APPENDIX B
COLLABORATIVE ENVIRONMENT AND LIFE CYCLE GOVERNANCE

Department of Health and Human Services

Centers for Medicare & Medicaid Services

Collaborative Environment and Life Cycle Governance – Exchange Reference Architecture Supplement

Draft

Version 0.91

March 16, 2011

Foreword

This *Collaborative Environment and Life Cycle Governance – Exchange Reference Architecture (ERA) Supplement*, Version 1.0, provides the collaborative environment and life cycle governance for developing the nationwide health insurance Exchange information technology (IT) systems and data. The Centers for Medicare & Medicaid Services (CMS) has reviewed and accepted this *Collaborative Environment and Life Cycle Governance* as a foundational component of the Exchange Reference Architecture in accordance with the CMS IT governance process.

The CMS Deputy Chief Information Officer leads the establishment of this collaborative environment with the support of all components of the IT staff and contractors.

Any changes to the *Collaborative Environment and Life Cycle Governance* must be approved by the CMS Deputy Chief Information Officer.

Henry Chao   Date
Deputy Chief Information Officer
Centers for Medicare & Medicaid Services

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Record of Changes

Number	Date	Reference	A=Add, M=Modify, D=Delete	Description of Change	CR #
1	February 1, 2011	All		Initial Working Draft, v 0.2 for CMS comment	NA
2	February 8, 2011	All	M	Initial Working Draft, incorporating comments from CCIIO and QSSI, v0.4 for CMS comment	NA
3	February 11, 2011	All	M	Draft v0.5 for CMS review	NA
4	March 3, 2011	All	M	Draft v0.9 for CMS and IRS review	NA
5	March 10, 2011	All	M	Incorporated comments by CMS and IRS; draft v 0.91 for CMS and IRS review and comment	NA
6	March 16, 2011	All	M	Incorporated comments CCIIO stakeholders; draft v 0.93	NA

CR: Change Request

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1.   Introduction

The Patient Protection and Affordable Care Act of 2010[1] (hereafter simply the "Affordable Care Act") provides for each state to have a health insurance Exchange. An Exchange is an organized marketplace to help consumers and small businesses to buy health insurance in a way that permits easy comparison of available plan options based on price, benefits and services, and quality. Consumers seeking health care coverage will be able to go to the health insurance Exchanges to obtain comprehensive information on coverage options currently available and make informed health insurance choices. By pooling consumers, reducing transaction costs, and increasing transparency, Exchanges create more efficient and competitive health insurance markets for individuals and small employers.

The Department of Health and Human Services (HHS), Centers for Medicare & Medicaid Services (CMS) is responsible for providing guidance and oversight for the Exchanges. This responsibility includes defining business, information, and technical guidance that will create a common baseline and a set of standards for health insurance Exchange implementation activities. CMS will focus this guidance on the key tradeoffs and technology choices necessary to create interoperable and coordinated Exchange services between the federal government and the states.

CMS recognizes the complexity in this systems development and the necessary speed and agility required to build the Exchanges. To coordinate and ensure the optimal execution of investments associated with the Affordable Care Act, CMS will coordinate all Exchange investments and their associated development projects. By applying CMS governance for Exchange development, CMS intends to optimize investments, facilitate expediency and best practices, and establish effective collaboration and cross-agency and state sharing. Accordingly, CMS proposes a streamlined life cycle development process—the Exchange Life Cycle (ELC)—and a collaborative environment that facilitates standardized methodology and processes to promote a common language, effective communication, efficient linkages, asset reuse, and information sharing.

1.1   Purpose

The purpose of this *Collaborative Environment and Life Cycle Governance – Exchange Reference Architecture (ERA) Supplement* is to describe the life cycle governance for the Exchange, the Exchange Life Cycle model, and the supporting, collaborative Application Life Cycle Management (ALM) environment that will enable all Exchange systems development.

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[1]   Public Law 111–148, Patient Protection and Affordable Care Act, March 23, 2010, 124 Stat. 119,
http://www.gpo.gov/fdsys/pkg/PLAW-111publ148/content-detail.html
http://www.healthreform.gov/health_reform_and_hhs.html

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1.2   Scope

This document establishes initial life cycle governance; the proposed ELC model; and the Collaborative ALM Environment, methodology, and processes that CMS will provide for Exchange systems development. Appendix A presents more detail on specific ALM scenarios that may be relevant to states as they determine how to engage within the ALM environment.

CMS will augment the content in this ERA supplement with further refinement of the Exchange stakeholder relationships, key transactions, and technical standards.

1.3   Intended Audience

The distribution of this document is available to all states, other federal agencies, and supporting contractors. Exchange stakeholders will use the methodology, processes, and tools described here to identify and capture the necessary details, direction, and artifacts to define and implement Exchanges.

1.4   Document Organization

This document is organized as follows:

Section		Purpose
Section 2:	Exchange Life Cycle Governance	Provides a high-level overview of the life cycle governance to assist with and promote collaborative and consistent Exchange development.
Section 3:	Exchange Life Cycle	Defines the streamlined Exchange Life Cycle model, and describes the necessary processes and oversight for Exchange systems development, including discussion of the ELC's reviews and artifacts.
Section 4:	Collaborative Environment	Describes the Collaborative ALM environment, including the provided ALM tools, functionality, and processes that enable and support the Exchange.
Appendix A:	ALM Scenarios of Use	Identifies three scenarios in which a state would use the ALM environment.
Acronym List		Defines the acronyms used in this document
List of References		Presents the references used in the development of this document.

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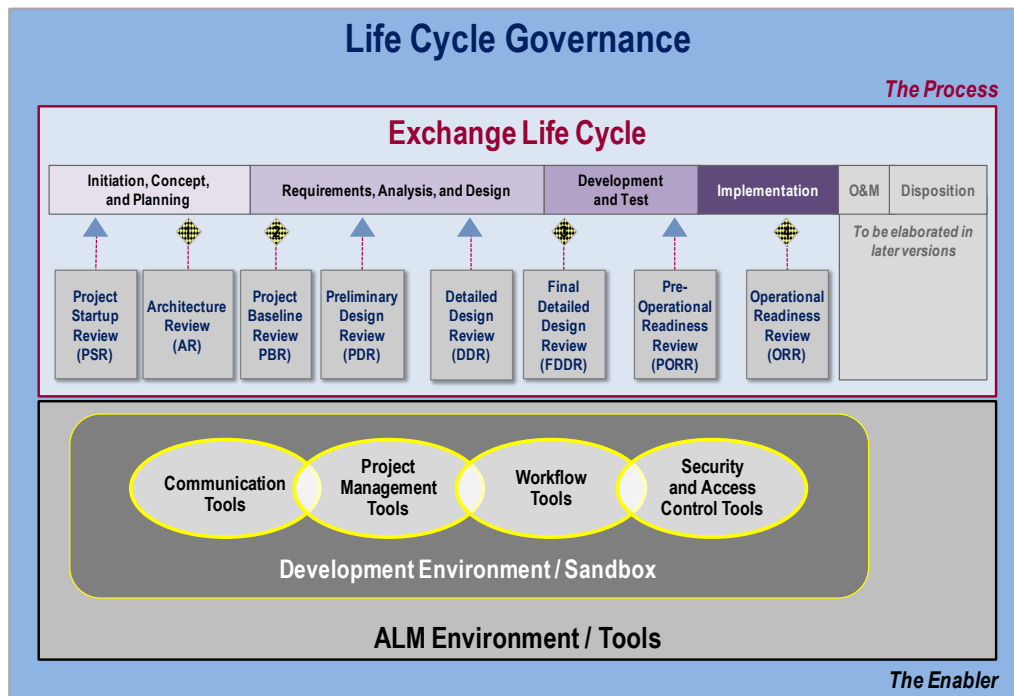
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2. Exchange Life Cycle Governance

CMS is responsible for supporting the delivery of the Exchanges as prescribed by the Affordability Care Act. CMS supports a shared governance model that will provide coordinated and integrated oversight between appropriate existing and new solutions related to Medicaid and Exchange programs. The key to success for a national program of such complexity and impact is the ability for project stakeholders to collaborate effectively, and to create a multi-component IT solution that integrates, interoperates, and functions effectively as a whole. More information on specific CMS governance bodies and responsible parties related to Medicaid and Exchange solutions will be identified and communicated in future supplements.

