



Mississippi, Rhode Island, Maine Unemployment Insurance Consortium

Independent Verification and Validation Request For Proposal

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Bidders Pre-Bidders Webinar
April 1, 2015; 11:00 AM EDT

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Keyword Search: "RFP"
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Proposal Submission Date
May 1, 2015; 5:00 PM EDT
rfp_responses@itsc.org

National Association of State Workforce Agencies
Center for Employment Security Education and Research
Information Technology Support Center

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I. BACKGROUND AND PURPOSE

The US Department of Labor has offered an opportunity to develop a joint, multi-tenant Unemployment Insurance (UI) technology system in consortium through UIPL-18-12. The state agencies responsible for administration of the unemployment insurance (UI) programs of Mississippi, Rhode Island, and Maine (hereafter referred to as MRM), their governors, and their executive directors have committed to the development of this system, contingent upon adequate funding provided by the US Department of Labor. The Mississippi Department of Employment Security (MDES) has completed the modernization of their UI System, which will be the basis for the modernization Maine and Rhode Island's respective systems. The multi-tenant solution will be based upon the MDES existing UI System and will be created in a cloud environment, operated by MRM and funded through subscriptions paid to MRM by each participating state.

In 2012, MDES received grant funds to partner with additional states and develop a multi-state UI Benefits and Tax system. Tata Consultancy Services (TCS), the original vendor of MDES's UI System, re-engineered and modernized their legacy system. TCS was selected as the prime developer for the modernization project. TCS is refactoring MDES UI System's architecture to accommodate the implementation of a largely common set of functionalities among the MRM states. (Refer to the Technical Architecture Appendix B for a detailed technical description of MDES UI System and MRM.) Please refer to Appendix A for a high-level MRM Consortium Deployment schedule that depicts planned deployment dates and environment availability dates.

The National Association of State Workforce Agencies (NASWA) together with its subsidiary, Information Technology Support Center (ITSC) is releasing this RFP for specific Independent Verification and Validation (IV&V) services on behalf of MRM. For purposes of this RFP, both NASWA and ITSC will be referred to collectively as ITSC. The purpose of the RFP is to procure a vendor for deliverables-based Firm Fixed Price IV&V services whereby the Contractor provides independent and expert, objective-based analysis to validate that the MRM system meets the needs of the business users and stakeholders and verifies that the system complies with the requirements and specifications. The IV&V areas of focus are:

- Project Management Methodology, Methods, Processes, and Tools
- Requirements Traceability
- Architecture and Design Refactoring
- Testing
- Data Migration

II. DEFINITIONS

MS UI System: Mississippi Department of Employment Security modernized UI benefits and tax application.

III. SOLUTION OBJECTIVES

The focus areas of MRM in procuring Independent Verification and Validation (IV&V) services are:

- Project Management Methodology, Methods, Processes, and Tools
- Requirements Repository Management and Traceability
- Architecture and Design Refactoring
- Testing
- Data Migration

The duration of this engagement shall be from Contract Award to the full deployment of the MRM system for all states. The maximum Full Time Equivalent (FTE) shall be two and one-half staff members over the duration of the contract.

IV. PROPOSAL FORMAT AND TIMELINE

A. Format

Responses must be received electronically by 5:00 p.m. Eastern Time on May 1, 2015. The bidder will then receive a confirmation receipt within 24 hours of their submission. Responses will be sent to the email address of the sender along with any additional email addresses included in the submittal.

Please ensure that the submittal is in PDF format. All proposals must be submitted electronically to the following email address: rfp_responses@itsc.org.

Late proposals will not be accepted.

The ITSC believes a Bidder can submit a reasonably concise response that fully illustrates its proposed Solution. Therefore, Bidder shall make every effort to limit its full RFP response to 200 pages or less.

B. Timeline

The following RFP Schedule of Events represents ITSC's best estimate for this RFP.

EVENT	DATE (all dates are NASWA business days)	TIME (EDT)
1. RFP Issued	March 23, 2015	
2. Pre-proposal Webinar	April 1, 2015	11:00 a.m.
3. Written "Questions & Comments" Deadline	April 8, 2015	5:00 p.m.
4. Response to Written "Questions & Comments"	April 15, 2015	
5. Proposal Deadline	May 1, 2015	5:00 p.m.
6. Q&A with Bidders (optional)	TBD	
7. Best and Final Round (optional)	TBD	
8. Evaluation Notice Released	TBD	
9. Contract Negotiations and Signing	TBD	

ITSC reserves the right, at its sole discretion, to adjust the RFP Schedule of Events as it deems necessary. Any adjustment of the Schedule of Events shall constitute an RFP amendment, and ITSC will communicate such to potential Bidders from whom ITSC has received a Notice of Intent to Propose.

C. Guidelines for Questions and Comments

All questions pertaining to this RFP must be submitted in writing via e-mail to rfp_responses@itsc.org by 5:00 PM EST on April 8, 2015. Questions submitted after this date and time will not be considered. The consolidated questions and answers will be posted under the MRM IV&V RFP link on the landing page of: www.itsc.org. Only answers transmitted in this manner will be considered official and valid.

V. PROPOSAL AND CONTRACTUAL REQUIREMENTS

This section outlines specific information required in the response and will be used by ITSC as a basis for Contractor selection. For each requirement below, the Bidder must indicate their compliance and provide a detailed explanation of how they will fulfill each requirement in a separate Technical Proposal Document. Each requirement and Bidder response will be evaluated as part of the award process and constitutes a contractual obligation, subject to final negotiations with NASWA, on the

part of the Bidder should they be selected as the awarded Contractor. Please provide proof where applicable.

A. Project Management Methodology, Methods, Processes, and Tools

MRM overall Program Management Methods, Process, Tools, and Techniques employed in this project include:

1. Project Integration Management - Verify and validate that the various elements of the project are properly coordinated which includes:
 - a. Project Plan Update and Maintenance (using Microsoft Project)
 - b. Project Plan Execution
 - c. Integrated Change Control Process
2. Project Time Management - Verify that activities are in place for timely completion of the project which includes:
 - a. Activity Definition – Verify that specific activities have been identified to produce the various project deliverables.
 - b. Activity Sequencing – Verify that interactivity dependencies have been identified and documented.
 - c. Activity Duration Estimating – Verify that the number and duration of work periods have been properly estimated to complete individual activities.
 - d. Schedule Development – Verify that activity sequences, activity durations, and resource requirements were properly created for the project schedule.
 - e. Schedule Control – Verify control changes to the project schedule.
3. Project Resource Management - Verify that the project has necessary and sufficient staff resources to meet overall project milestones and timelines which includes:
 - a. Resource Planning.
 - b. Resource Monitoring
 - c. Human Resources Acquisition and Backfilling
4. Project Communications Management - Verify timely and appropriate generation, collection, dissemination, storage, and ultimate disposition of project information which includes:
 - a. Communication planning
 - b. Information distribution
 - c. Performance reporting
5. Project Risk Management - Verify that the project management has identified, analyzed, and responded to project risk, including maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to project objectives which includes:
 - a. Risk management planning
 - b. Risk identification
 - c. Qualitative risk
 - d. Quantitative risk

- e. Risk response planning
- f. Risk monitoring and control

Bidder Proposal and Contract Deliverables

Proposal Requirements: For each item A.1 through A.5 above and their lettered sub-elements, demonstrate a full understanding of the MRM project management methodology, tools and processes. Using past successful experiences, demonstrate how the Bidder will successfully verify and validate each item. The Bidder is limited to ten (10) pages. The Bidder must clearly label and identify their responses such that they trace to each item above, including sub-indentured items.

Contractual Requirements: A monthly report deliverable providing assessment of program management activities at the project and state levels, including recommendations for changes, modifications, improvements (See Appendix C for Pricing)

B. Requirements Repository Management and Traceability

As background for MRM requirements, traceability is the ability to describe and follow the life of a requirement, in both forwards and backwards direction (i.e. from its origins, through its development and specification, to its subsequent deployment and use, and through all periods of on-going refinement and iteration in any of these phases). It refers to the ability to define, capture, and follow the traces left by requirements on other elements of the software development environment. In the requirements engineering field, traceability is understanding how high-level requirements, including objectives, goals, aims, aspirations, expectations, and needs, are transformed into low-level requirements.

1. MRM uses Rational Requirements Composer (RRC) as its requirements management tool to implement an effective Requirements Management Process. As part of the Requirements Management Process, MRM is generating and regularly updating the Requirements Traceability Matrix. Items include, but are not limited to:
 - a. Business Rules
 - b. Functional Requirements
 - c. Non-Functional Requirements
 - d. Use Cases
 - e. Architecture and Design artifacts,
 - f. Application Code and Drools Business Rules
 - g. Data definitions
 - h. Test cases
 - i. Test plans
 - j. Test results

2. RRC is also being utilized for:

- a. Tracking changes to all artifacts stored in the system back to their origins.
- b. Base-lining to track the state of requirements at any given point in time.
- c. Linking and tracing to track relationships among requirements. For example, the tool shall have the ability to link the below items:
 - i. Business Rules to Functional Requirements
 - ii. Functional Requirements to Use Cases
 - iii. Use Cases to design artifacts implementing the use case
 - iv. Program/Database modules to use cases
 - v. Test Plans to Use Cases (May be redundant)
 - vi. Test Plans to Program/Database modules
 - vii. Test Results to Test Plans
 - viii. Workflow to automate requirements change management processes.
 - ix. Integration with other System development and Testing tools

Bidder Proposal and Contract Deliverables

Proposal Requirements: Bidders shall demonstrate an understanding of the MRM Requirements Management and Repository approach. Using past successful experiences, they shall demonstrate how they will successfully verify and validate each item 1 through 2 above including all numbered sub-elements. The Bidder must clearly label and identify their responses such that they trace to each item above, including sub-indentured items.

Bidders shall provide their successful experiences, including references for MRM verification, demonstrating how they will validate that the RRC requirements repository includes all validated use cases and element-level functional and non-functional system requirements (use case statements, a discrete business rule, etc.) resident in validated use cases, business rules, supplemental specifications, storyboards, relevant requirements artifacts, and RFP requirements.

