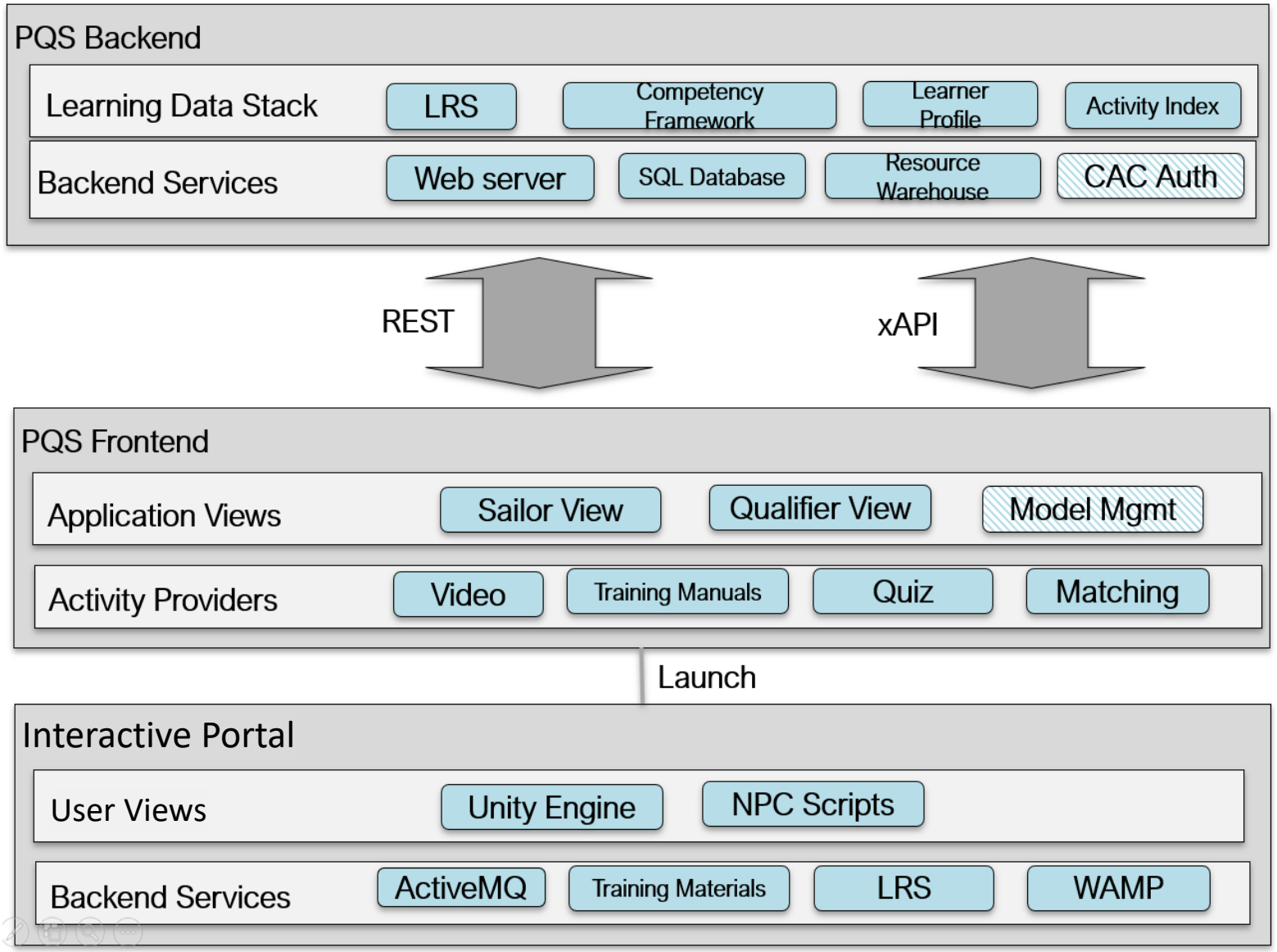
xAPI

- Track fine-grained student-content interactions
  - Pages viewed in a PDF
  - Percentage of video watched
  - Content completed, how recently and how quickly
  - Individual answers correct / incorrect in practice quizzes

- Can gather longitudinal statistics and enable inferences
  - Content view count indicating utility to Sailors
  - Usage in context indicating use case (reference, test prep, introductory)
  - Change over time indicating possible obsolescence of content

Implemented Architecture

- Moves Science of Learning concepts into operational use
- Leverages existing DoD and Naval research investments



SOARTECH

Backend / Learning Data Stack

- Learning Record Store (LRS)
  - Serves as an xAPI data warehouse
  - Stores evidence about learners, resources, and qualifications
- Competency framework
  - Defines and relates job tasks, competencies, and underlying knowledge or skills
- Learner profile
  - In our use, a long-term record of inferences about student performance and qualifications
- Activity index
  - Maps every Naval watch station to required learning material and PQS qualifications

SOARTECH

Web Architecture

- RESTful web services back end written in Java (JAX-RS)
  - Can support multiple user interfaces if needed
- User interface / front end written in Vue.js
  - Can run on laptop or mobile devices
- Data storage with Postgres DB for logins, user roles, learning ontologies
  - LRS for activity records, qualifications
- Can embed and deliver a variety of content with xAPI integration:
  - Movies (HTML 5 video player)
  - PDF (JS-based PDF renderer)
  - Multiple-choice quizzes
  - Links to launch external learning activities

Technical Challenges

- Deployed hardware must be compliant with DoD IA guidelines
  - NIST SP-800
  - DISA's STIG (Security Technical Implementation Guides)

- Interoperability between data silos – even within the Navy, there are challenges to collecting and centralizing information
  - Challenges collecting training material
  - Legacy training exists in Adobe Flash, must be rewritten for modern Information Assurance

- DoD needs shared standards for xAPI usage
  - Common challenges: Unique identifiers not aligning, verb mismatches, inconsistent triggers, different ways of referencing content (ID, URL, etc), link data versus catalogs for vocabulary

Lessons Learned

- Tight communication loop between vendor and DoD representatives
  - DoD stakeholders, funders, leadership
  - Subject-matter experts and end users
- Software solutions should be agnostic to hardware choices
  - Responsive UI design to flexibly meet deployment constraints
  - Visual clarity for use on multiple devices
- Open challenges in integrating LRS solutions in real-time web systems
  - Existing SOTA LRS solutions have slow (> 100 ms) response times for retrieval
  - Cannot process inside the user interaction timeframe
  - Local caching layer, offline processing, and process batching needed

SOARTECH

Conclusions

- Agile development in a DoD setting
- Working prototype with IA compliance enables demonstration and feedback
- xAPI enabled
- Supports Ready Relevant Learning to help every Sailor perform at peak

SOARTECH

Questions?

- **Acknowledgement**
  This material is partially based upon work supported by the Naval Education and Training Command (NETC) under Contract No. OPM2615D0001.
  Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NETC or the Department of Defense.

- **For more information**

  J.T. Folsom-Kovarik
  Lead Scientist, Soar Technology, Inc.
  Jeremiah@soartech.com