CMS is proposing as part of the overall governance approach life cycle governance of the development, implementation, and maintenance of all solutions related to the Exchanges. The primary purpose of CMS' life cycle governance is to provide the mechanisms and tools to:

- Encourage the use of systems development best practices and clear technical guidance
- Streamline systems development through common processes
- Promote sharing and provide efficient access to asset reuse
- Leverage existing solutions and create common and seamless services where appropriate
- Provide a framework with common synchronization points across multiple projects
- Offer flexibility to encourage the use of agile systems development methodology
- Ensure use of established standards (data and technical) to enable interoperability.

The CMS Exchange life cycle governance relies on the Exchange Life Cycle process that provides the framework to oversee development and implementation of Exchange IT solutions, from project initiation to systems operation and retirement. The governance approach also encompasses the collaborative ALM environment, which acts as the enabler for the ELC. Figure 1 depicts the relationship between the Exchange life cycle governance, ELC process, and collaborative ALM environment tools at a high level. Sections 3 and 4, respectively, present a detailed description of ELC and ALM components.

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Figure 1. CMS Life Cycle Governance and Correlation between the ELC Process and the Collaborative ALM Environment

CMS governance is responsible for effective oversight and coordination of the two key components of Exchange development: the **process**—the Exchange Life Cycle—and the **enabler**—the collaborative ALM environment. The ELC process lays out the specific phases, stage gate reviews, purpose, outcomes, and artifacts throughout the Exchange Life Cycle. The ELC includes key reviews to ensure cohesive solution development for the benefit of federal and state stakeholders. These reviews will include, but not be limited to, ensuring solution alignment with the Exchange Reference Architecture.

CMS' ALM will offer a shared development and test environment, as well as project management, communication, and security tools to support the ELC process. As the enabler, the ALM environment will provide the tools for the states to make progress within the ELC. The states will use the ALM tool features to submit and store artifacts and deliverables in a common environment shared by all key stakeholders. The heart of the ALM environment is the project document library where artifacts that are required and recommended for the ELC can be created, stored, and modified, and shared with critical partners and key stakeholders. The ALM tool will maintain multiple versions of artifacts for a complete historical view of all modifications. Milestone and stage gate reviews can be scheduled based on the completion of tasks that are specified in the workflow. Review input also will be saved within the document library. The artifact owners will be able to share artifacts within and across teams. Artifacts can be linked to specific change control tasks, which will ensure their currency. The document library and other ALM tools will be managed through secure access control, allowing the appropriate level of privacy and sharing for multiple projects as appropriate. The ALM processes and environment will be augmented to address any security concerns that may arise.

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The common ALM environment also provides the states with a sandbox to store products and components of the Exchange as they are developed. As the various stage gate reviews approach, the states will use the ALM tool to navigate through the review process by acknowledging automated notifications on timing and participation of reviews, submitting new artifacts, organizing artifacts for review and version control, and using discussion forums for communication throughout the review process.

CMS is developing additional content to further explain and describe the states' use of the ALM environment and tools for implementing the ELC process. This content will include how to submit and access artifacts for stage gate reviews and which products and components will be available for sharing and reuse across multiple stakeholders. In addition, CMS will provide more details on Medicaid connectivity.

As CMS matures the Exchange life cycle governance, CMS will communicate additional details regarding specific governance bodies and related functions.

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3. Exchange Life Cycle

Given the need to respond quickly to the health reform requirements of the Affordable Care Act, CMS will use the Exchange Life Cycle as a streamlined model to guide and coordinate the development and implementation of the Exchanges. Various organizations will be involved in developing the Exchange IT solutions. Toward those ends, the Exchange Life Cycle accommodates all forms of systems development methodologies. CMS encourages the use of agile systems development methodology and will accommodate agile processes in the Exchange Life Cycle stage gate reviews as appropriate.

The Exchange Life Cycle offers a consistent framework to help guide project managers, business owners, IT Governance, critical partners, and other stakeholders communicate expectations and execute key synchronization points across the project life cycle in the form of artifacts and stage gate reviews. The Exchange Life Cycle model aligns to the life cycle discussed in the HHS November 2010 Innovation Funding Opportunity Announcement, and provides states additional definition of the life cycle's prescribed phases, artifacts, and reviews.

Figure 2 shows the Exchange Life Cycle model and its four phases: Initiation, Concept and Planning; Requirements, Analysis, and Design; Development and Test; and Implementation. As depicted in the figure, CMS directly owns the Architecture Review, Project Baseline Review, Design Review, and Operational Readiness Review and associated artifacts. The remaining four reviews (Project Startup, Preliminary Design, Detailed Design, and Pre-Operational Readiness Review) may be delegated to other key stakeholders. In addition to addressing the identified artifacts, each review will include activities to help the states achieve certification for their Exchange. The certification process will take into account the Affordability Care Act legislation and regulations, as well as specific capabilities, functionalities, and systems identified in the Innovation Grant and other related communications to the states for establishing the Exchange. The certification process will maximize the states' ability to acquire certification at the end of the project to enable Exchange operation.

The Exchange Life Cycle model will assist with collaboration among the federal government and states, and where possible, unify the systems development activities. CMS derived the Exchange Life Cycle from the HHS EPLC (Enterprise Performance Life Cycle) and the CMS ILC (CMS Integrated IT Investment & System Life Cycle Framework). The ELC tailors the life cycle project phases, and aligns reviews and artifacts to the needs of Exchange projects. The HHS EPLC[2] and CMS ILC[3] web sites present a full description of the phases, reviews, and artifacts of the respective models.

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[2] Detail regarding HHS EPLC phases, artifacts, and reviews can be found at http://www.hhs.gov/CCIIO/eplc/
[3] Detail regarding the CMS ILC phases, artifacts, and reviews can be found at
    https://www.cms.gov/ILCReviews/01_Overview.asp

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Exchange Life Cycle (ELC)

Initiation, Concept, and Planning	Requirements, Analysis, and Design	Development and Test	Implementation	O&M	Disposition

To be elaborated in later versions

REVIEWS

Architecture Review

Project Baseline Review

Design Review

Operational Readiness Review

Project Startup Review (PSR)

Architecture Review (AR)

Project Baseline Review (PBR)

Preliminary Design (PDR)

Detailed Design Review (DDR)

Final Detailed Design Review (FDDR)

Pre-Operational Readiness Review (PORR)

Operational Readiness Review (ORR)

C **Acquisition Strategy (F)**
C **Risk Analysis (F)**
C **Scope Definition (F)**
C **Project Management Plan (P)**
R Concept of Operations (F)
R Alternatives Analysis (F)
R Performance Measures (F)

C **Architectural Diagrams (F)**
R Business Process Models (F)

C **Requirements Document (P)**
C **Information Security Risk Assessment (P*)**
C **System Security Plan (P*)**
C **Test Plan (P)**
C **Technical Architecture Diagrams (F)**
R Logical Data Model (F)

C **Requirements Document (I)**
C **System Design Document (P)**
C **Interface Control Document (P)**
C **Database Design Document (P)**
C **Data Management Plan (P)**
R Physical Data Model (P)
R Data Conversion Plan (P)

C **Test Plan (F)**
C **Contingency / Recovery Plan (P*)**
C **Implementation Plan (P)**
C **User Manuals (P)**
C **O&M Manual (P)**
C **Training Plan (P)**
C **Test Reports (P)**
C **Data Use/ Data Exchange/ Interconnection Security Agreement (P)**
C **Information Security Risk Assessment (F*)**
C **System Security Plan (F*)**
R Automated Code Review Results (F)
R Business Product (P)
R Training Materials (P)