Contractual Requirements: The Contractor shall validate and verify that the following detailed requirements are being met by the Design, Development, and Implementation (DDI) Vendor on a quarterly basis (See Appendix C for Pricing):

- a. All configurable system requirements shall be clearly identified.
- b. Common and System requirements shall be clearly identified.
- c. All State-unique System requirements shall be clearly identified for each specific MRM State.
- d. All system requirements shall be traceable to design, code, and test, at the element level using traceability matrices.
- e. All requirements changes shall be tracked with traceability to downstream development
- f. Processes clearly identified
- g. Verify and Validate B.1 through B.2 above

- h. The requirements repository tool shall be accessible by all MRM States through the use of a software tool that is capable of generating meaningful and current status reports and offers both out-of-the-box and custom reports.
 - i. Bidder shall maintain the integrity of the requirements repository throughout the development and operations, encompassing all System changes that occur under any resulting contract(s) from this solicitation.

C. Architecture and Design refactoring

MRM is refactoring Java-Based ACCESS MS for use by Maine and Rhode Island. Key architectural and design tenants are:

1. Promote as much configurability of the system by MRM business users as is practical and consistent with the functional requirements:
 - a. Business rules configurability, including calculations
 - b. Parameter configurability
 - c. Modifying or adding a UI program
 - d. System administration function configurability
 - e. Batch process configurability
 - f. Deployment and External Services Configurability
 - g. User Interface themes and styles configurability
 - h. Third Party product configurability
 - i. Correspondence and Workflow configurability
 - j. Mobile configurability
2. Ensure components are configurable and reusable to the maximum extent given leveraging MS ACCESS and development timelines.
3. The MS ACCESS architecture shall be refactored to optimize the sharing of solution's computing and software resources to the practical extent feasible, minimally implementing:
 - a. A shared network and infrastructure
 - b. A "Core" application solution and code which has mechanisms to promote the cost-effective reuse on a repeated basis
 - c. A core for which, when a change is made, the modification is only designed and coded once
 - d. Three separate distinct instances of the system to allow for operational independence
4. Best practices using interfaces, design patterns, and other principles of Object Oriented Development such as:
 - a. Single Responsibility Principle – each responsibility shall be a separate class and each class shall have only one reason to change.
 - b. Separation of Concerns Principle – software shall be split into discrete features that encapsulate distinct behavior and data that can be used by other classes. This ensures that code re-use is realistic with smaller blocks of code making bugs easier to isolate. Testing of small code segments is easier and

- the quality of the code is increased due to greater confidence that all aspects are being tested.
- c. Interface Segregation Principle – The dependency of one class to another one shall depend on the smallest possible interface.
 - d. Dependency Inversion Principle – Lower-level, dependent modules are referenced as abstract types rather than concrete implementations. High-level modules shall not depend upon low-level modules. Both shall depend upon abstractions. Abstractions shall not depend upon details. Details shall depend upon abstractions. Use dependency injection to supply an external dependency to a high-level module.
5. Architecture and solution shall be interoperable between the various modules using documented standards (e.g., web services, REST, etc.) and be consistent between all modules for maximum reuse and extensibility.
 6. Analysis and Design constructs and mechanisms shall be clearly derived from and trace to requirements. The traceability shall be maintained throughout the lifecycle of the project as part of the RTM.
 7. Design and Behavioral Patterns employed in the design shall be identified and documented to include the purpose and business processing application
 8. All uses of polymorphism and inheritance shall be used to promote leveraging of the ACCESS code base as appropriate.
 9. Application Code and Drools Business Rules shall be reused to ensure sharing of common functional requirements and rules across the application.
 10. Ensure the mobile implementation and solution meets the business needs and verify adherence to the specifications, and consistency with Best Practices using IBM MobileFirst.

Bidder Proposal and Contract Deliverables

Proposal Requirements: Bidders shall provide their successful experiences, including references for MRM verification, on how they will verify and validate that TCS is successfully adhering to each tenants identified in C.1 through C.10 above. The Bidder must clearly label and identify their responses such that they trace to each item above, including sub-indentured items.

Contractual Requirements: Contractually, the Bidder shall independently verify and validate that TCS is adhering to each tenant above, and provide a final report addressing TCS compliance and any non-compliance recommended corrective actions.

D. Testing

The Bidder shall provide objective and independent review and assessment to validate that the system being developed is the “right” system, and to verify that TCS is building the system correctly.

MRM requires Verification and Validation Testing (VVT) Services to:

- Verify and Validate that the system or software developed by the DDI Vendor meets the needs or requirements of MRM.
- Verify and Validate that the system or software developed by the DDV Vendor meets the design specifications.
- Verify and Validate that the system or software is free from defects to a sufficient level as determined by MRM.

1. Unit, Component, Integration, System Testing

The Bidder must assess the DDI Vendor Unit, Component, Integration, System Testing of the MRM system.

Responsibilities may include assessment and verification of the DDI Vendor testing as follows:

- a. Black Box Testing
- b. Structural Testing also known as “White Box Testing”
- c. Random Testing
- d. Static Testing
- e. Hardware and Software “Fault-Injection
- f. Dependability Analysis
- g. Hazard Analysis
- h. Perform Systems Testing including interfaces and MRM state end user involvement as defined in TCS and MRM approved test plans
- i. Regression testing
- j. Performance/Stress Testing in the cloud, mirroring the production environment
- k. system performance testing
- l. system load testing
- m. Installation Testing

Bidder Proposal and Contract Deliverables

Proposal Requirements: Describe, based on verifiable past experience, how the Bidder shall successfully fulfill each lettered items above. The Bidder shall address the processes, tools, and methods it has successfully used in past similar projects and what processes, tools, and methods they shall employ for this MRM activity. The Bidder must clearly label and identify their responses such that they trace to each item above, including sub-indented items.

Contractual Requirements: Report providing results of all tests conducted above as determined by MRM including recommendations for changes and modifications on a monthly basis, or as needed based on timely corrective actions (See Appendix C for Pricing).

2. User Acceptance Testing

An Acceptance Test team composed of State users from various functional areas will conduct the Acceptance Test. As with the system testing, the Acceptance Test will evaluate the MRM System as an integrated whole system in its entirety. The Acceptance Test will be conducted when systems testing and QA testing have been successfully completed and deemed “fit for use” by MRM. The Acceptance Test will include all activities to take place during the actual implementation.

The test will verify the following:

- a. All functional aspects of the system
- b. Installation of software
- c. Accurate and correct conversion of legacy data and manual data
- d. Effectiveness of training methods and materials
- e. Response time and overall system performance
- f. System hardware, software and telecommunications performance
- g. System, data, and application security
- h. Accuracy/performance of system interfaces
- i. Incorporates Mock Business Day

Bidder Responsibilities

1. Verify completeness of the DDI Contractor’s test plan
2. Validate MRM states’ readiness to initiate and execute UAT
3. Verify and Validate the Acceptance Test processes to ensure items a – i above are achieved successfully
4. Verify that a statistically valid sampling of errors and anomalies observed during testing are recorded and managed (see Test Result Tracking for further details and requirements)
5. Verify that all errors/anomalies are tracked until fixed and successfully retested
6. Weekly Report during any UAT activity on results of all tests and any changes which should be identified, prioritized and addressed with the MRM Project Director, including thresholds where quality of the MRM application software (functionally and technically) are at risk

Bidder Proposal and Contract Deliverables

Proposal Requirements: Describe, based on past and verifiable past experience, how the Bidder shall successfully fulfill each requirement item D.2.a through D.2.i above, and the six (6) items under “Bidder Responsibilities”. The Bidder must clearly label and identify their responses such that they trace to each item above, including sub-indentured items.

Contractual Requirements: Report evaluating the DDI Contractor's Acceptance Test plan, including recommended changes. Report on MRM states' readiness to initiate and execute Benefits/Appeal and Tax UAT (See Appendix C for Pricing).

3. Overall UAT Test Result Tracking

Bidder shall verify and validate that:

- a. The MRM and THE DDI VENDOR automated defect tracking tool captures, tracks, and reports UAT defects, issues, and discrepancies discovered at any test level of product testing and user acceptance testing.
- b. There is clear traceability of defects of the following attributes to assist both defect tracking and defect metrics collation for in-process validation controls efficiency in defect containment:
 - i. Software component
 - ii. Application development lifecycle stage
 - iii. Test level and Test type
 - iv. Test iteration
 - v. Common Core/State association
 - vi. Module, functional area, and use case concentration
 - vii. Test Scenario, Test Case, and Test Script responsible for defect detection
 - viii. Test data set, etc.
- c. That the defect tracking tool implements an integrated defect metrics framework to provide
 - i. real-time view of implemented software product health as it is being evaluated at multiple test levels
 - ii. critical indicators on overall maturity and effectiveness of implemented test strategies and deployed test assets in detecting defects prior to delivery utilizing following pre-build dashboards with Consortium and State-level views:
 1. Defect Density
 2. Defect Removal Efficiency
 3. Testing Efficiency
 4. Delivered Defect Density
 5. In Process Defect Density
 6. Overall Defect Density
- d. There is isolation of State specific software product defects from other States.
- e. Ensure the DDI Vendor is using these metrics to report the results of all testing phases to the MRM states. The test report will include the following in addition to the agreed upon test metrics:
 - i. Description of known outstanding issues at the end of testing phase;
 - ii. Plan for resolution; and

- iii. Impact assessment on Project schedule.
- f. In addition, Contractor shall ensure that test results are supplemented by an updated Requirements Traceability Matrix that captures downstream traceability of requirements to test cases developed/deployed for each test level and their final execution status at the test level.

Bidder Proposal and Contract Deliverables

Proposal Requirements: Describe, based on verifiable past experience, how the Bidder shall successfully fulfill each requirement 3.a through 3.f above and each of their sub-elements. The Bidder must clearly label and identify their responses such that they trace to each item above, including sub-indentured items.

Contractual Requirements: Report on a weekly basis documenting the results of UAT testing for the prior week and cumulatively addressing overall status, progress, trends, metrics, and D.3.a through D.3.f above, and include recommendations for changes and modifications (See Appendix C for Pricing).

E. Data migration

Each MRM State will require data conversion from its existing applications/systems to the System. TCS shall complete data conversion as a part of the System implementation for each MRM State, and the cost for data conversion for each MRM State shall be included in the proposed firm, fixed-fee price for System development and implementation.

TCS shall perform data conversion from existing systems/applications to the System as a part of the implementation for each MRM State. TCS's responsibilities shall include functions and processes necessary to ensure the successful conversion of each State's data to the proposed System, including the following minimum activities identified below. In the ETL Process, the extraction is the responsibility of the States, and the Transformation and Loading is the responsibility of the Contractor (TCS) with their ETL tool. The states lead the data cleansing activities.

