

Testing Environments for Assessing Conformance and Interoperability

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National Institute of Standards and Technology

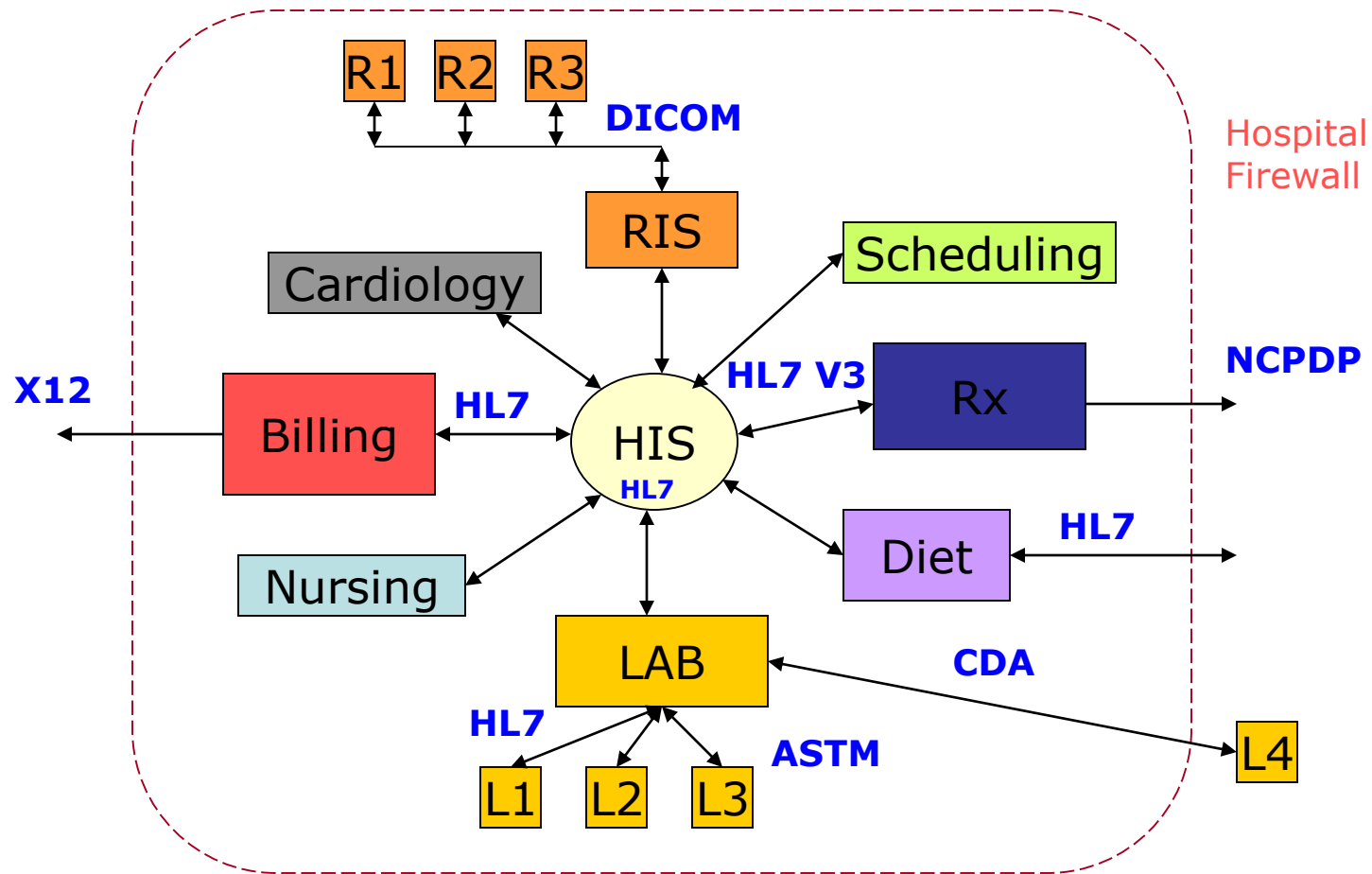
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Outline

- Background and Motivation
 - Healthcare System Landscape
 - Healthcare Data Exchange Standards
 - Testing of Healthcare Data Exchange Standards
 - American Recovery and Reinvestment Act (ARRA)
 - Meaningful Testing
- Testing Environments Taxonomy
 - Aspects of Conformance and Interoperability Testing
- Testing Environments
 - Patient Management and Document Retrieval Use Case
 - Example Walk-through
 - Testing Infrastructure
- Wrap-up

Healthcare Integration

Problem: Exchanging Data Reliably



Adapted from HL7 Desktop Reference Guide—NeoTool 2002

Healthcare Data Exchange Standards

- Standards
 - HL7 V2 – messaging standard for exchange of administrative and clinical data
 - HL7 V3
 - messaging standard for exchange of administrative and clinical
 - Reference Information Model/XML Based/OO Approach
 - DICOM – messaging standard for exchange of medical images
 - CDA – document standard for exchange of administrative and clinical data
 - IEEE 1073 – standard for exchange of data between medical devices
 - NCPDP – ePrescribing standard
- Organizations
 - HITSP - Develop HIT Standards and Specifications
 - NHIN - Conduct testing to ensure that products align with recognized HIT standards
 - IHE
 - Develop HIT Standards and Specifications
 - Conducts standards testing in various contexts
 - And more...