C **Project Management Plan and Schedule (F)**
C **Project Process Agreement (F)**
C **Release Plan (F)**
R Privacy Impact Assessment (P*)

C **Requirements Document (F)**
C **System Design Document (F)**
C **Interface Control Document (F)**
C **Database Design Document (F)**
C **Data Management Plan (F)**
R Physical Data Model (F)
R Data Conversion Plan (F)
R System of Record Notice (P*)

C **Implementation Plan (F)**
C **Contingency / Recovery Plan (F*)**
C **User Manuals (F)**
C **O&M Manual (F)**
C **Training Plan (F)**
C **Test Reports (F)**
C **Data Use/ Data Exchange/ Interconnection Security Agreement (F)**
R Business Product (F)
R Training Materials (F)
R System of Record Notice (F*)
R Project Completion Report (F)
R SLAs / MOUs (F)
R Privacy Impact Assessment (F*)
R POA&M (F*)
R Authority to Operate (F*)

Legend:

◈ Must be performed by CMS and other key stakeholders

▲ May be delegated

Artifacts
C Core
R Recommended
(P) Preliminary
(I) Interim
(F) Final
(*) Input into Federal System Certification and Accreditation

Non Phase-Specific Artifacts include:
- S508
- Security
- Earned Value Management data
- Periodic investment status reports
- Periodic briefings / meeting minutes
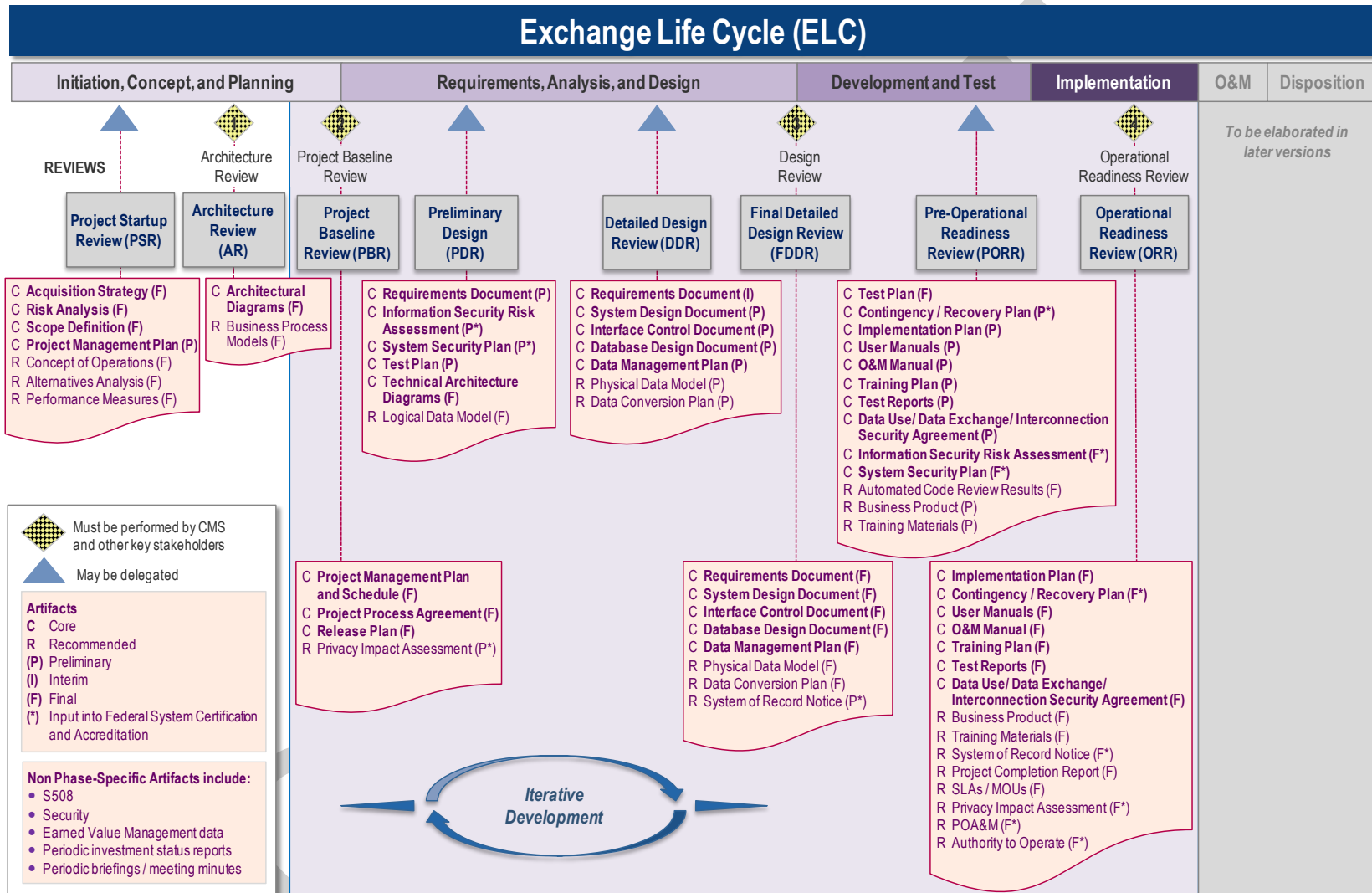
Iterative Development

Figure 2. Proposed Exchange Life Cycle Model

The following subsections provide a detailed description of each Exchange Life Cycle phase and review, complete with purpose, reviewers, and core (mandatory) and recommended artifacts (Preliminary, Interim, and Final).

3.1 ELC Phase – Initiation, Concept, and Planning

Overview:

During the Initiation, Concept, and Planning Phase, the business owner of an Exchange solution identifies what the project is intended to do, and presents the plans for achieving the Exchange business goals and objectives. The activities of this phase include:

- Identify significant assumptions and constraints, and explore alternatives
- Identify project goals, objectives, risks, and clear and measurable success factors
- Develop an architectural framework and high-level content
- Formally approve the project based on evidence that the Exchange business needs will be met, and the solution will conform to the Exchange Reference Architecture
- Analyze how the project will be managed, culminating in the Project Management Plan.

Outcomes:

The outcomes of the Initiation, Concept, and Planning Phase include:

- Establish the project's feasibility, viability, and alignment with Exchange program objectives
- Approve all required artifacts, and approve any recommended artifacts that are provided
- Complete project planning artifacts, including refinement of Project Management Plan, project schedule, and Project Process Agreement baselines.

3.1.1 Project Startup Review (PSR)

Purpose:

Determine project feasibility, viability, and alignment with Exchange program goals and objectives.

Reviewers:

May be delegated.

Core Artifacts:

- Acquisition Strategy (Final): Plan for resource acquisition and associated task orders.
- Risk Analysis (Final): Identification and potential mitigation of any uncertain events that may impact project objectives.

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- Scope Definition (Final): Explanation of planned project achievements and boundaries, to include definition of project success.

- Project Management Plan (Preliminary): Overall plan for project execution, monitoring, and control. Includes tasks, duration, milestones, dependencies, resource(s), critical path, and variance capture process.

Recommended Artifacts:

- Concept of Operations (Final): Conceptual functions and stakeholder interactions.

- Alternatives Analysis (Final): Potential alternatives for project solution design and implementation, and associated conditions when an alternative may be more viable.

- Performance Measures (Final): Key performance indicators of significant accomplishments or events. May provide information regarding project status.

3.1.2   Architecture Review (AR)

Purpose:

Ensure that business needs are met and that the Exchange solution conforms to the Exchange Reference Architecture.

Reviewers:

CMS and key stakeholders must perform this review.

Core Artifacts:

- Architectural Diagrams (Final): Framework to identify the conceptual integration of the underlying business functionality, data, and infrastructure of the intended solution.

Recommended Artifacts:

- Business Process Models (Final): Pictorial representation of Exchange business processes and information flows, including sequence of events.