The Contractor, TCS, shall develop and implement a Data Conversion Plan. This plan shall address the conversion of the data in a timely manner for each MRM State. The plan shall ensure data integrity and validity of the converted data. The Data Conversion Plan shall address the Contractor's strategy for converting the data on an ongoing basis through Performance Period for Acceptance. The Data Conversion Plan shall be developed to support and incorporate each MRM State approved implementation schedule.

The Bidder shall verify and validate that the following are accomplished by TCS and the States in MRM:

1. Identify roles, responsibilities, and staffing required to support conversion
2. Conversion overview noting objectives, approach, roles, techniques, testing process, data validation, impact, and resources.
3. Conversion strategy for handling “black out” period when switching from the old system to the new and the interfaces associated with each.
4. Conversion process (automated, manual, verification procedures, and acceptance responsibilities).
5. Identification and mapping of all data sources (source to target and also target to source).
6. Identification of data elements and/or systems to be converted, replaced, or impacted.
7. Identification of data needed to populate the System so that it is fully functional.
8. Data mapping specifications.
9. Identification of all conversion tasks.
10. Development of conversion programs, including specifications, program coding, test plans, and complete testing.
11. Schedule of conversion tasks.
12. Conversion environments.
13. States have sufficient staffing to support all data conversion and migration activities
14. Conversion support (system resource requirements, policy, and hardware) of all ETL cycles.
15. Manual conversion system/data cleanup and cleansing activities.
16. Manual data entry activities.
17. Procedure for continually updating MRM State data when there are changes to the source systems until all the MRM State sites have been implemented.
18. Identification of necessary computer processing workloads.
19. Identification of and planning for manual support requirements.
20. Identification of control procedures and evaluation criteria.
21. Special training for conversion activities.
22. Any interim file maintenance requirements.
23. Conversion testing and cleansing.
24. Data conversion and load process.
25. Identification and tracking of defects, error handling, and audit requirements.
26. Backup and recovery of converted data, including methods for returning to legacy state.
27. Procedure to review and compare the data from each State’s legacy system with the converted data in the “To Be” System. These reviews shall be conducted, at a minimum, by functional area with any resulting discrepancies documented and fully explained for the approval of each MRM State.
28. Inventory of data fields from each MRM State’s legacy system that are successfully mapped to those in the “To Be” System along with fields that cannot be mapped. For fields that cannot be mapped, include a detailed explanation for review and approval by each MRM State.

29. Inclusion of users to verify data integrity at the completion of the conversion process.

Bidder Proposal and Contract Deliverables

Bidder Requirements: Describe, based on past and verifiable past experience, how the Bidder shall successfully fulfill each requirement E.1 through E.29 above.

Contractual Deliverables: Bidder shall independently provide a report, an interim and final, that addresses whether TCS and the states have sufficient staff and expertise to accomplish tasks 1-29 above, verify the correctness and completeness of benefits and tax data mapping (source to target and target to source), verify and validate TCS's Data Migration Plan, that the ETLs and data cleansing is being accomplished consistent with the Project plan and level of accuracy needed for tasks 27-29 above and the deployment of the Benefits and Tax system for all three MRM states, and the final ETL loads for each state and major phase will be accomplished within acceptable blackout windows as determined by MRM, as well as providing any non-compliance recommended corrective actions for all these items (See Appendix C for Pricing).

F. Bidder Staffing Requirements and Qualifications

The following are the Bidder staffing and qualification requirements as they relate to the services set forth in the RFP.

1. Relevant Required Experience

For both the Bidder and the individual team members, emphasis should be placed on contracts that are similar in scope to the services requested by this RFP. Specifically, in its bid proposal, the Bidder shall have and document for the firm and team members, the following experience:

- a. Experience with business and information technology processes which are similar in size and complexity to the MRM project
- b. Review and analysis of program requirements and plans to confirm traceability, accuracy, and consistency throughout the program lifecycle
- c. Performance of Quality Assurance functions with respect to large scale, automated systems implementations
- d. Experience with Use Cases and Requirements Traceability
- e. Experience with large-scale implementation during design and implementation phases
- f. Experience with industry-standard and best practices regarding quality, quality assurance and quality control principles and techniques
- g. Expertise with a Requirements Management Tool, preferably RRC, and their most effective use within large-scale development and integration projects
- h. Broad experience with technical writing and review

- i. Experience with project management IV&V activities such as: Project Management, Project Planning, Managing Scope, Issue Resolution, Change Management
- j. Testing process including creation of test cases for testing software subroutines, systems and databases using existing tools, utilities and programs, script development, code reviews, script review, and testing reviews
- k. Data Migration experience for large software development project, including strong familiarity with data mapping, validation, ETL tools, and cleansing
- l. Expertise in refactoring a single, large software architecture to be multi-entity whereby computing resources are optimized

2. Preferred Required Experience

- a. Knowledge of Unemployment Insurance

3. Required Bidder's Response

Provide a narrative which details Bidder's relevant qualifications and experience.

- a. Qualification Form for Key Personnel

MRM and NASWA ITSC is seeking the necessary level of expertise to accomplish the contractual requirements of this engagement. As such, specific qualifications are enumerated below. For each qualification, place an "X" in the appropriate column to indicate if the candidate exceeds the qualification, meets the qualification, or does not meet the qualification. The table below shall be completed by the Bidder and provided in separate reference sheets. Bidder should provide additional information or clarifying statements in the 'Comments' column as appropriate.

Key Personnel: Bidder's Project Manager Candidate

Name: _____

<u>Required Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
The Bidder's Project Manager shall have managed one or more IT project(s) which: a. a budget of at least \$3 million in IT application development or IV&V services b. Project duration of at least two (2) years c. Project with complexities requiring coordination of work between multiple entities and vendors in a distributed environment				
The Bidder's Project Manager shall have a current Project Management Professional credential (or "PMP®") from the Project Management Institute.				
The Bidder's Project Manager shall have an understanding of and experience with iterative information system development methodologies.				
The Bidder's Project Manager shall have a minimum of twelve (12) years of project management experience in the public or private sector.				
The Bidder's Project Manager shall have project management experience in one (1) or more of the following business applications: Unemployment Insurance, Financial Accounting, Case Management, Tax Collection, Insurance or Claim Processing.				
The Bidder's Project Manager shall have a minimum of four (4) years of hands on experience using project management methodologies and associated tools and metrics.				
The Bidder's Project Manager shall have an undergraduate degree in an area relevant to the skills needed for managing the proposed Solution.				

<u>Desired Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
The Bidder's Project Manager should have a minimum of five (5) years of experience in managing IV&V Services for systems architecture development and implementation projects.				

The Bidder's Project Manager should have led one (1) or more projects that involved designing business processes and procedures and developing new systems.				
The Bidder's Project Manager should have led one (1) or more projects that involved communication and customer relationship management activities with both internal and external stakeholders.				
The Bidder's Project Manager should have experience in managing government IT projects.				
The Bidder's Project Manager should have experience in the Unemployment Insurance automation field.				
The Bidder's Project Manager should have an advanced degree in an area relevant to the skills needed for managing the proposed Solution.				
The Bidder's Project Manager should have a minimum of three (3) years of experience in managing systems architecture development and implementation projects.				
The Bidder's Project Manager should have demonstrated an ability to communicate and translate technical terminology, concepts and issues in terms understandable to technical and non-technical management and staff.				

Key Personnel: Bidder's Requirements Repository Management and Traceability Lead

Name: _____

<u>Required Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
<p>A minimum of three (3) years of direct experience on a large software development project with the requirements management repository RequisitePro and/or Rational Requirements Composer;</p> <p>Developing and managing an RTM to include items such as:</p> <ul style="list-style-type: none"> -Business Rules to Functional Requirements -Functional Requirements to Use Cases -Use Cases to design artifacts implementing the use case -Correspondence to use case -Batch programs to use case -Reports to use case -Program/Database modules to use cases -Test Plans to Use Cases (May be redundant) -Test Plans to Program/Database modules -Test Results to Test Plans -Workflow to automate requirements change management processes. <ul style="list-style-type: none"> • Integration with other System development and Testing tools • Control of changes to requirements, design and code. • Control of interface changes • Traceability of requirements, design and code. • Documentation of the change request process including check in/out, review and regular testing. • Documentation of the change control board and change proposal process. • Change log that tracks open/closed change requests. 				
Demonstrated ability to translate and communicate technical terminology, concepts and issues in terms understandable to technical and non-technical management and resource staff				

<u>Desired Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
A minimum of three (3) years of Unemployment Insurance experience				

Key Personnel: Bidder's Lead Test Candidate

Name: _____

<u>Required Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
The Bidder's Lead Test Manager shall have a minimum of three (3) years of hands on experience with testing processes, including unit, component, integration, system, and UAT, and tools.				
The Bidder's Lead Test Manager shall have experience in two (2) or more major projects as its Test Manager in an IV&V capacity.				
The Bidder's Lead Test Manager shall have a minimum of three (3) years of hands on experience utilizing an iterative software development methodology.				
The Bidder's Lead Test Manager shall have an undergraduate degree in an area relevant to skills needed for leading testing elements of the proposed Solution.				

<u>Desired Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
The Bidder's Lead Test Manager should have a solid understanding of application development project lifecycle including requirements gathering, analysis, design, development, testing and implementation.				
The Bidder's Lead Test Manager should have experience on one (1) or more projects as the Test Manager.				
The Bidder's Lead Test Manager should have an advanced degree in an area relevant to skills needed for leading testing elements of the project.				
The Bidder's Lead Test Manager should have demonstrated an ability to translate and communicate technical terminology, concept and issues in terms understandable to technical and non-technical management and staff.				

Key Personnel: Bidder's Architecture and Refactoring Design Lead

Name: _____

<u>Required Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
A minimum of three (3) years of direct experience with architecting, designing and developing a complex, large scale Web application and its technology components, such as the Application (SOA, JEE/Java), Database (DB2 preferably), and other technologies identified in Appendix B Technical Architecture				
A minimum of one (1) large software development project experience in refactoring a base architecture to transform it into a multi-tenant-type system that optimizes computer resources (hardware, software, 3 rd party products)				
A minimum of three (3) years of direct experience with architecting and/or implementing a large scale software solutions that is highly configurable by the system's business users;				
A minimum of one large software development project experience in direct experience Business Rules Engine				
Demonstrated ability to communicate and translate technical terminology, concept and issues in terms understandable to technical and non-technical management and resource staff.				