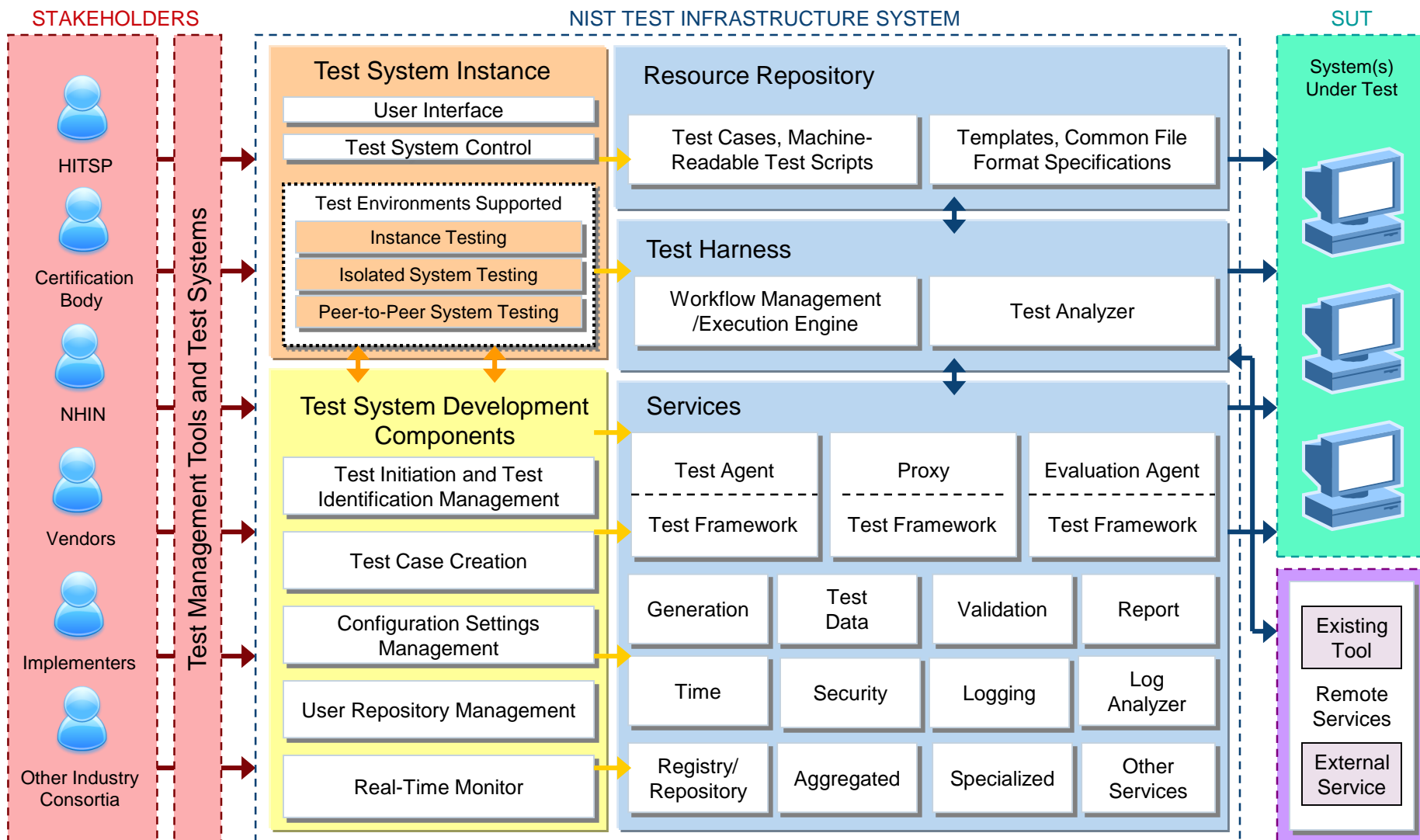
Testing of Healthcare Data Exchange Standards

- Meaningful Use (U.S. Office of the National Coordinator (ONC))
 - American Recovery and Reinvestment Act (ARRA)
 - Encourage a more widespread adoption of interoperable health information technology
 - Legislation calls for the ONC for Health IT, in consultation with NIST, to recognize a program for the voluntary certification of health information technology as being in compliance with applicable certification criteria to meet defined meaningful use requirements
 - Vendor products are certified
 - Provider s who purchase and use products meaningfully get incentive payments
- IHE
 - Pre-connectathon – Individual conformance testing prior to Connectathon
 - Connectathon Event – On-site Interoperability Testing
- Organizations
 - HITSP
 - NHIN – Testing at the regional network level
 - CCHIT - Conduct testing associated with the organization's certification criteria; NIST provided tools to support CCHIT testing

Motivation

- We need to be able to support a wide range of testing
 - Provide a variety of testing services to health IT stakeholders
 - Support conformance and interoperability testing for numerous healthcare messaging and document data exchange standards
 - Provide a set of reusable components and services
 - *“A Framework for Building Test Systems—an SOA Approach”*
 - *Assortment of testing infrastructure uses*
 - *Enables user customization*
 - Support different delivery mechanisms including APIs, desktop applications, web applications, and web services
 - Provide a feedback loop to enhance the healthcare standards
 - Integrated existing tools when appropriate
 - Collaborate and harmonize with other tooling efforts
 - Roll out tools and resources incrementally
- State of testing of healthcare data exchange standards
 - There is not a clear understanding of testing terms or concepts in the industry or testing organizations
 - The depth and level of conformance and interoperability is not fully understood or portrayed correctly
 - Testing events or certifications claimed interoperability testing in which only certain aspects of testing are done
 - This is not sufficient for interoperability
 - After testing was completed little knowledge of the coverage and depth of testing is given or known to the systems/vendors that under when testing
 - Little understanding of the testing environments and what can be tested in those in environments
 - Testing is fragmented
 - Disparity in tools
- NIST goals
 - Harmonize testing efforts
 - Present methods to present coverage and scope of testing
 - Develop healthcare testing infrastructure that can be leverage
 - Concepts discussed in this talk will be integral to the design of the testing infrastructure