3.1.3   Project Baseline Review (PBR)

Purpose:

Assess project plan for scope, schedule, risk, etc.

Reviewers:

CMS and key stakeholders must perform this review.

Core Artifacts:

- Project Management Plan and Schedule (Final): Overall plan for execution, monitoring, and control.

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- Project Process Agreement (ELC Tailoring Plan) (Final): Justifications for adding, not using, or combining, specific reviews and selection of artifacts applicable to the project.

- Release Plan (Final): Descriptions of the system functionality that will be developed and implemented in each release, and the rationale for each release.

Recommended Artifacts:

- Privacy Impact Assessment (Preliminary): Required of federally owned systems. Determines if Personally Identifiable Information (PII) is contained within a system, what kind of PII, what is done with that information, and how that information is protected.

3.2   ELC Phase – Requirements, Analysis, and Design

Overview:

During the Requirements, Analysis, and Design Phase, a common set of business rules are refined and the business requirements are validated and decomposed into functional and non-functional requirements. The requirements are used to define the Exchange design in detail, including inputs, processes, outputs, and interfaces, and permit further detailed project management planning. Detailed specifications are developed to support the IT solution that fulfills the Exchange requirements for a particular release. The requirements and logical description of the entities, relationships, and attributes of the data are defined and allocated into system and data design specifications. These design specifications are organized in a way suitable for implementation within the constraints of a physical environment (e.g., computer, database, and infrastructure).

Outcomes:

The outcomes of the Requirements, Analysis, and Design Phase include:

- Baselined business, functional, and non-functional requirements for the Exchange release.

- Baselined design for the Exchange release's system components, services, data, security, and infrastructure.

- Common repository of business rules, for use by the shared services and all relevant stakeholders.

3.2.1   Preliminary Design Review (PDR)

Purpose:

Verify that the preliminary design satisfies the requirements for the Exchange release and is in conformance with the Exchange Reference Architecture.

Reviewers:

May be delegated.

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Core Artifacts:

- Requirements Document (Preliminary): Initial, traceable requirements for business and technical functionality to be delivered upon project completion.

- Information Security Risk Assessment (Preliminary): Required of federally owned systems. Identification of risks and possible mitigation associated with information security components and supporting infrastructure. For federally owned systems, this assessment will be used for system certification and accreditation (C&A).

- System Security Plan (Preliminary): Required of federally owned systems. The plan describes security controls within the system that will protect the confidentiality, integrity, and availability (CIA) of the system and its information. For federally owned systems, this plan will be used for systems C&A.

- Test Plan (Preliminary): Plan for testing activities, periods, test cases, mapping requirements to the specific tests, tracking and resolving issues, verification methods, test data needs, and version control. Maps requirements to test cases. Identifies requirements for the testing environment where test cases will be executed. The test plan will include a plan for an end-to-end integration test from end-consumer to all systems and back, testing all federal and state agencies, as appropriate, to ensure accurate Exchange functionality and data.

- Technical Architecture Diagrams (Final): Description of network, data storage, security, middleware, and server architecture.

Recommended Artifacts:

- Logical Data Model (Final): Definition of common understanding of business data elements and inter-relations to form the basis for physical database design.

3.2.2   Detailed Design Review (DDR)

Purpose:

Verify that the detailed design satisfies the requirements for the Exchange release and is in conformance with the Exchange Business Architecture and standards.

Reviewers:

May be delegated.

Core Artifacts:

- Requirements Document (Interim): Updated requirements for business and technical functions to be delivered on project completion.

- System Design Document (Preliminary): Transformation of the requirements, user-oriented functional design, and data design into more technical specifications from which the system will be built.

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- Interface Control Document (Preliminary): Description of the inputs and outputs of a single system/services, the interface between two systems/services, or the interface protocol between physical components.

- Database Design Document(s) (Preliminary): System context and the basic database design approach, including dependencies and interfaces with other databases and/or systems.

- Data Management Plan (Final): Strategy for managing data during and after project execution. Identifies data archiving/data retention plans.

Recommended Artifacts:

- Physical Data Model (Preliminary): Database entities/tables/views, attributes/columns/fields, and relationship between entities influenced by database performance, indexing, storage, and denormalization.

- Data Conversion Plan (Preliminary): Strategy, preparation, and specifications for converting data for system deployment to production and for use during execution.

3.2.3   Final Detailed Design Review (FDDR)

Purpose:

Verify that the detailed design satisfies the requirements for the Exchange release and is in conformance with the Exchange Reference Architecture.

Reviewers:

CMS and key stakeholders must perform this review.

Core Artifacts:

- Requirements Document (Final): Detailed and final requirements for business and technical functions to be delivered on project completion.

- System Design Document (Final): Transformation of the requirements, user-oriented functional design, and data design into more technical specifications from which the system will be built.

- Interface Control Document (Final): Description of the inputs and outputs of a single system/services, the interface between two systems/services, or the interface protocol between physical components.

- Database Design Document(s) (Final): System context and the basic database design approach, including dependencies and interfaces with other databases and / or systems.

- Data Management Plan (Final): Strategy for managing data during and after project execution. Identifies data archiving/data retention plans.

Recommended Artifacts:

- Physical Data Model (Final): Database entities/tables/views, attributes/columns/fields, and relationship between entities influenced by database performance, indexing, storage, and denormalization.

- Data Conversion Plan (Final): Strategy, preparation, and specifications for converting data for system deployment to production and for use during execution.

- System of Record Notice (SORN) (Preliminary): Required of federally owned systems. A System of Record is a group of any records under the control of a federal agency from which information is retrieved by the name of the individual or by some identifying number, symbol, or other identifying particular assigned to the individual. The federal government is required to inform the public of any collection of information about its citizens from which data are retrieved by a unique identifier. A SORN consists of three documents: (1) a Narrative Statement that is submitted to the Office of Management & Budget (OMB), (2) a Preamble provided to Congress, and (3) a Statement of Records Notice provided to Congress. The Preamble and the Statement of Records Notice are also published in the *Federal Register* to notify the public of a new or revised SORN.

3.3   ELC Phase – Development and Test

Overview:

During the Development and Test Phase, the detailed requirements and design information documented in the Requirements, Analysis, and Design phase are transformed into machine-executable form. The detailed requirements and design information are verified and validated that all of the individual system components (and data) of the Exchange solution function correctly and interface properly with other components within the system. As necessary, system hardware, networking, telecommunications and security equipment, and Commercial Off-the-Shelf (COTS)/Government Off-the-Shelf (GOTS) software are configured. New custom-software business applications and services are developed, database(s) are built, and software components are integrated. Test data and test case specifications are finalized, and tests are conducted for individual components, integration, and end-to-end functionality from end-consumer to all systems and back, testing all federal and state agencies, as appropriate, to ensure accurate Exchange functionality and data. Tests verify and validate that the Exchange solution fulfills all business, functional, and non-functional requirements for the release. Formally controlled and focused testing is performed to uncover and prioritize defects in the Exchange solution that must be resolved. A number of test categories are performed during the Test Phase (e.g., functional testing, integration testing, user acceptance testing, regression testing, end-to-end testing across all Exchange participants, and Section 508 testing).

Outcomes:

The outcomes of the Development and Test phase include baselined and executable software, infrastructure, and database configuration specifications, and test results.

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3.3.1   Pre-Operational Readiness Review (PORR)

Purpose:

Confirm that all system components, data, and infrastructure of the Exchange solution successfully fulfill all business, functional, and non-functional requirements for the release.

Reviewers:

May be delegated.

Core Artifacts:

- Test Plan (Final): Strategy and detailed approach for conducting verification and validation testing. Includes procedures for preparation and execution of test cases and for reporting testing results to verify and validate functional and non-functional requirements. The test plan will include a plan for an end-to-end integration test from end-consumer to all systems and back, testing all federal and state agencies, as appropriate, to ensure accurate Exchange functionality and data.