<u>Desired Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
Experience as Lead System Architect on a large-scale software development project that exceeded \$7.0 million				
A minimum of three (3) projects of similar scope and duration where served as the Lead System Architect				
A minimum of three (3) years of Unemployment Insurance experience				

Key Personnel: Bidder's Data Migration Lead

Name: _____

<u>Required Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
A minimum of three (3) years of direct experience with remediating and converting legacy non-relational data to relational databases				
A minimum of one (1) project of similar scope as the Data Conversion Technical Team Lead managing three (3) or more staff				
A minimum of two (2) years direct experience with conversion product(s) and automated processes to optimize the conversion process (specify products and processes)				
A minimum of three (3) years direct experience with database technologies				
A minimum of three (3) years of experience in the definition of transformation and mapping rules associated with the conversion or scrubbing/cleansing of legacy data				
Solid understanding of project lifecycle including requirements gathering, analysis, design, development, testing and implementation				
Demonstrated ability to translate and communicate technical terminology, concepts, and issues in terms understandable to technical and non-technical management and resource staff				

<u>Desired Qualifications</u>	Exceeds the Qualification	Meets the Qualification	Does Not Meet the Qualification	Comments
Experience as Data Conversion Lead on a large-scale software development project that exceeded \$7.0 million				
Experience as Data Conversion Lead on large-scale government or private sector insurance or financial software development project				
A minimum of three (3) years of Unemployment Insurance experience				
Experience in analysis required for converting data from multiple sources				
Experience in at least one (1) project where iterative development, testing, and implementation cycles of the conversion process were performed				

Proposal Requirement

The Bidder is required to provide a Project Plan, which is clearly identified in their reply, for this effort to include staff resource loading. See Appendix A for the overall MRM Project Plan. The maximum Full Time Equivalent (FTE) shall be two and one-half staff members over the duration of the contract.

Contractual Requirement

The Contractor shall provide an updated Project Plan on a quarterly basis.

b. Key Personnel and Resumes

The Bidder shall submit resumes for Key Personnel who are being proposed as a part of this RFP response. All personnel are required to be able to pass a background check. Each resume submitted shall include the following minimum information:

- i. Traditional resume information that confirms the Key Personnel member meets the experience and knowledge requirements listed under Relevant Experience for their assigned position. This information shall include the following specific data elements:
 - Full Name
 - Education
 - Identify each undergraduate and graduate College/University attended
 - Start and End Dates attended
 - Degree status (completed, in progress, etc.)
 - If degree was completed, attach a copy of the related transcript to authenticate the award of the degree
 - Employment History
 - Identify each position held within each referenced organization
 - Start and End Dates for position
 - General description of responsibilities required for each position
 - Specific project characteristics (if related to the proposed solution)
 - Certifications
 - Title of each certification received
 - Description of recurring certification requirements (if any)
 - Copy of appropriate documentation to authenticate certification award
- ii. Three (3) references to validate the individual's experience relative to this RFP. At a minimum, the following details shall be provided for each technical reference:
 - Name of the individual being proposed as a technical reference

- Company/organization name and position title where the technical reference currently works
 - Brief explanation of the technical references' past experience working with the proposed Key Personnel member
 - Current telephone number and email address that ITSC can use to contact the technical reference
- iii. At least one (1) sample of a document (Corporate Directive, Project Management Procedure, Technical White Paper, IT Specification, etc.) that was written almost entirely (90% or greater) by the proposed Key Personnel member. These samples will be evaluated to confirm the technical skill level and English proficiency of the proposed Key Personnel member.

Required Bidder's Response

Provide resumes as specified above for all project resources Bidder is proposing to successfully complete this Contract.

c. Bidder Experience

The Bidder shall provide a comprehensive listing of contracts of similar size and scope that the Bidder has successfully completed, as evidence of the Bidder's ability to successfully complete the services required by this RFP. Emphasis shall be placed on contracts that are similar in size and scope to the work required by this RFP.

Contracts used as Bidder Experience shall be from within the last five years. If Bidder has completed fewer than five similar projects in the last five years then include all projects completed in the last five years.

A description of all such contracts shall include:

- i. A description of the contract including a description of how it relates to the Bidder's ability to contribute to the success of the project that is the subject of this RFP
- ii. Beginning and ending dates for each similar contract
- iii. A list of team members who were involved in the project and their roles on the project
- iv. The contact name, address, phone number and e-mail address of the company performing work on each similar project

d. Bidder Information

Proposals must have a cover page that includes:

- Name of Prospective Vendor
- Project Title
- Contact Person

- Address
- Telephone, Fax Number, and E-Mail Address

e. References

Provide at least three (3) to five (5) references that match the scope of work outlined in this solicitation for projects that were completed successfully; at least 3 of the projects must be those identified in 3. above. Provide the principal contact, telephone number and email address, as well as a brief description of work performed. At least three (3) references must be available and responsive. Points will be deducted from the score for this criteria if the evaluation committee is unable to reach three (3) of the references provided. ITSC reserves the right to include other entities as additional references. ITSC also reserves the right to call references only on the selected Bidders as a method of determining responsibility.

G. Financials

Provide a copy of the last certified, audited financial statements for your company. ITSC reserves the right to review financials only on the selected Bidders as a method of determining fiscal responsibility.

H. Costs

Bidders shall provide the information required in the cost format specified in Appendix C, Cost Analysis, in order to be eligible to be awarded a contract. The information contained in this format will then be evaluated by the Evaluation Committee. The maximum Full Time Equivalent (FTE) shall be two and one-half staff maximum over the duration of the contract.

I. Conflicts with Terms, Conditions, or Requirements

1. Bidder shall list any exceptions or confirm that it has no exceptions to any of the terms, conditions or requirements of this RFP and/or documents contained in the Appendices.
2. Exceptions shall be accompanied by alternative or substitute language, which would be acceptable to Bidder. Conflicts with stated requirements shall be noted in the corresponding paragraphs within Bidder's response format.
3. Additional terms or conditions proposed by Bidder for consideration shall be provided with a reference to the corresponding paragraph in the RFP or Appendix Document.

VI. PROPOSAL SCORING AND SELECTION

A. Proposal Rating Criteria & Evaluation

Proposals will be evaluated as described in this section. Proposals that do not meet the minimum eligibility criteria will be automatically disqualified and will not be scored. The criteria and the level of importance associated with each is listed below:

Scoring Criteria	% of points
Project Management Methodology, Methods, Processes, And Tools	10
Requirements Repository Management And Traceability	10
Architecture And Design Refactoring	10
Testing	10
Data Migration	10
Bidder and Staffing Capabilities	20
Financials	10
Costs	10
Terms and Conditions Conformance	10

Bidders may be given an opportunity to provide an oral presentation or demonstration at the discretion of the MRM Consortium. ITSC reserves the right to limit the selection of the number of Bidders. ITSC reserves the right to select the presentation site. During the presentation, Bidder shall provide specific responses to the questions posed to it and may also make a summary presentation of its proposal. The presentation shall include a description of how Bidder's revisions, if any, may have affected the over-all nature of its offer as compared to the initial proposal. If the Evaluation Committee members believe it to be necessary, a question/answer period may follow. The entire oral presentation by the award winning Bidder will become part of the contractual artifacts and will be legally binding on the Bidder unless otherwise overridden by subsequent contract negotiations in writing.

B. Award and Notification

1. Award Recommendation

Upon completion of the evaluation process, the Evaluation Committee will formulate a recommendation as to which proposal(s) is/are determined to be most advantageous to the Consortium within available resources. A formal recommendation of the Evaluation Committee will be forwarded to MRM

Consortium Executive Committee for review and joint approval pursuant to the terms of the MRM Memorandum of Understanding (MOU).

2. Notice Of Intent To Award

Upon approval of the recommendation, a Notice of Intent to Award will be published by NASWA/ITSC. The awarded Bidder(s) will be contacted by ITSC to complete post-award requirements.

VII. RFP EVALUATION PROCESS

A. Proposal Evaluation

An Evaluation Committee will judge the merit of proposals timely received in accordance with an established evaluation criteria set and process (see below for the high level factors).

B. Evaluation Process

The Consortium will undertake an intensive, thorough, complete, and fair evaluation process. All Bidders shall be afforded fair and equal treatment throughout the evaluation process.

C. Evaluation Committee

Each Evaluation Committee member will independently evaluate the merits of proposals received in accordance with the evaluation factors stated within this RFP, followed by discussion of the entire Evaluation Committee. The sole objective of the Evaluation Committee will be to recommend for award the proposal determined most advantageous to the MRM Consortium.

D. Basis for Award

The purpose of this RFP is to solicit proposals for the goods/services specified herein. The requirements stated within this RFP represent the minimum performance requirements necessary for response as well as desired elements of performance.

E. Clarifications / Discussions

The Consortium may conduct discussions with selected Bidders for the purpose of promoting understanding of the Consortium's requirements and Bidder's proposal, clarifying requirements, and making adjustments in services to be performed and in prices and or rates. Bidders engaged in such discussions may be sent a list of questions and will be given a specified number of days in which

to formulate and submit written responses to the questions and provide any related revisions to their initial proposals. The nature of the questions will be, generally, clarifying in nature and will permit related revisions to proposals. Such revisions will be at the option of Bidder, but will be limited to the guidelines set forth in the Consortium's requested clarifications. No major changes will be permitted, nor will the Consortium accept any additional written materials not relevant to the questions/clarifications requested.

F. Best and Final Offers (“BAFO”)

Adjustments may also be allowed in conjunction with clarifications, discussions, presentations and/or demonstrations, but only to the extent such revisions are consistent within the proposal requirements.

These revisions will be considered as best and final offers. Such adjustments shall be submitted in writing.

G. Final Evaluations

After completion of clarifications, presentations, and BAFOs, as may be required, the Evaluation Committee will re-consider the initial proposal ratings and may make any adjustments they believe to be warranted as a result of the additional information obtained.

H. Notice of Intent to Award

Upon approval of the recommendation, a Notice of Intent to Award will be published by ITSC and the Awarded Bidder will be contacted by ITSC to complete post-award requirements.

I. Adequacy and Completeness of Response

In general, all aspects of a proposal will be evaluated based on its adequacy and completeness with regard to the information requested in the RFP and its appendices- i.e., compliance with terms, conditions, and other provisions contained in the RFP, as well as Bidder’s ability to read and follow instructions. Failure of Bidder to provide the information required in this RFP may result in disqualification of the proposal.

This responsibility belongs to the Bidders.