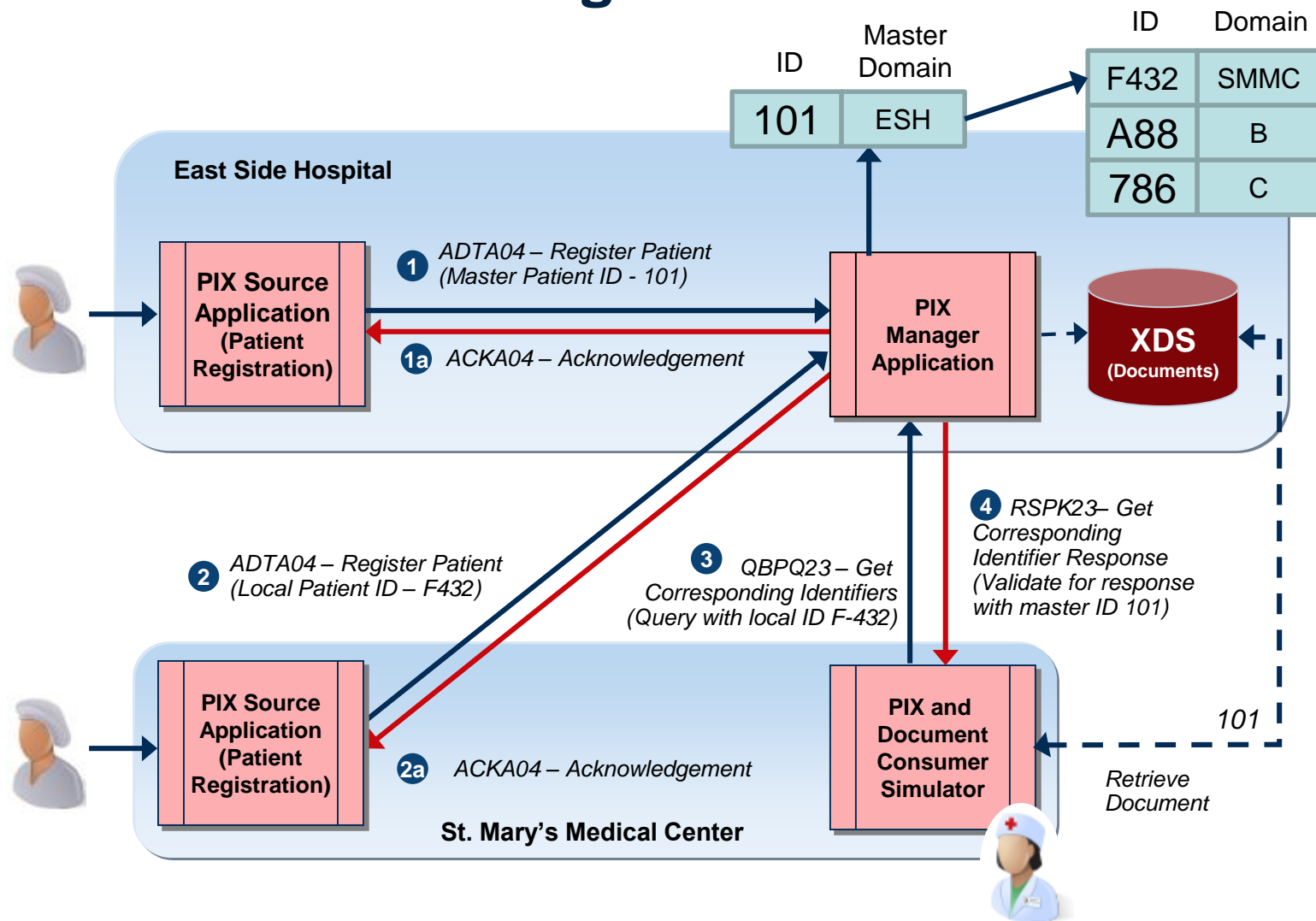
Conceptual View of System Components



Test Environments Taxonomy

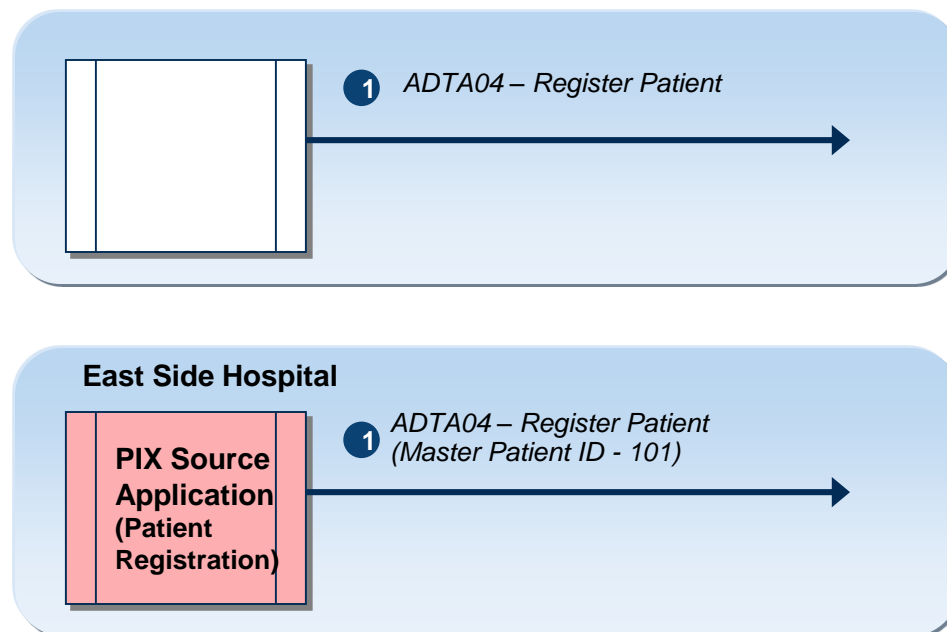
- Data Instance Test Environment
 - Evaluation of data content against a set of conformance rules
 - Data Content Validation Testing
 - No Context; not associated with an application
 - Data Content Conformance Testing
 - Test object is identified as having been produced by a specific application
- Isolated System Test Environment
 - Includes Instance Testing Activities
 - Protocol Usage Conformance Testing
 - Testing for Conformance to the Requirements of the Data Exchange Standard
 - Test range of conformance requirements
 - Multiple test cases conducted
 - System Behavior Conformance Testing from Application Functional Requirements
 - e.g., Pre-connectathon Testing
- Peer-to-peer System Test Environment
 - Includes Isolated System Testing Activities
 - Syntactic Interoperability Testing
 - Semantic Interoperability Testing
 - e.g., Connectathon Testing