- Contingency/Recovery Plan (Preliminary): Required of federally owned systems. Includes management policies and procedures to maintain or restore business and technical operations in the event of emergency, system failure, or disaster. For federally owned systems, this plan will be used for systems C&A.

- Implementation Plan (Preliminary): Descriptions and procedures of how the Exchange solution will be installed, deployed, and transitioned into an operational system.

- User Manuals (Preliminary): Explanation of how to use the established product from a business function perspective.

- Operations & Maintenance (O&M) Manual (Preliminary): Description of the business product operating in the production environment, and information necessary to effectively handle routine production processing, ongoing maintenance, performance monitoring, and identification of problems, issues, and/or change requirements.

- Training Plan (Preliminary): Description of training effort to use and support the system, including initial and subsequent remedial training for business users and system support personnel.

- Test Reports (Preliminary): Test results obtained at the conclusion of test activities, including test performance and outcomes. Includes defect reports and system security test results. The test reports will include identifying any issues in any process from beginning to end - from end-consumer to all systems and back - testing all federal and state agencies, as appropriate, to ensure accurate Exchange functionality and data.

- Data Use Agreement(s)/Data Exchange Agreement(s)/Interconnection Security Agreement (Preliminary): Agreements between parties for the use of personal identifiable data, and to ensure secure data exchange. This includes a Safeguards Procedures Report (SPR), which includes information that Internal Revenue Service (IRS) Office of Safeguards expects from an agency regarding their procedures for

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safeguarding Federal Tax Information (FTI), in any instance where that agency intends to receive, store, process, or transmit FTI.

- Information Security Risk Assessment (Final): Required for federally owned systems. This assessment includes identification of risks and possible mitigation associated with information security components and supporting infrastructure. For federally owned systems, this assessment will be used for system C&A.

- System Security Plan (Final): Required of federally owned systems. This plan describes security controls within the system that will protect the confidentiality, integrity, and availability of the system and its information. For federally owned systems, this plan will be used for systems C&A.

- Automated Code Review Results (Final): Report with results from development code reviews that inspect for software security vulnerabilities.

Recommended Artifacts:

- Business Product (Preliminary): The systems solution delivered for the release, including hardware, software, data, and documentation.

- Training Materials (Preliminary): Documentation associated with the deployment and use of the Business Product, including instructor and student guides, audio-visual aids, and computer-based or other media

3.4   ELC Phase – Implementation

Overview:

During the Implementation Phase, the Exchange solution system components, data, and infrastructure are migrated from a Test environment to an Implementation/Pre-Production environment. The Implementation environment mirrors the Production environment's infrastructure and security configuration. In this Implementation environment, the Exchange solution undergoes full integration testing from end-consumer to all systems and back, testing all federal and state agencies, as appropriate, to ensure accurate Exchange functionality and data, performance and stress testing, and testing for security risks and vulnerabilities. System deployment into this environment is the means to test the use of the Implementation Plan and O&M manual. All system deployment and configuration activities are executed as a dry run during this phase, including data conversion. The Implementation Phase also includes user training for using, operating, and maintaining the Exchange solution. For federally owned systems, the final Exchange solution must receive an Authorization To Operate (ATO) before deployment to the Production environment.

Outcomes:

The outcomes of the Implementation Phase are that all Exchange solution deliverables (executable software, data, configuration files, and documentation) are ready for deployment to the Production environment, and the Exchange solution is ready for operation. For federally owned systems, the Exchange solution must receive an ATO.

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3.4.1   Operational Readiness Review (ORR)

Purpose:

Determine if the Exchange solution is ready for deployment into a production environment and is ready to support business operations.

Reviewers:

CMS and key stakeholders must perform this review.

Core Artifacts:

- Implementation Plan (Final): Descriptions and procedures of how the Exchange solution will be installed, deployed, and transitioned into an operational system.

- Contingency/Recovery Plan (Final): Required for federally owned systems. This plan includes management policies and procedures to maintain or restore business and technical operations in the event of emergency, system failure, or disaster. For federally owned systems, this plan will be used for system C&A.

- User Manuals (Final): Explanation of how to use the established product from a business function perspective.

- Operations & Maintenance Manual (Final): Description of the business product operating in the Production environment, and information necessary to effectively handle production processing, ongoing maintenance, performance monitoring, and identification of problems, issues, and/or change requirements.

- Training Plan (Final): Description of training effort needed to use and support the system, including initial and subsequent remedial training for business users and system support personnel.

- Test Reports (Final): Test results obtained at the conclusion of test activities, including test performance and outcomes. Includes defect reports and system security test results. The test reports will include identifying any issues in any process from beginning to end - from end – from end-consumer to all systems and back - testing all federal and state agencies, as appropriate, to ensure accurate Exchange functionality and data.

- Data Use Agreement(s)/Data Exchange Agreement(s)/Interconnection Security Agreement (Final): Agreements between parties for the use of personal identifiable data, and to ensure secure data exchange. This includes a SPR, which includes information that IRS Office of Safeguards expects from an agency regarding their procedures for safeguarding FTI, in any instance where that agency intends to receive, store, process, or transmit FTI.

Recommended Artifacts:

- Business Product (Final): The systems solution delivered for the release, including hardware, software, data, and documentation.

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- Training Materials (Final): Documentation associated with the deployment and use of the Business Product, including instructor and student guides, audio-visual aids, and computer-based or other media.

- System of Record Notice (Final): Required of federally owned systems. A System of Record is a group of any records under the control of a federal agency from which information is retrieved by the name of the individual or by some identifying number, symbol, or other identifying particular assigned to the individual. The federal government is required to inform the public of any collection of information about its citizens from which data are retrieved by a unique identifier. A SORN consists of three documents: (1) a Narrative Statement that is submitted to OMB, (2) a Preamble submitted to Congress, and (3) a Statement of Records Notice provided to Congress. The Preamble and the Statement of Records Notice are also published in the *Federal Register* to notify the public of a new or revised SORN.

- Project Completion Report (Final): Assess the project relative to completion of all scheduled activities within expected performance measures, and derive any lessons learned and best practices to be applied to future projects.

- Service Level Agreements (SLA)/Memorandum of Understanding (MOU) (Final): SLAs and MOU agreements between parties who use or support the Exchange solution.

- Privacy Impact Assessment (Final): Determines if PII is contained within a system, what kind of PII, what is done with that information, and how that information is protected.

- Plan of Action and Milestones (POA&M) (Final): Required of federally owned systems. The POA&M includes specific action steps for mitigating Exchange system security weaknesses identified by a security assessment.

- Authority to Operate (Final): Required of federally owned systems. A system obtains its ATO by virtue of performing System Certification and System Accreditation. System Certification is the comprehensive evaluation of the management, operational, and technical security controls implemented for an information system to ensure compliance with information security requirements. System Accreditation follows System Certification and is the official management decision to authorize operation of an information system.

3.5   Non Phase-Specific Artifacts

Some artifacts will be used throughout the project life cycle to facilitate decision making and communication. The following list of recommended artifacts is not tied to any one phase and is intended for use as needed:

- **Section 508 Product Assessment:** Assessment by COTS/GOTS/custom software manufacturers, developers, or vendors to demonstrate how their product does or does not meet the various Section 508 requirements.

- **Security:** Continual assessment and refinement of security considerations within the Exchange and between interfacing agencies.

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- **Earned Value Management Data:** Data related to measuring project progress by combining measurements of scope, schedule, and cost to provide early warning of performance problems.

- **Periodic Investment Status Reports:** Status reports related to investment consumption with details on areas and types of consumption. These status reports will provide adequate transparency to show a scheme for investment forecasting and allocation prioritization, and will demonstrate alignment to strategic objectives.

- **Periodic Briefings and Meeting Minutes:** Pre-scheduled and as-needed meetings with CMS and other key stakeholders to discuss progress, joint-solution building, and issue resolution.