J. Contract Review

Bidders shall review the attached Terms and Conditions, Appendix D, and list any exceptions, or confirm that no exceptions are taken, to the each contract. Any exceptions shall be accompanied by alternative or substitute language which

would be acceptable to Bidder. ITSC will review the proposal to ensure Bidder has not taken any exceptions which may be deemed unacceptable or exceptions to stated requirements which may be deemed unacceptable in meeting the RFP requirements. Any exceptions taken could result in elimination of Bidder's proposal from further consideration, or result in delay or failure to execute a contract, whereby ITSC could terminate the award and commence negotiations with another Bidder.

K. Payment Plan

The payment plan will be negotiated and based on, in part, ITSC's review of the Appendix C.

Appendix A
MRM Project Schedule

Task Name	Start	Finish
Benefits Modernization		
Benefits 1 Subproject		
Requirements Phase	Thu 6/6/13	Tue 4/1/14
Analysis Phase	Wed 1/29/14	Wed 6/25/14
Design Phase	Wed 4/30/14	Wed 9/17/14
Development Phase	Mon 9/8/14	Fri 12/26/14
System Testing Phase	Mon 12/8/14	Tue 4/21/15
User Acceptance Testing Phase	Fri 4/3/15	Tue 7/14/15
Implementation Phase (Mississippi)	Thu 5/14/15	Mon 6/8/15
Training and Knowledge Transfer Phase	Thu 5/14/15	Fri 5/22/15
Warranty Support Phase	Mon 6/8/15	Fri 9/4/15
Production Support Phase	Mon 9/7/15	Tue 9/8/16
Benefits 2 Subproject	Fri 1/17/14	Tue 8/29/17
Requirements Phase	Fri 1/17/14	Fri 1/23/15
Analysis Phase	Thu 11/27/14	Fri 2/20/15
Design Phase	Mon 12/22/14	Tue 4/21/15
Development Phase	Thu 4/16/15	Mon 8/31/15
System Testing Phase	Wed 8/5/15	Wed 3/2/16
User Acceptance Testing Phase	Wed 12/2/15	Wed 5/25/16
Implementation Phase (all 3 states)	Mon 1/4/16	Thu 5/26/16
Training and Knowledge Transfer Phase	Mon 1/18/16	Wed 5/25/16
Warranty Support Phase	Thu 2/4/16	Wed 8/24/16
Production Support Phase	Thu 5/5/16	Tue 8/29/17
Tax Modernization	Mon 9/15/14	Tue 12/11/18
Tax 1 Subproject	Mon 9/15/14	Tue 12/11/18
Requirements Phase	Mon 9/15/14	Tue 4/7/15
Analysis Phase	Wed 4/8/15	Fri 6/26/15
Design Phase	Mon 6/8/15	Fri 10/30/15
Development Phase	Mon 11/2/15	Mon 7/4/16
System Testing Phase	Tue 7/5/16	Tue 11/1/16
User Acceptance Testing Phase	Mon 7/3/17	Mon 9/4/17
Implementation Phase	Mon 8/7/17	Wed 9/6/17
Training and Knowledge Transfer Phase	Mon 8/21/17	Tue 8/29/17
Warranty Phase	Thu 9/7/17	Wed 12/6/17
Production Support Phase	Thu 12/7/17	Tue 12/11/18
Data Migration and Bridging	Mon 9/2/13	Wed 12/16/15
Data Migration	Mon 9/2/13	Wed 12/16/15
Benefits 1 - ME, RI	Mon 9/2/13	Wed 2/4/15
Benefits 2 - ME & RI	Fri 2/27/15	Wed 12/16/15
Bridging Interfaces	Fri 8/1/14	Fri 1/9/15

APPENDIX B

MRM CONSORTIUM TECHNICAL ARCHITECTURE

Version 2.1



March 18, 2015

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APPENDIX B

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Document Revision List

Rev#	Date	Description	New Page #	Prev Page #	Revised By
1	09/23/2013	Document updated as per the review comments given by ITSC.			TCS
2	09/23/2013	Document updated as per the review comments given by State of Maine.			TCS
3	10/02/2013	Document updated as per the review comments given by State of Rhode Island.			TCS
4	10/21/2013	Document updated as per the review comments given by State of Maine on Version 1.1.			TCS
5	10/25/2013	Document updated as per the review comments given by ITSC on Version 1.1.			TCS
6	10/29/2013	Document updated as per the review comments given by State of Rhode Island on Version 1.1.			TCS
7	01/27/2014	Document updated with changes given by MDSE. ACCESS MS Server details have been added along with updated logical diagram on Version 2.0.			TCS
8	02/24/2014	Document updated with changes given by MDSE. ACCESS MS logical diagram has been updated along with few Software components on Version 2.1.			TCS
9	04/25/2014	Document updated with changes given by MDSE. ACCESS MS logical diagram has been updated along with sentence modification for Access environment under chapter 3.			TCS

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1. Introduction

This document contains the technical architecture for the Automated Comprehensive Claims and Employment Service System (ACCESS) of MRM Consortium being developed as part of the Phase III of Unemployment Insurance Modernization (UIM) project for the Mississippi Department of Employment Security (MDES).

This document will form the technical basis for the subsequent phases of the project such as technical detailed design, construction and enhancement.

1.1 Target Audience

The target audience for this document is the MDES development team, the MDES business user and the Tata Consultancy Services (TCS) development team.

1.2 References

The technical architecture is created based on the following artifacts:

- Technical Architecture document for ACCESS MS Tax and Benefits System
- Scope of Work document for the MRM Consortium

2. Acronyms and Abbreviations

S No	Acronyms	Description
1.	ACCESS	Automated Comprehensive Claims and Employment Service System
2.	ALJ	Administrative Law Judge
3.	API	Application Programming Interface
4.	AS	Application Server
5.	BI	Business Intelligence
6.	BIRT	Business Intelligence and Reporting Tools
7.	BOR	Board of Review
8.	CSR	Customer Service Representative
9.	CSS	Cascading Style Sheets
10.	DAO	Data Access Object
11.	DBMS	Database Management Systems
12.	DHS	Department of Human Services
13.	DMS	Document Management System
14.	DMZ	Demilitarized Zone
15.	DNS	Domain Name Server
16.	EAP	Enterprise Application Platform
17.	EJB	Enterprise Java Beans
18.	ES	Employment Services
19.	ETL	Extract, Transform and Load
20.	FEIN	Federal Identification Number
21.	FTP	File Transfer Protocol
22.	HTML5	Hyper Text Mark-up Language 5
23.	HTTP	Hypertext Transfer Protocol
24.	HTTPS	HTTP over SSL

S No	Acronyms	Description
25.	IaaS	Infrastructure as Service
26.	IBM	International Business Machines
27.	ICON	Interstate Connectivity
28.	IDE	Interactive Development Environment
29.	IIOP	Internet Inter-ORB Protocol
30.	IP	Internet Protocol
31.	IRS	Internal Revenue Services
32.	IT	Information Technology
33.	ITS	Information Technology Services
34.	IR	Interactive Response
35.	JEE	Java Platform Enterprise Edition
36.	JAAS	Java Authentication and Authorization Service
37.	JAF	Java Activation Framework
38.	JAXP	Java API for XML Parsing
39.	JDBC	Java Database Connectivity
40.	JDO	Java Data Objects
41.	JMS	Java Message Service
42.	JMX	Java Management Extensions
43.	JNDI	Java Naming and Directory Interface
44.	JPA	Java Persistence Architecture
45.	JSP	Java Server Pages
46.	JSTL	Java Standard Tag Library
47.	JTA	Java Transaction API
48.	KPI	Key Performance Indicator
49.	LDAP	Lightweight Directory Access Protocol
50.	MDES	Mississippi Department of Employment Security

S No	Acronyms	Description
51.	ME	Maine
52.	MQ	Message Queue
53.	MRM	Mississippi, Rhode Island and Maine
54.	MS	Mississippi
55.	MVC	Model View Controller
56.	OCR	Optical Character Recognition
57.	ODBC	Open Database Connectivity
58.	ODBO	Object Linking and Embedding, Database for Online Analytical Processing
59.	OLAP	Online Analytical Processing
60.	OMG	Object Modelling Group
61.	ORB	Object Request Broker
62.	ORM	Object Relational Mapping
63.	RI	Rhode Island
64.	RMI	Remote Method Invocation
65.	RTC	Rational Team Concerts
66.	SAN	Storage Area Network
67.	SDK	Software Development Kit
68.	SIEM	Security Information and Event Management
69.	SOA	Service Oriented Architecture
70.	SSH	Secure Shell
71.	SSL	Secure Sockets Layer
72.	SSO	Single Sign On
73.	TCS	Tata Consultancy Services
74.	UAT	User Acceptance Test
75.	UDB	Universal Database

S No	Acronyms	Description
76.	UI	User Interface
77.	UIM	Unemployment Insurance Modernization
78.	VSAM	Virtual Storage Access Method
79.	WAN	Wide Area Network
80.	XML	eXtensible Mark-up Language

3. Technical Architecture Validation

This section describes the technical architecture validation decisions made for the ACCESS System based on the Access MS Benefits and Tax Systems. ACCESS-MS current system is having two environments namely UAT and Production.

Application Hosting

The UI application for all the MRM Consortium states will be hosted out of a third party data center. The infrastructure for ME, MS & RI will be hosted separately on a cloud (IaaS) infrastructure that will be also managed by a third party such as IBM, Savvis, AT&T, BULL or others. The entire platform will be virtualized so that any requirement for scaling up / down can be easily achieved. This will also enable any future consortium member state to deploy the new UI application within a very short turnaround time. The modular architecture will enable any future state to be part of the MRM consortium within a very short time span.

The new MRM application will be based on the IaaS cloud platform and will have three logically separate infrastructures for each of the member states. Each state will have the below mentioned servers for their state specific application with a common code base and business rule sets.

MDES had discussions with IBM & Sun Guard regarding the application hosting on cloud infrastructure (IaaS). They will also explore the options with a few more vendors and keep all the MRM consortium member states informed as more information is available.

The following table presents the various architectural software and hardware components and any applicable upgrade paths.

S. No	Software Component	Current Version (Mississippi)	Upgrade To	Remarks
3.1 Programming Language				
1.	Java Programming Language	Java 6	Java 7	
2.	Java Enums	Java 5 Based Enums	Java 7 Based Enums	
3.	Objective C	None	2.0	iOS programming language
3.2 Commercial Software				
4.	DB2 UDB Database	9.7	10.5	Upgrade the fix packs as and when need arises.