Patient Identification Management Use Case

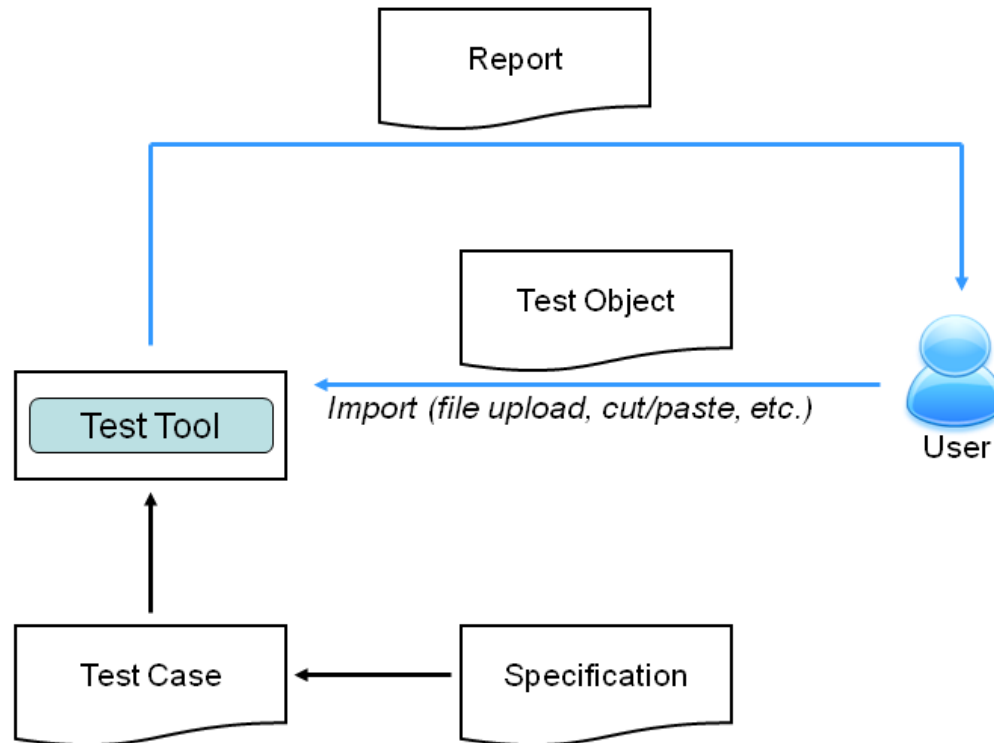


Data Instance Test Environment

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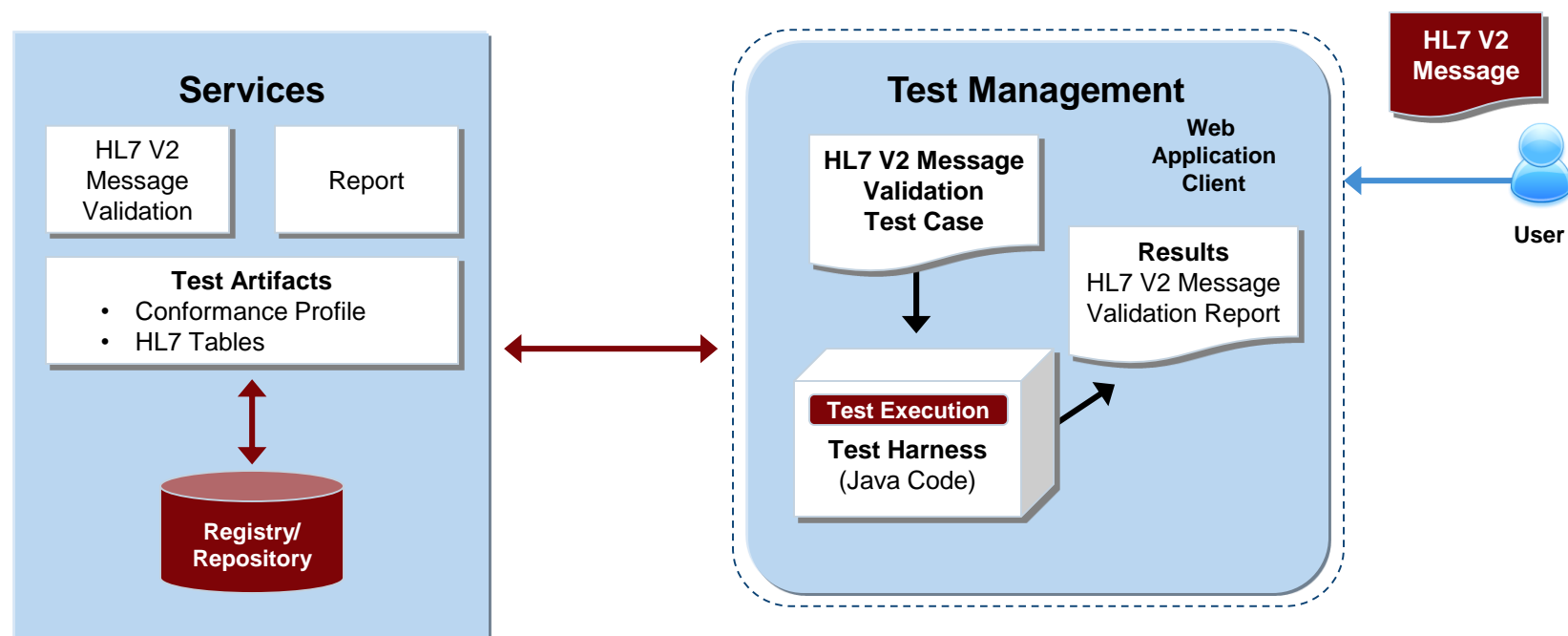