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4. Collaborative ALM Environment

The ELC provides all project stakeholders (including business owners) the necessary processes and methodology to determine who must do what, when, and how in the proposed Exchange environment. The Application Life Cycle Management collaboration tools, functionality, and processes support the streamlined Exchange Life Cycle for all Exchange systems. The collaborative ALM environment enables systems developers and project managers in performing the work prescribed in the ELC.

A key to successful development for large, complex systems is a consistent and repeatable project development methodology that facilitates collaboration and reduces risks. The geographical dispersion and technological variances of federal agencies and states, as well as the speed and agility required to meet health care reform timelines, present significant challenges in building the Exchanges systems. The development of successful Exchange IT solutions hinges upon all stakeholders having access and insight into all project elements, the ability to learn from one another, and efficient sharing and reuse of developed assets. To facilitate this, CMS' ALM tools, functionality, and methodology will support the ELC in a collaborative environment for Exchange systems, in which participants can easily access, reuse, and enhance appropriate systems development components across state and federal agencies, and share insight into the ELC.

A collaborative ALM environment will contribute organizational and oversight efficiency to the Exchange development process. It will offer the capabilities to facilitate communication, collaboration, development, management, and governance. All of the features in the ALM-supported Exchange environment will be made available to the states and federal agencies. Figure 3 depicts a high-level overview of the proposed features of the collaborative ALM environment. In addition, Appendix A provides high-level scenarios to assist states in deciding how to engage within the collaborative ALM environment.

The collaborative ALM environment is centralized; its features and functions are accessible to all users, regardless of geographic location. Dispersed project teams can create, manage, and organize all aspects of the systems development within this collaborative environment, which simplifies sharing and reusing assets. For example, the collaborative ALM environment will provide:

- Communication and sharing through a centralized repository for all documents, deliverables, discussions, and project Wikis. The repository can be associated with development products, shared with other stakeholders for collaborative purposes, and available at all times for project team oversight.

- An extensive set of project management tools (including task and alert features) providing the ability to track project progress clearly, manage issues and risks, and control the project deliverables as prescribed in the project's ELC Project Process Agreement.
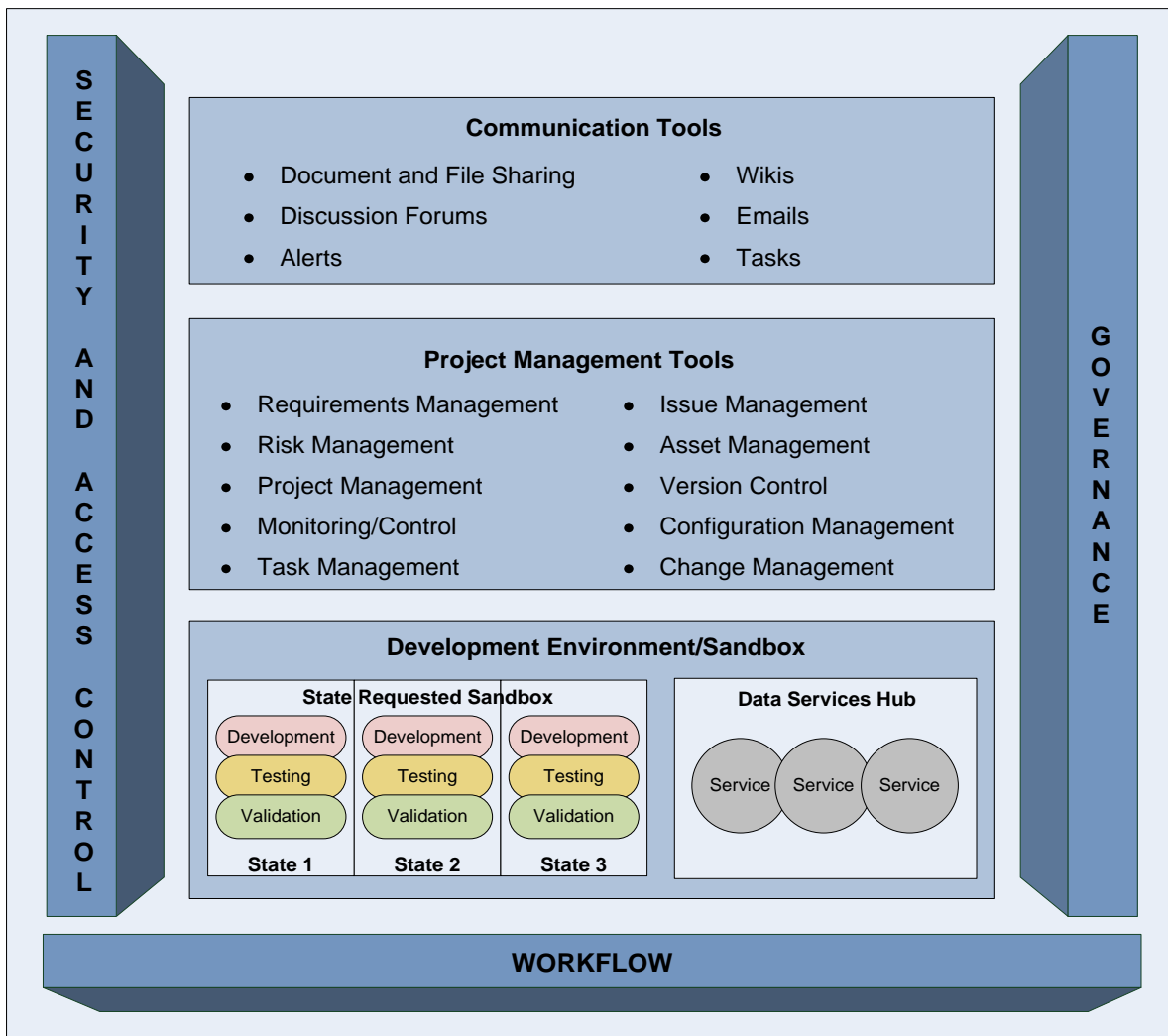
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Figure 3. Collaborative ALM Environment for Exchange Development

- Support for traceability across the project deliverables. Whether the deliverable is a document or source code, it can be associated with provided scope and requirements to ensure that the project team is informed and compliant. A project team can thus post information once and ensure the distribution of and access to new information and requirements by all project teams. In addition, a project team can associate every aspect of development with any other aspect for greater coordination, organization, and monitoring by CMS or state project team members.

- A collaborative development and test environment/sandbox for use by the states. The "sandbox" makes all products/components in development, from source code and file releases, to problem reports and test results, accessible to CMS and state project teams. Similarly, the ALM environment will provide access to common Data Services Hub services to enable integration testing.

The following subsections provide summary descriptions of the tools and features proposed for the collaborative ALM environment.

4.1   Communication Tools

The collaborative ALM environment will employ a variety of communication and collaboration tools, including the document library, the discussion forum, and Wikis. All states will receive role-based access to the communication and collaboration tools. The following subsections provide a brief description of these communication tools.

4.1.1   Document Library

The document library supports centralized storage and access of all written, edited, reviewed, and published artifacts and related materials. The purpose of the document library is to facilitate an easy review and editing process for artifacts related to multiple projects. The library will enable access to information for sharing, learning, and knowledge transfer throughout the project. Given the complexity and anticipated magnitude of parallel processes during the Exchange development and implementation life cycle, CMS will establish a structured artifact hierarchy with naming standards, to ensure that all artifacts, whether related to IT principles, deliverables associated with specific ELC stage gate reviews, or meeting minutes, etc., are stored in a consistent and easily retrievable manner.

The document library automatically maintains a version history of each artifact, including information regarding the artifact's owner, artifact status, and version comments. The artifact owner can use the review feature to track the peer evaluation process, or lock an artifact while changes are made. Any artifact can be associated with a task, code commit, or any other type of artifact within the Exchange Life Cycle and collaborative ALM environment.

4.1.2   Discussion Forum

The discussion forum contains workspaces where project members can work together online or by email. Forum administrators can enable a mailing list for each forum, and messages can be posted without opening the application via email. Access can be restricted for private forums by setting specific permissions. A forum may be moderated by a set user with the capability to require screening of each posting before posting. The option to set "trusted users" eliminates the moderator approval for posted messages. These features help document communications between project members for future reference without having to forward an email chain or rewrite similar material for the project team later.