S. No	Software Component	Current Version (Mississippi)	Upgrade To	Remarks
5.	WebSphere Application Server	7.0+ (Supports JEE 5 specifications and Java 6)	8.5 (Supports JEE 6 specifications and Java 7)	Options are being explored if JBoss Enterprise Application Platform v 6.1 can replace WebSphere 8.5.
6.	Drools Workflow	5.1	Same	
7.	LDAP Server	Sun Directory Server 5+	RedHat JBoss Directory Server 8.2	
8.	Spectrum Address Validation	Spectrum Software	Same	Current licensing is at 3 million records hit per year.
9.	Mail Stream Plus	Mail Stream Plus	Same	Current licensing is at 3 million records hit per year
10.	Reporting Servicer	JReport 9.0+ / BIRT	BIRT 4.2	JReports will have to be migrated to BIRT server.
11.	Microsoft MS Access – Adhoc Reporting	Microsoft MS Access 2003	IBM Infosphere	
12.	IR	Avaya	Same	IR Software is out of scope. State will continue to use their existing software which the Application will Interface with Weekly Certification filing functionality.
13.	Spell Check Software	Rapid Spell - http://www.keyoti.com/products/rapidspell/javaWeb/#	Same	
14.	Drop Down Menu Software	UDM 4.5	Same	
15.	IBM Cognos BI	None	IBM Cognos BI 10.1	Refer 8. Business Intelligence for Cognos features and comparison with other BI products.
16.	IBM App Scan	None	IBM Security App Scan 8.7	Refer 6.2.3. Security for more details

S. No	Software Component	Current Version (Mississippi)	Upgrade To	Remarks
17.	IBM Infosphere Guardium Data Activity Monitor	None	9.0	Refer 9.1 IBM Infosphere Guardium Data Activity Monitor for more details.
18.	IBM Infosphere Guardium Data Encryption	None	9.0	Refer 9.3 IBM Infosphere Guardium Data Encryption for more details.
19.	EMC AVAMAR	6.1	Same	Refer 10.1.14 Backup Process for more details.
20.	Connect Direct	4.6	Same	Software Tools used for TOP requirement. Refer 10.1.12 TOP (Treasury Offset Program) for more details.
21.	JSCAPE MFT Server	JSCAPE MFT Server Professional Edition 7.2	JSCAPE MFT Server Professional Edition 8.8	JSCAPE MFT Server is a platform independent managed file transfer solution that centralizes all file transfer processes. JSCAPE MFT Server supports all major file transfer protocols including FTP/S, SFTP, SCP and HTTP/S.
22.	Vormetric Data Security Manager	None	Latest available version	Centrally manages policies and keys for all Vormetric products.
23.	Vormetric Transparent Encryption	None	Latest available version	Secures any database, file or volume across servers.
3.3 Open Source Software				
24.	DMS - Apache Jackrabbit	1.5	2.6	Upgrade as and when need arises and a stable version is available. Refer 10.1.7 Document Management System for more details

S. No	Software Component	Current Version (Mississippi)	Upgrade To	Remarks
25.	Batch Scheduler Software - Quartz	1.7.3	Same	Upgrade as and when need arises and a stable version is available

3.4 Application Framework Software (Open Source)

26.	User Interface Layer - Apache Struts	1.3.5	Same	Decision taken to remain with Struts 1 and not upgrade to Struts 2 as it will require major change and there won't be much benefits.
27.	Data Access Layer - Hibernate	3.3.2 with Annotations.	4.2	
28.	Logging – Log4j	1.2.2	Same	
29.	Display Tag Library (Search Result Screens)	1.2	Same	
30.	Bitronix Transaction Manager (BTM)	1.3+	Same	It's used as standalone transaction manager for BizServer
31.	Business Rules Engine	None	JBoss Drools Expert 5+	Rules Engine to be integrated for implementing State Specific Rules.
32.	Cocoa Touch	None	2	Framework Collection for iOS app development

3.5 Development Software/Tools

33.	Requirements Management – Rational Requirements Composer	None	Jazz Platform 4.0	For requirements, use case management and impact analysis.
34.	Rational Team Concerts	None	Jazz Platform 4.0	Configuration management tool with version control and work item management

S. No	Software Component	Current Version (Mississippi)	Upgrade To	Remarks
35.	Rational Software Architect	None	IBM Modelling Tool	Modelling during analysis and design phase.
36.	Rational Quality Manager	None	IBM Testing Tool	Managing test plan, test design, test implementation, execution and evaluation
37.	Rational Performance Tester	7.1	8.1	
38.	Robo Help			Help file generation
39.	Prototype	Axure	Axure	http://www.axure.com/
40.	Eclipse IDE	3.4.2 , 3.5+	RTC Client	
41.	Ant	1.7+	1.8+	Apache Ant is a Java-based build tool.
42.	JBoss – Development Application Server	5.0+	7.0+	For development environment
43.	SQL Client - Squirrel	3.5	Same	Update as and when need arises and a stable version is available.
44.	XDoclet (1.2.3)	1.2.3	Same	Struts Configuration Generator, Struts Validation Generator
45.	Eclipse with ADT	None	3.5+	Eclipse with Android Development Tools plugin
46.	Google CodePro AnalytiX	7.0	Same	CodePro tools used for code quality
47.	Android SDK	None	4.3	Android mobile app development kit
48.	Xcode	None	4.6.3	IDE for iOS app development
49.	iOS SDK	None	6	Software Development Kit for iOS

S. No	Software Component	Current Version (Mississippi)	Upgrade To	Remarks
3.6 Software Systems (Production)				
50.	Consortium DB2 Database	Benefits & Tax Database for MS	DB2 Schema is common for all three consortium states.	
51.	Web Application	Separate Benefits and Tax Web application	Each state will have its own Benefits and Tax application instance	Pros and Cons discussed later on in this section.
52.	Drools Database	Drools Tables resides in the ACCESS database.	Same	
53.	BizServer	MS Biz Server	Deploy as a separate application for each state.	
54.	Batch Server	MS Batch Server	Deploy as a separate application for each state.	
55.	Report Server	MS Report Server	Separate Reporting server for each state.	
56.	Mail Stream Plus Server	Mail Stream Plus server	Same server	
57.	DMS Repository	DMS repository	2 DMS Repositories with Current and Old documents for each state	

3.7 Separate vs. Bundled Application

The main purpose of separating the Tax and Benefits applications is to reduce the dependency of the Tax application to the Benefits application and vice versa. To further separate the existing applications, the common features that are used by both the Tax and Benefit applications will be restructured and maintained in the core framework. As a result, the Tax and Benefits applications will use all these common objects and methods from the framework layer. By maintaining this architecture, we can avoid code repetition in each state specific application, increasing maintainability and developers' productivity.

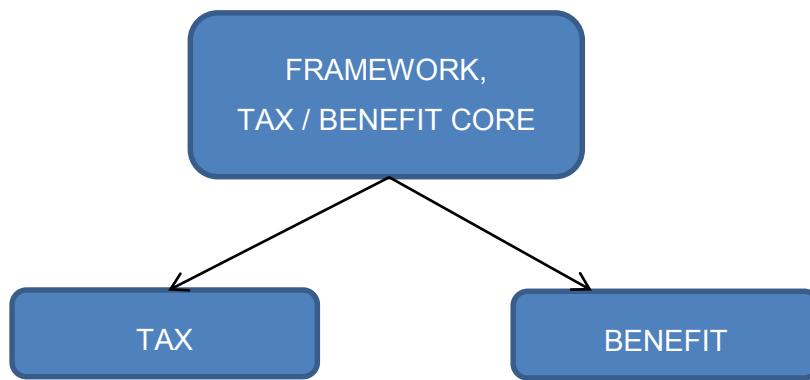


Figure 1: Build process for separate application

The following table lists the pros & cons of providing the Tax system as a separate application vs. bundling the Tax application with the Benefits application.

Comparison between Tax and Benefits as a separate application and bundled application

S. No	Separate Application	Bundled with Benefits Application
1.	Problems of each application are isolated. Problems occurring in one application will not affect the others.	Problems of one application can affect the working of other application.
2.	Each application can be brought down on their own times, independent of each other. Tax application will be up and running even when Benefits is down and vice versa.	If there is an issue in either Benefits or Tax, the whole application has to be brought down for the fix/new build to be deployed.
3.	Availability of the system increases.	Availability of the system decreases
4.	Maintainability of the system increases. Software system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment without having any adverse effect on the other system.	Maintainability of the system decreases.
5.	Deployment benefit increases, as the codebase gets smaller the build and deployment time will decrease.	Build and deployment time will increase as codebase will get bigger.
6.	Any issue related with multiple application login can be easily resolved with Single Sign On between these two applications.	None
7.	Developer's productivity increases as the development build time decreases due to small codebase	Developer's productivity decreases as the development build time increases due to larger codebase
8.	Performance of the system increases as the software size decreases along with the distribution of the number of concurrent users accessing the system.	Performance of the system can easily decrease due to larger number of concurrent users even when they are accessing quite different modules of the system.

Recommendation: Deploy Tax as separate application

4. General Description

This section describes a high-level architecture overview of the ACCESS System, which will be on a distributed computing environment.

4.1 Architecture Overview

The ACCESS System will be built on Java Platform Enterprise Edition (JEE 6) based multi-tier architecture. ACCESS will have three main tiers:

- Client Tier
- Middle Tier
- Enterprise Information System (EIS) Tier

These tiers contain multiple layers, which interact with each other to perform business functions. The main reasons for dividing the application into tiers/layers are:

- Each layer has a specific system abstraction and specific responsibilities.
- When an application is divided into layers, each layer can be monitored, tuned, and upgraded independently.
- The partitioning of the application enables rapid design and development of the system.
- Separating the functions into distinct layers enables ease of monitoring and better optimization of the performance of each layer.
- Load balancing and addition of capacity can be performed independently in each layer.
- Multi-tier architecture makes it simpler to scale the system across multiple processors on different machines.
- The separation of operations provides the ability to add features easily without having to redesign the entire system.

Figure 2 depicts the logical view of the ACCESS layered architecture. The design of ACCESS will predominantly be based on this architecture.