Data Instance Testing



Instance Testing

Conformance Testing of an HL7 V2 Message

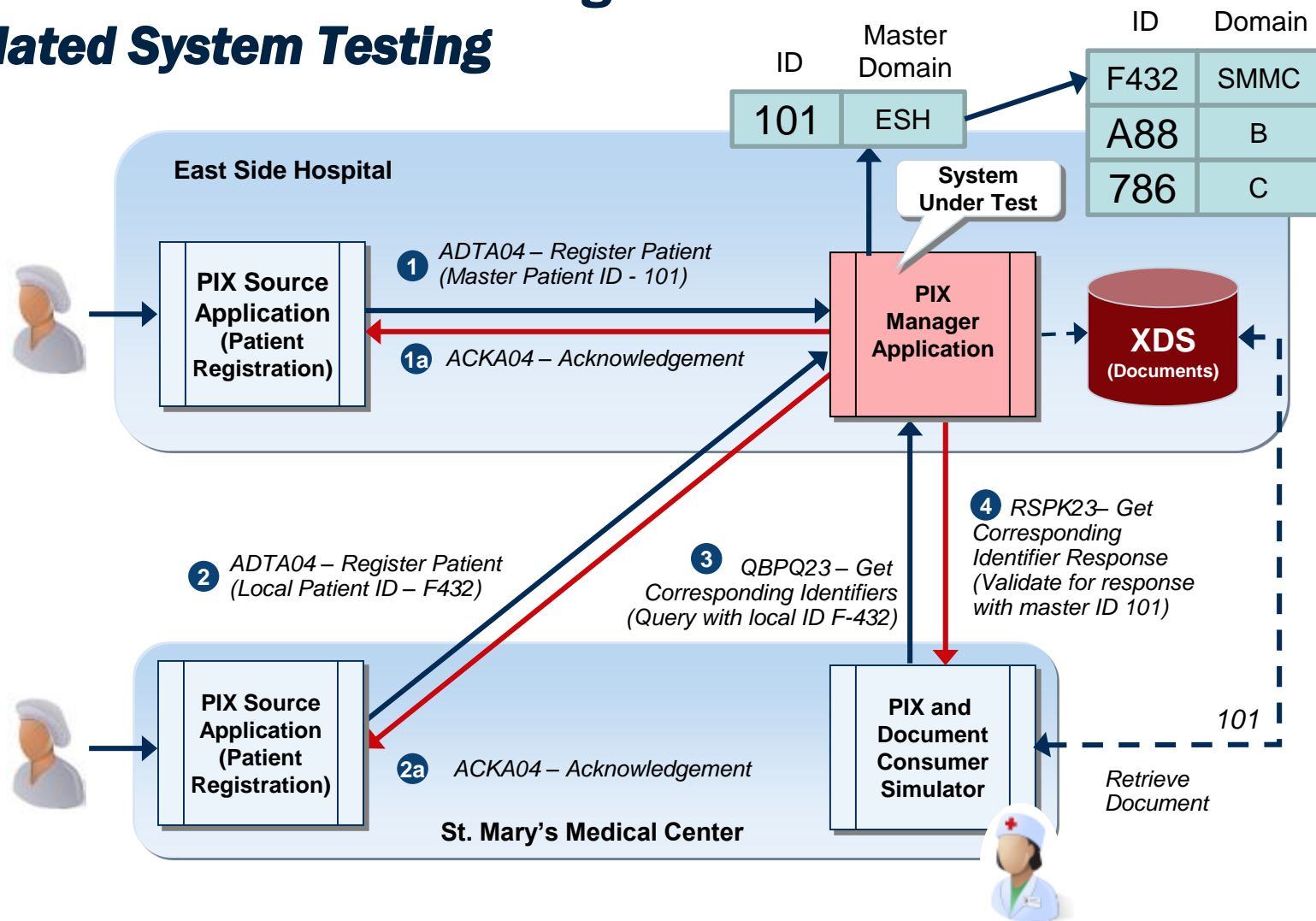


Isolated System Test Environment

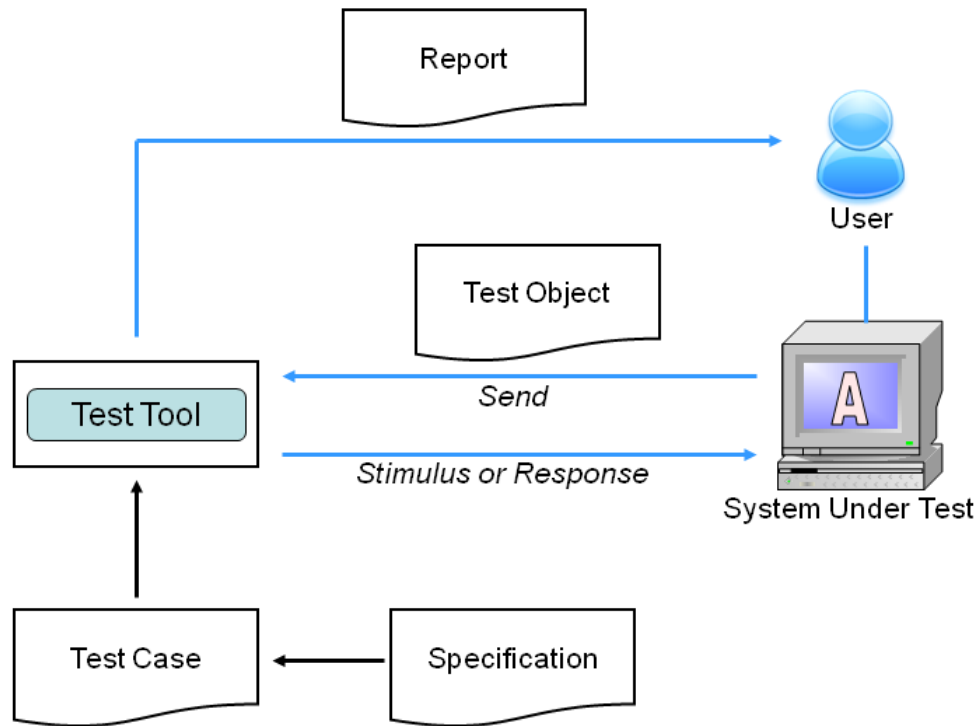
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Isolated System Testing