4.1.3   Wikis

The Wiki is useful for managing and centralizing any unstructured or linkable content. For example, if an image is hosted remotely that would be useful to the project but could be moved or removed, the Wiki can house the image independently. The collaborative ALM environment supports the creation of an unlimited number of Wiki pages, and automatically maintains versioning of these pages. Like all libraries within the collaborative ALM environment, all versions of the Wiki are fully searchable by date, author, text, etc., and can be associated with any other item within the collaborative ALM environment.

4.2   Project Management Tools

The collaborative ALM environment includes management tools that both CMS and the states can use to organize the projects, direct tasks, and track and report progress throughout the ELC.

A template can be set when creating a new project within the collaborative ALM environment. For example, CMS could create or customize the built-in template as a roadmap for the states to follow, allowing for the enforcement of organizational standards and the facilitation of process improvement. Alternatively, if a state were to create a workspace for its project that would be beneficial to others, the template could be saved and applied to other states' project pages.

The features of site administration enable all authorized users in all projects to view and manage project detail. It is possible to group projects for administrative purposes and to enable administrative actions to affect multiple projects and users simultaneously. The site administrator can control the addition/deletion and locking/unlocking of projects to ensure organization and to assure that no changes occur in a project while collating or migrating project data.

Even for those states that choose their own development methodologies, CMS will be able to set tasks for the state to implement any key policy changes and oversee them to completion via collaboration features. Once tasks are established, the collaborative ALM environment allows reordering and movement between task folders for organizational purposes. Dependent successor tasks can also be set. Furthermore, the collaborative ALM environment contains a summary section that displays the project-wide task status, information on the status of individual tasks, and the progress and workload for each states and individuals within the projects. Alerts can also be set. For example, an alert can be sent automatically to a specified user or role-based group when a task is overdue.

The ELC prescribes that states track requirements, tasks, defects, testing results, etc. The ALM environment makes all of this information accessible through the tracking feature. The ALM environment also provides details on an estimated level of effort for tasks. This can be useful for planning as states share their level of effort metrics with others. With these experience-derived metrics, states gain an increased degree of accuracy in planning the quantity and type of resources for allocation. Project teams can extract and manipulate the information maintained to create project reports at varying levels of detail for project management, CMS oversight, and benchmarking against other Exchange projects.

4.3   Development Environment / Sandbox

For those states that choose to use the collaborative ALM environment, the available tools will include a build and test feature, source code repository, and file release repository.

The build and test feature is a continuous integration software tool that entails adding small pieces of code at a time while detecting and repairing bugs immediately, as opposed to trying to integrate large code commits at once. Using this feature, multiple developers can work on code in parallel while minimizing rework due to integration issues brought about by adding to potentially outdated code. By approaching development from a continuous integration strategy, developers gain immediate feedback on the quality, functionality, and system-wide impact of

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code they are writing, and also consistently provide the most current and up-to-date version of the build for testing, review, or sharing within states. A centralized environment makes it possible for developers of a dispersed consortium of states to develop code together. It also facilitates CMS oversight to check on the states' progress during development rather than only after product delivery.

The collaborative ALM environment offers a source code repository for the various builds. Each project can have one or more source code repositories that use Software Configuration Management (SCM) servers. Inherent with SCM servers are the practices of revision control and baselining, which are also tenets of continuous integration. Commits of source code files can be set to be associated with various other items such as defect reports, feature requests, tasks, and documents. If, for example, CMS creates a new requirement for the Exchange, the source code commit can be associated with the document containing the requirement. This association allows for simplified oversight to ensure requirements are applied to the product and for the comparison of various solutions between states. Associations can also be applied to software releases, which are maintained within the collaborative ALM environment. If the product for a software release includes code created as a result of the example requirement, the requirement document can be associated with the release, thus completing the traceability path for the requirement.

Build results can be uploaded as a post-build action as a package, release, or file. The collaborative ALM environment maintains information for each release, such as status as active or pending, and maturity level. Releases are first organized by product, and each product can contain multiple releases. A list of files contained in each release is also accessible through this feature. These releases can be augmented or edited later, and can be associated with other project information such as documents, tasks, tracker artifacts, or integrated application objects.

The ALM environment will provide access to common Data Services Hub (the "Hub") services, which is also an aspect of the Development/Sandbox features. The Hub will provide a single interface to the states that supports common Exchange services, such as enrollment verification, as well as the exchange of information with all of the federal partners as deemed appropriate.[4] The Hub's common services will be available to the collaborative ALM environment to support integration testing.

4.4   Workflow

CMS is assessing Workflow functionality, features, and tools for use with the collaborative ALM environment. Future ERA supplements will provide more details on this topic area.

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[4]   *Exchange Reference Architecture: Foundation Guidance,* Draft, Version 0.96, Centers for Medicare & Medicaid Services, March 3, 2011.

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4.5   Security and Access Control

The collaborative ALM environment includes a suite of project administration functions to control security and access to the project sites. An administrator creates all project sites and sets the project template. CMS can create one base parent project to encompass all state subproject sites, which becomes the source for a subproject's members, user groups, roles, and corresponding permissions. Subprojects can be separated from parent projects to change the project hierarchy or to make it a standalone project if the administrator deems necessary. Projects can also be locked and unlocked by the administrator to ensure that no changes occur in a project while establishing, collating, or migrating project data. In addition, applications within the project site can be hidden, which is particularly useful because not all states will be utilizing the ALM development environment.

When creating a new project site, the administrator sets whether it will be *private*, which allows access to project members only; *gated*, which allows access to project members and unrestricted users; or *public*, which allows access for all users. A subproject can inherit project members, user groups, and roles from its parent project. For each application (tasks, documents, file releases, trackers, discussion forums, etc.) permissions can be assigned globally based on user type. Conversely, each user's permissions and access rights can be set individually.

Site administrators have further control over security by setting password requirements. In conjunction, administrators can track user activities. In the event of a data security compromise, a record of who is performing what activities will help resolve some of the security issues. Web servers log every page—or every Universal Resource Locator (URL)—accessed from the ALM environment, including the Internet Protocol (IP) address of the user, date and time of access, etc. These logs are very useful in tracking the source of any security violations that may occur.

4.6   ALM Environment Governance

CMS will govern the access and use of the collaborative ALM environment. Project processes and standards will be established and best practices adopted. When there are changes to the project processes, standards, and practices, the ALM environment can associate these changes with the affected areas of the project and communicate them across all projects at once. Adaptable administrative security and access features will buttress the established flow of control within the collaborative ALM environment, as described in subsection 4.5. The learning, sharing, and reuse processes are promoted by the many communication tools within the environment. The information contained within a project site can be shared and distributed efficiently based on the administrator's discretion. All project performance is managed, and all user activities are tracked, allowing for a great degree of accountability.

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Appendix A. ALM Scenarios of Use

A.1 ALM Methodology in Exchange Development

CMS will employ a web-based Application Life Cycle Management (ALM) environment that provides critical insight into Exchange Life Cycle (ELC) project execution for dispersed teams through a centralized suite of development, management, communication, and collaboration tools. A key to successful software development for large complex systems is a consistent and repeatable project management methodology that allows for collaboration and reduces risks. To support this, CMS has outlined the ELC.[5] As the states, independently or as a consortium, undertake the development of an Exchange, an ALM environment can support the organization and oversight of the ELC development processes through tools that enable systems development, building and testing, issue tracking, document management, task assignment, project reporting, and communications from within one environment.

All features of the ALM environment are centralized and can function to assist dispersed project teams or consortia of states in creating, managing, and organizing all aspects of the ELC from within one environment. At a minimum, the communication and collaborative functions of the CMS's preferred ALM solution can be utilized by states that will choose to use their own development environment. This allows for the sharing of information between states and CMS for a more informed and collaborative effort.