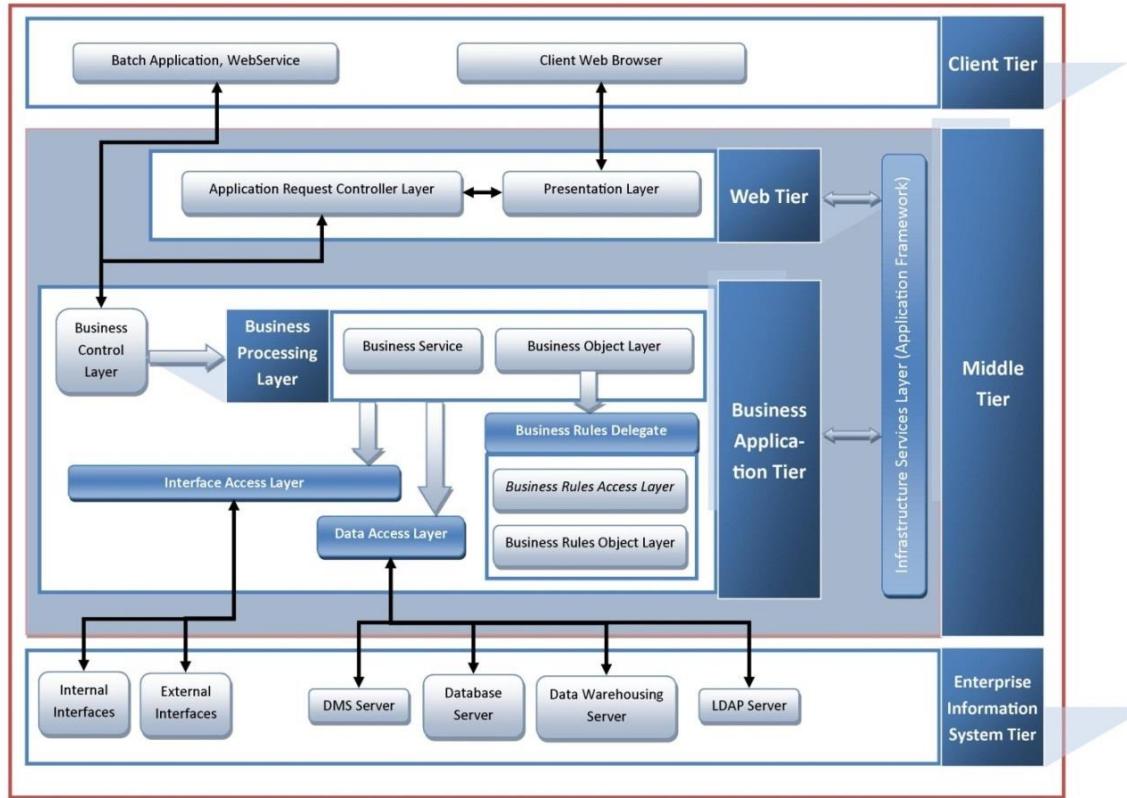


Figure 2: Logical View of ACCESS Layered Architecture

4.1.1 Client Tier

For the ACCESS system, the client tier will be the combination of browser, batch application and IR web service.

4.1.1.1 Browser

A browser is the means by which the users will connect to the system. Browsers are the thinnest of clients; they display data to the users and rely on servers for application functionality.

4.1.1.2 Batch Application

A batch application will also act as a client for the main application business processing. To take the load off the main server, another server application (BizServer) will be deployed to process requests coming from the batch application.

4.1.1.3 Web Service

4.1.1.3.1 IR Application

An IR application will also act as a client for the main application business processes. This IR application will send the request to the main business processes via the wrapper web services. The request will be processed and response will be sent back via the synchronous two way request-response mechanism.

4.1.1.3.2 Mobile Application

A Mobile application will also act as a client for the main business processes. This mobile application will interact with the ACCESS system via web services to provide access to business services to the end user. This request will be processed and response will be sent back to mobile devices synchronously. Details of mobile application for ACCESS system has been described in detail in the [Mobile Application](#) section of this document.

4.1.2 Middle Tier

The middle tier receives and processes requests from the client tier. This eliminates the need for client programs to deal with the complexity of databases and other complex back end systems. The middle tier is made up of the following:

- Web Tier
- Business Application Tier
- Infrastructure Services Layer (Application Framework)

4.1.2.1 Web Tier

Web Tier will have two main layers and they are:

- Application Request Controller Layer
- Presentation Layer

Application Request Controller Layer

The Application Request Controller Layer receives the request from the client tier and forwards to the appropriate User Interface (UI) model of the Presentation Layer and also to the Business Control Layer for processing. It also acts as a mediator between the Presentation Layer and the Business Layer.

Presentation Layer

Most of the end user interactions (except batch processing and internal messaging invocation for workflow components) with the system will be through the Presentation Layer. The Presentation Layer will be used to display information and for receiving inputs from the end user. This layer has been sub-divided into four parts:

- User Interface (UI) View
- User Interface (UI) Model

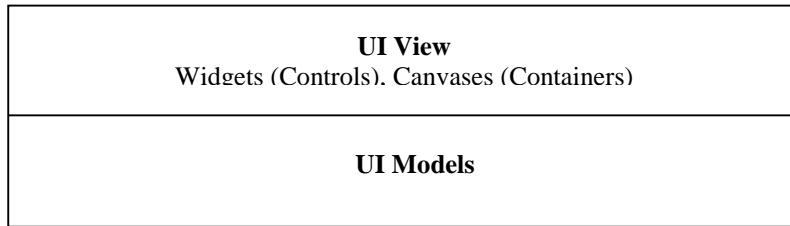


Figure 3: Presentation Layer

The UI view layer is responsible for managing the user interaction and visual aspects of the system. Examples of user interaction management are:

- Navigation scheme (Both screen and field navigation)
- Graphical widgets used for capturing data and to issue a command

Examples of visual aspects are:

- The static text displayed in a screen
- The language used to display static text
- Graphical Widgets used to display dynamic/static system information
- The order in which the information is presented

The main focus of the presentation layer is to provide the ability to change the visual aspects of the system without affecting other parts of the system. This is achieved by separating the UI model from the UI view layer. UI model is the layer beneath the UI view layer. UI Model is a non-graphical representation of the UI view layer. The advantages of dividing the presentation layer are:

- UI view (see Figure 3) is not required to drive other layers. This facilitates automated testing of components belonging to other layers and independent development of other layers without requiring any UI to drive them.
- Provides flexibility to choose from a variety of widgets and canvases and have different views of the same model.

UI view will be an extremely thin layer, which will capture the user inputs and will have the ability to perform very basic functions and then pass the information to the UI model. The UI model retains all the information that is displayed in presentation and will interact with the application layer to accomplish the end user's request. One UI model can be linked to a number of UI views.

4.1.2.2 Business Application Tier

Business Application Tier will have four main layers and they are:

- Business Control Layer
- Business Processing Layer
- Business Rules Delegate
- Interface Access Layer
- Data Access Layer

Business Control Layer

The Business Control Layer passes the request from the application request controlling layer to the business processing layer. This is the only way for the UI model of the presentation layer to get data from the business processes.

Business Processing Layer

The Business Processing Layer contains the “business rules” or the main processing logic of the application. Business processing layer will have two sub layers:

- Business Service Layer (also known as the Business Function Layer)
- Business Object Layer

The Business Object Layer houses all the real world entities (physical as well as logical) that are stakeholders of the system. Each entity has attributes and operations that can be performed by the entity / on the entity. Business objects are connected to the database through the Data Access Layer. The Business Service Layer assembles the information from business object layer to serve a distinct business purpose. Each assembly represents a method in Business Service Layer. This layer receives inputs from UI Layer, invokes business objects and subsequently modifies the state of the system.

Business Rules Delegate

The Business Rules Delegate implements the delegate pattern for Business Rules Implementation. The implementation contains of following two sub layers:

- Business Rules Access Layer
- Business Rules Object Layer

The Business Rules Access Layer represents the framework classes that abstract the logic of accessing the Business Rules Knowledgebase from the calling Business objects. The Business Rules Object Layer consists of the Fact model required for Business Rules implementation. The Business Rules Delegate is explained in detail in the Business Rules Framework and Guidelines document checked in at:

“<consortium_main_view>\ACCESS_CONSORTIUM_VOB20-Standards And Guidelines\Business Rules\ Business Rules Framework and Guidelines Doc.docx”

Interface Access Layer

The Interface Access Layer will manage the abstractions for any external and internal systems. Business Processing Layer will be the only layer that interacts with this layer, which helps in isolating the dependencies of other system.

Data Access Layer

The Data Access Layer helps the components of business layer to access data and hides the implementation details of the underlying Enterprise Information System Tier.

4.1.2.3 Infrastructure Service Layer

The Infrastructure Service Layer is also called the Application Framework and has been described in detail in the [Application Framework](#) section of this document.

4.1.3 Enterprise Information System Tier

EIS tier provides the information infrastructure that is vital to the business processes of an enterprise. The EIS tier handles software and includes enterprise infrastructure systems such as database servers, directory servers, and internal/external systems.

4.1.4 Business Rules Engine

The Business Rules Engine is used to write all the business validation rules in a specific rule file. It will provide a separate layer from the development code (Business logic). Whenever any changes will be required to those validations it will only be necessary to change the rule files. So, there will be no need to change the code. Implementation for the Business Rules Engine has been described in detail in the [Business Rules Implementation](#) section of this document. The Business Rules framework component will be rolled out into Production well before the MS Benefits 1 rollout to serve as the POC for the implementation. This framework component rollout will be planned along with the MS support builds planned.

Key Features and Advantages of the Business Rules Engine:

- Declarative Programming
- Logic and Data Separation
- Speed and Scalability
- Centralization of Knowledge

5. Core and State Specific Component Implementation

For the MRM Consortium project, a single code base for all the three states and individual state specific deployment architecture is proposed. The single code base will be comprised of core and state specific components. This will support centralized application support for all the states thus reducing overall maintenance cost. The individual state specific deployment of the application will provide flexibility in terms of life cycle management to each state application thus allowing scheduling of application builds and upgrades for each state to be independent of the others.

5.1 Codebase Setup

For code configuration management it is suggested to upgrade to Rational Team Concert which is an upgrade of the current software Rational Clearcase-Clearquest UCM implementation. The Figure 4 depicts the various components that will be configured for the MRM consortium.