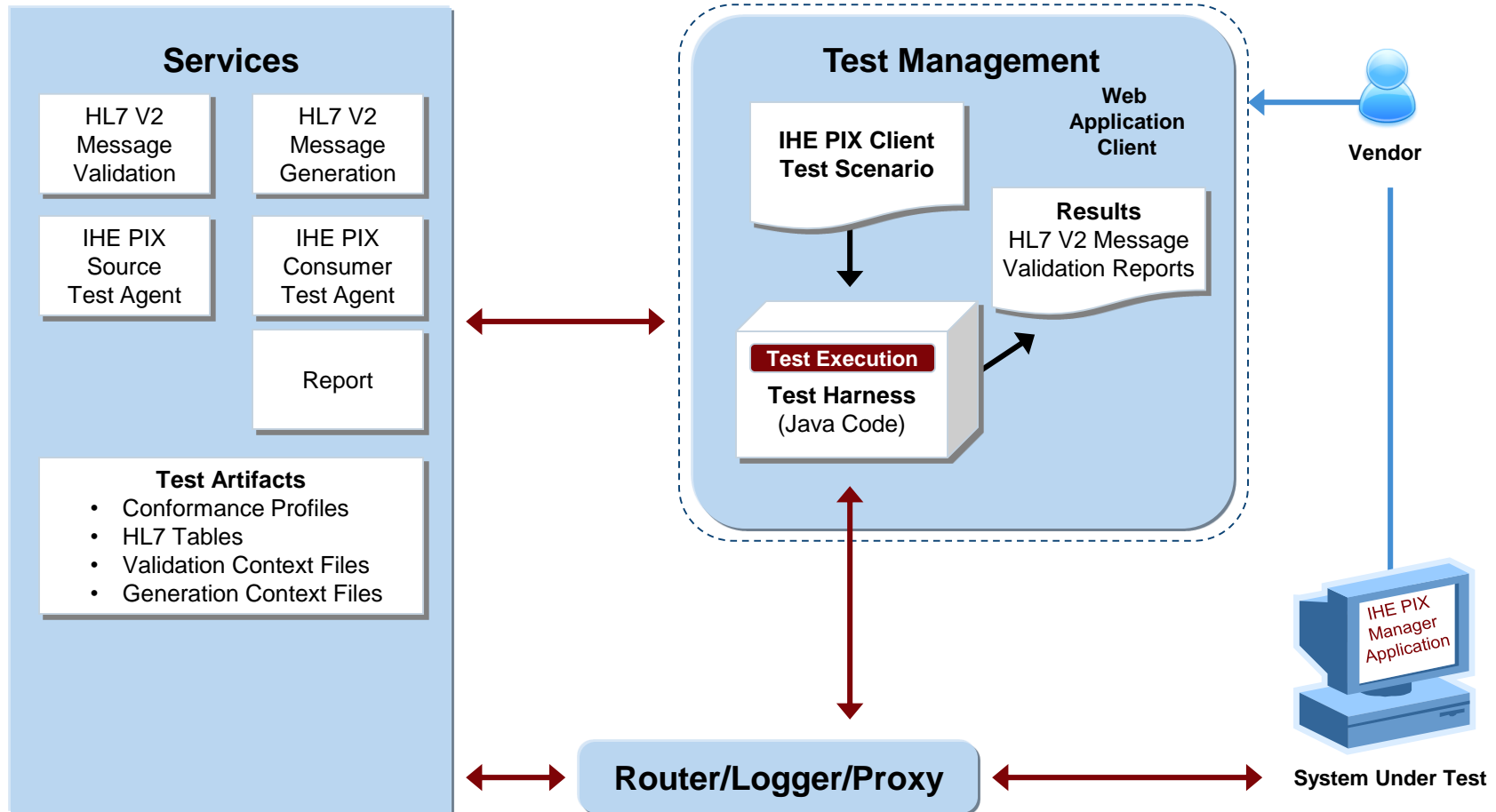


Isolated System Testing



Isolated System Testing

IHE PIX Testing using a Web Application Client

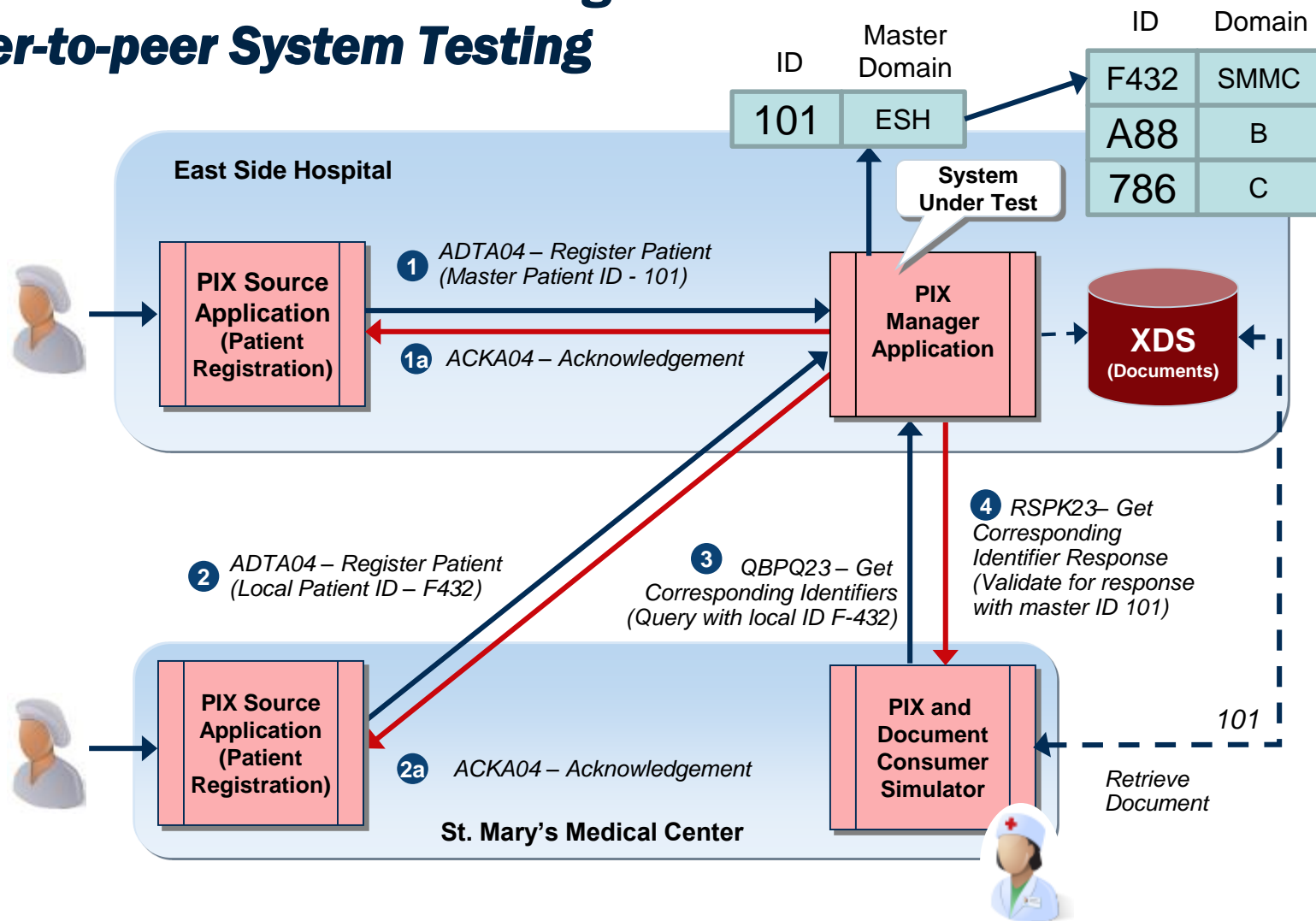