A.2 Life Cycle Management and Governance

The centralized ALM environment provides CMS the ability to oversee and manage the entire Exchange development and implementation within the Exchange Life Cycle process. The management features provided by the ALM environment will enable CMS to simplify the process of dispersing information, and ensure that all project teams have access to existing and new information and requirements.

A.3 State Use Scenarios

States have several options for setting their level of use in the collaborative ALM environment. This subsection delineates three options and how these options affect CMS oversight. Figure 4 summarizes the three scenarios and the elements available in each.

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[5]   Discussed in Section 3 of this document.

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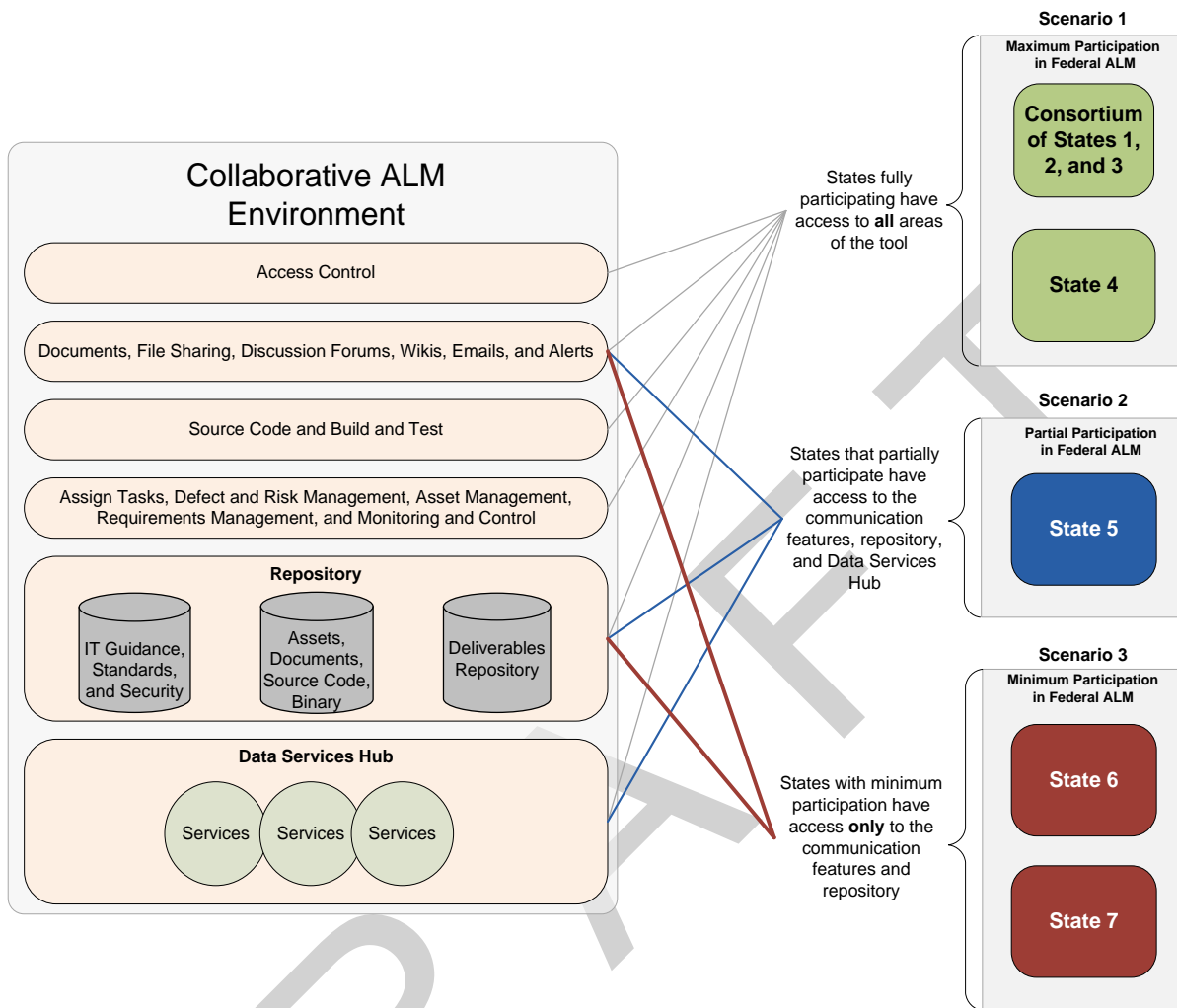
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Figure 4. Scenarios for State Usage of Collaborative ALM Environment

The following subsections provide greater detail for the three scenarios identified in Figure 4.

A.3.1   Scenario 1 – Full Participation

A state developing an Exchange participates fully in the ALM environment and will be:

- Using the ALM environment
  - All aspects of design and development will be defined, developed, and housed using the systems development tools
  - Design and development can be shared with other states and CMS
- Using the Data Services Hub
- Using the communication and tasking tools
- Fully under CMS oversight throughout the design, development, and implementation of the Exchange.

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A.3.2   Scenario 2 – Partial Participation

A state developing an Exchange participates partially in the ALM environment and will be:

- Using a separate, preferred environment for development outside of CMS's purview
- Updating and reporting ongoing progress to allow CMS oversight
- Using the Data Services Hub
- Using the ALM environment's communication and tasking tools
- Partially under CMS oversight throughout the design, development, and implementation of the Exchange.

A.3.3   Scenario 3 – Minimal Participation

A state developing an Exchange participates minimally in the ALM environment and will be:

- Using a separate, preferred environment for development outside of CMS's purview
- Updating and reporting ongoing progress to allow CMS oversight
- Not using the Data Services Hub
- Using the communication and tasking tools
- Minimally under CMS oversight throughout the design, development, and implementation of the Exchange.

Note: CMS is developing additional content to further explain and describe the states' use of the ALM environment and tools for implementing the ELC process. This content will include how to submit and access artifacts for stage gate reviews and which products/components will be available for sharing and reuse across multiple stakeholders.

A.4   Conclusion

Each state will determine the extent to which it uses the collaborative ALM environment in the development of the Exchange. Those states that choose to fully leverage the ALM environment will receive access to all development features, all communications features, and the Data Services Hub to house deliverables and receive information and tasks from CMS. (At a minimum, all states will receive access to the communication features.) States with maximum participation will have greater occasion to collaborate with other states and CMS. CMS will leverage the ability to share knowledge cultivated by the states to enhance collaboration, enable effective Exchange systems development, and to reduce project risks.

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Acronyms

AR	Architecture Review
ATO	Authority To Operate
CCIIO	Center for Consumer Information and Insurance Oversight
CIA	Confidentiality, Integrity, Availability
CMS	Centers for Medicare & Medicaid Services
COTS	Commercial Off-the-Shelf
DCIO	Deputy Chief Information Officer
DDR	Detailed Design Review
ELC	Exchange Life Cycle
EPLC	Enterprise Performance Life Cycle
ERA	Exchange Reference Architecture
FDDR	Final Detailed Design Review
GOTS	Government Off-the-Shelf
HHS	U.S. Department of Health and Human Services
ILC	Investment Life Cycle (CMS Integrated IT Investment &System Life Cycle Framework)
IP	Internet Protocol
IRS	Internal Revenue Service
FTI	Federal Tax Information
MOU	Memorandum of Agreement
O&M	Operations and Maintenance
OMB	Office of Management and Budget
ORR	Operational Readiness Review
PBR	Project Baseline Review
PDR	Preliminary Design Review
POA&M	Plan of Action and Milestones
PORR	Pre-Operational Readiness Review
PSR	Project Startup Review
SCM	Software Configuration Management

SOA	Service-Oriented Architecture
SORN	System of Record Notice
SPR	Safeguards Procedure Report
URL	Universal Resource Locator

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2. *Exchange Reference Architecture: Foundation Guidance,* Draft, Version 0.96, Centers for Medicare & Medicaid Services, March 3, 2011.