Peer-to-peer System Test Environment

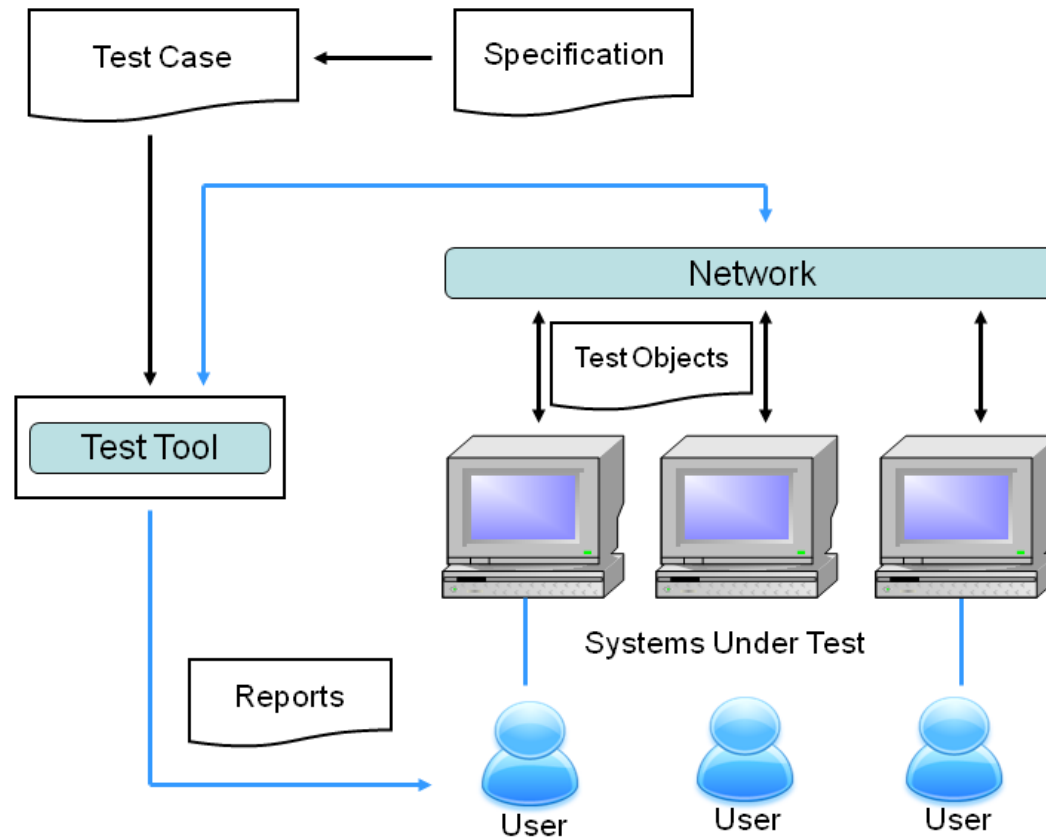
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Peer-to-peer System Testing

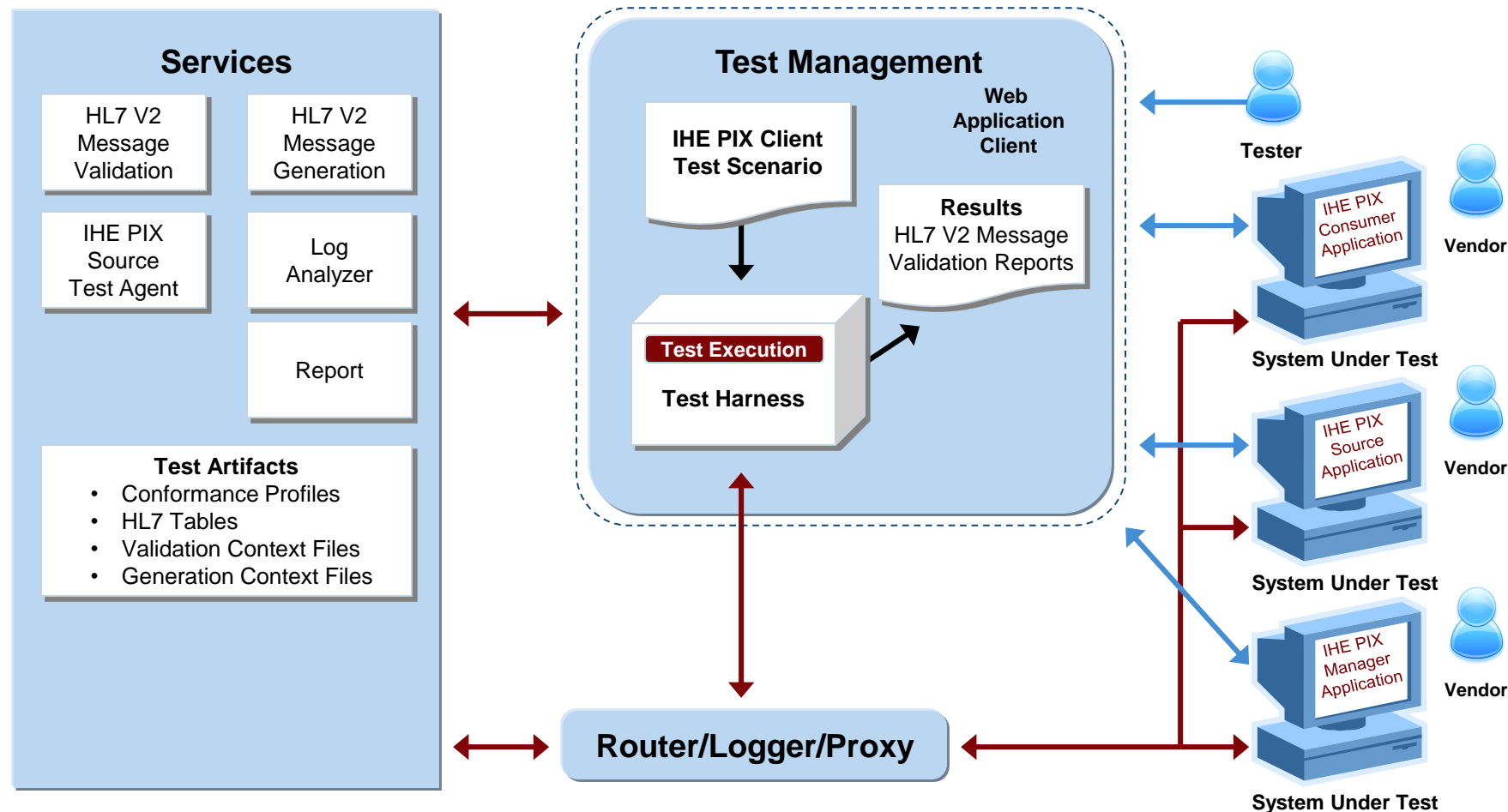


Peer-to-peer System Testing

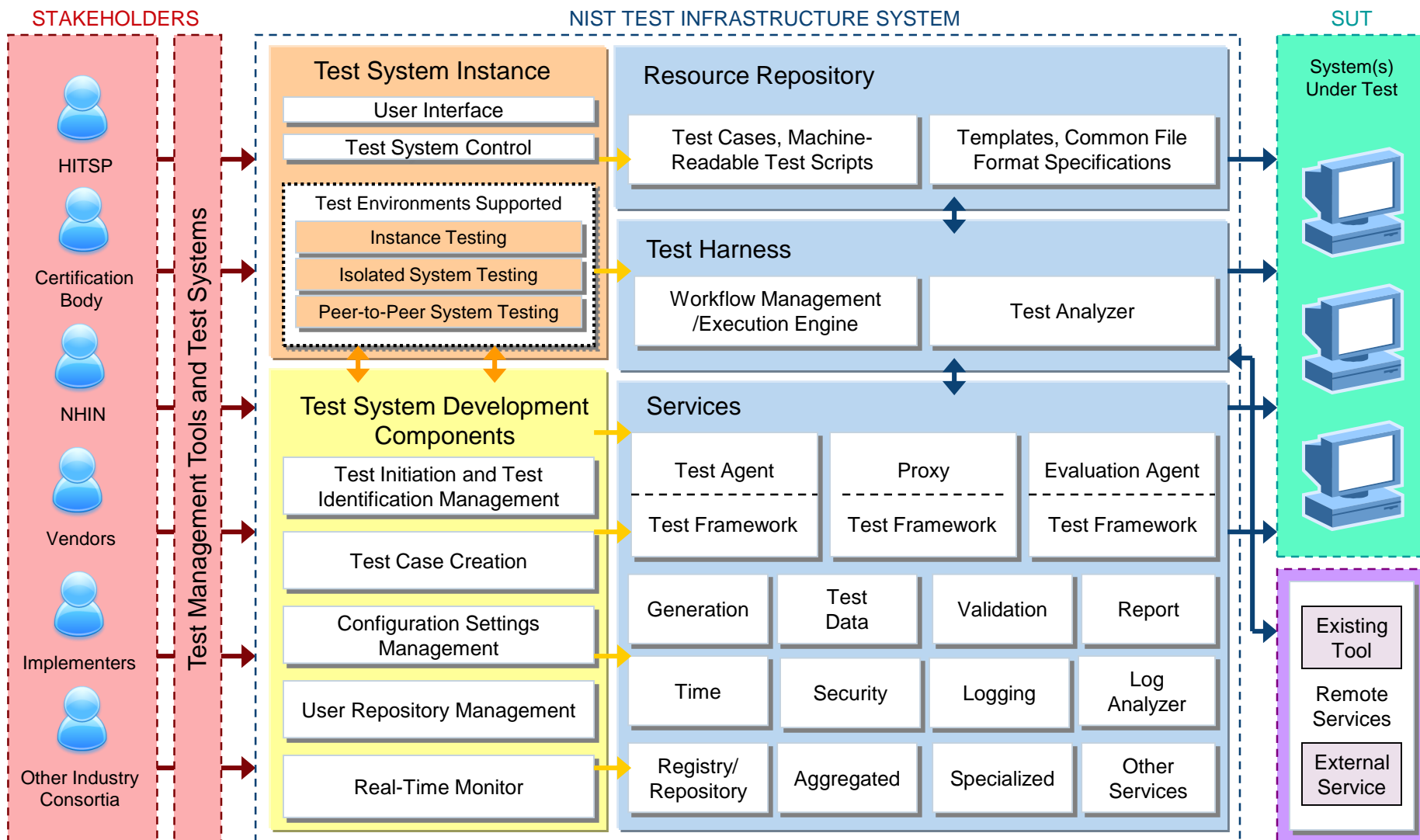


Peer-to-Peer System Testing

IHE PIX Testing using Proxy Model



Conceptual View of System Components



Summary

- Beyond a collection of tools
- Integrated testing system—Holistic View
 - Address the testing needs of entire process
 - From standards development to analysis
 - Users can make use of the framework to suit their needs
 - Composition of services is at their discretion
 - Formal methodology will live on beyond a collection of disparate tools
- System Requirements
 - Perform conformance and interoperability testing of healthcare information systems
 - Support multiple healthcare messaging and data standards
 - Support broad scope testing environments
 - Support different delivery mechanisms of tools
 - Flexible—can be use in many ways
 - Modular—component based, reusable pieces
 - Scalable—capable of handling increasing loads
 - Extensible—extend functionality via component integration

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