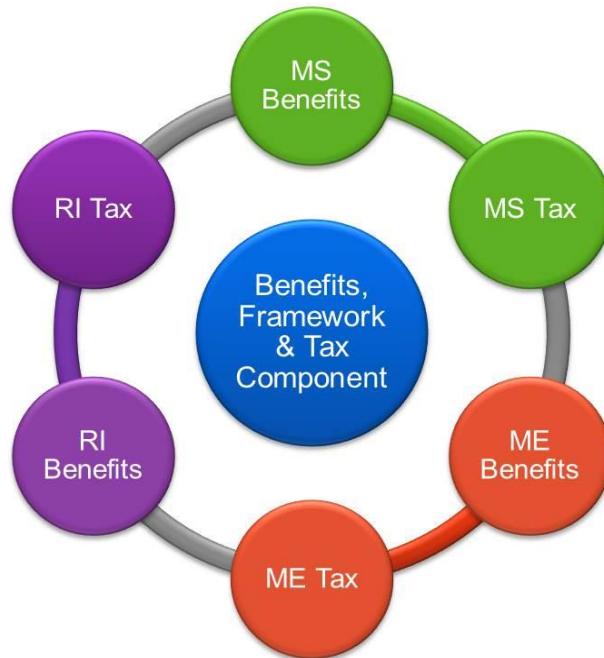


Figure 4: Components of MRM Consortium

This suggests a single code base repository for all the consortium member states. The single code base will facilitate centralized maintenance of the system. For Application deployment, each state will have its own instance of the application which will contain the common core component and the state specific component constituting the application. This is the same concept that is currently implemented in MS for Benefits and Tax with each application containing the common framework component. The application with the common and state specific component will be prepared by using the ant scripts. Following example explains the movement of a code(Activity) for multiple states in different builds.

Scenario: Activity 1 contains code changes corresponding to the common core component. This needs to be moved to all 3 states.

Following are the steps for moving this CQ for all 3 consortium states; these steps will further be finalized and elaborated once we have the RTC setup in place:

1. Developer works on the activity in local and delivers the code to the UAT stream after performing Testing and approval.
2. Developer resolves the activity marking that this is a core component change and requires build for all 3 states.
3. From UAT stream UAT build is done for the CQ where it is properly tested for moving to Production.
4. Once the CQ is verified, the code is moved to the Integration stream. From here the code will be moved to the staging stream for each state.
5. Based on each states scheduled build time, the code will be moved to the PRODUCTION stream for that state. And with the build, the code will be running in PRODUCTION for the state.

For cases where the build is only required for 1 state, i.e. the code change is only in the state specific component, the steps will remain the same as above. Only difference would be that the builds (UAT/Production) will be done only for that 1 state.

5.2 Framework services and capabilities for Core and State Specific Implementation

The application framework will be enhanced to accommodate the state specific differences at various points in the application with ease. The following points describe each of the identified areas for advancement.

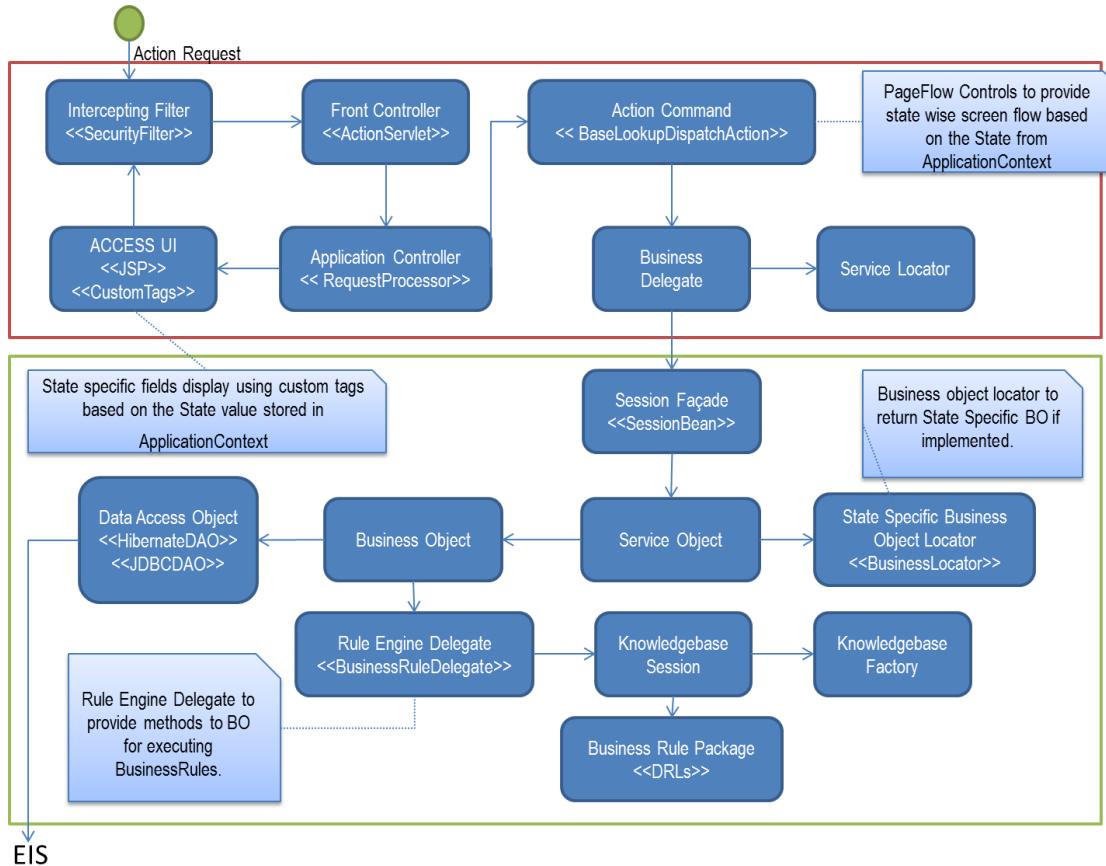


Figure 5: Component Diagram for Framework Services corresponding to Core and State Specific Implementation

5.2.1 State Specific GUI components to be displayed

The current ACCESS framework consists of a rich collection of framework tag libraries as well as a custom built tag library created specifically for the project. These tags enable consistent browser/platform GUI representation and enforce standardized coding practice. The tag libraries will be enhanced to include tags for state specific GUI component display.

5.2.2 State Specific Screen flow

The ACCESS framework keeps track of pages visited by the users. It gives the framework methods to traverse automatically back to previous pages visited. The page flow framework will be upgraded to have option of dynamically provide the screen based on state specific business rules that needs to be displayed beyond for a state specific application.

5.2.3 Business Rules Implementation for State Specific Business rules

JBOSS Drools Rules Engine will use DRL or Decision Table (XLS) files to write all the business validation rules.

Two approaches can be possible to write the state specific business rules.

1. To write all the state specific business rules in single state specific DRL file.

Implementation:

In this approach we can write all rules in a single DRL file and make one such DRL file for each different state implementation.

For execution of rules the Knowledgebase instance is required which uses the DRL files as an input. Using the Knowledgebase factory container will create one instance by passing all the state specific DRL files which contain all the state specific business rules.

Once the business objects need to execute some rules for any state it requires this Knowledgebase instance. After getting this instance it will create a Knowledgebase session from it, insert the required rules object into the session and then execute the rules.

Pros and Cons for using single Rule file

S. No	Pros	Cons
1.	In this approach only a single state specific DRL file will be created which contains all the business validation rules of specific states.	Creating a single file for all the business rules is difficult to manage.
2.	Deployment will be easy, since after modification only one file would be deployed.	If we need to change only one rule we need to modify this file and if any error exists it will not execute any rules.
		For every change in the single file complete testing of all rules would be required.

2. Creating state specific Rule package which contain several DRL files.

Implementation:

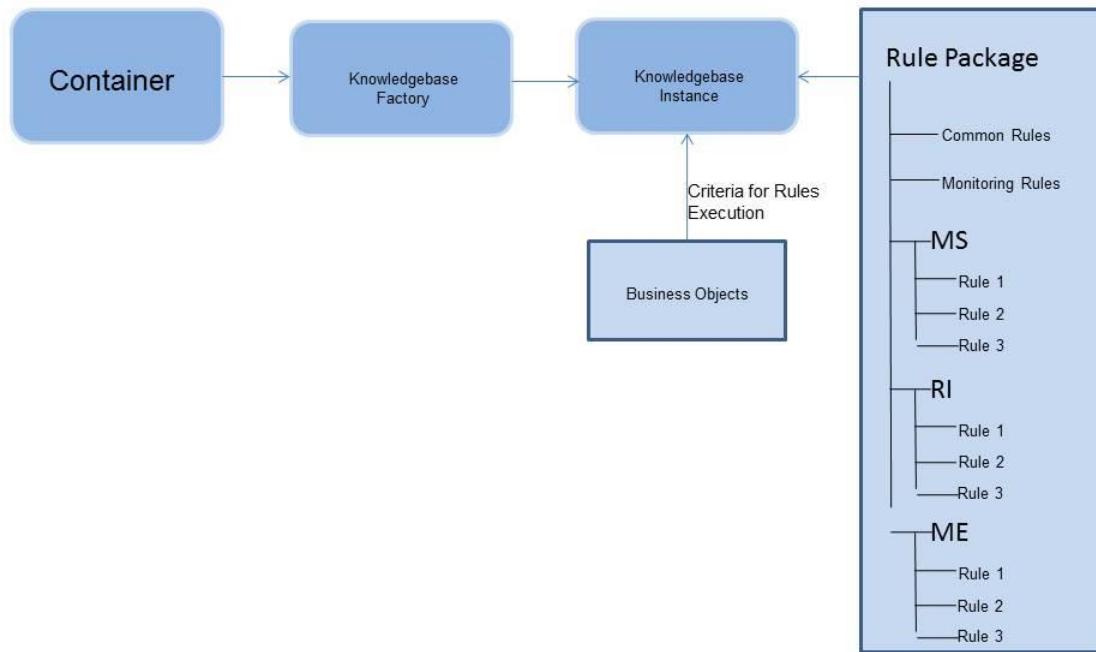


Figure 6: Business Rules Implementation

In this approach we can create one Rule package which contains all the common DRL files which can be used across the state. Along with this we need to create state specific packages inside that Rule package which should contain only state specific business rules. After that we need to create one XML or Property file to provide the mapping of the actual DRL file path to some logical name.

For execution of rules Knowledgebase instance is required which uses the DRL files as input. Using Knowledgebase factory container will create one instance of Knowledgebase by passing this XML or Property file.

Once the business objects needs to execute some rules it will use the Knowledgebase instance and provide the criteria for which rules needs to be fired. After getting this instance it will create a Knowledgebase session from it, insert the required rules object into the session and then execute the rules.

Pros and Cons for using Rule Package with multiple Rule file

S. No	Pros	Cons
1.	For specific combination of rules, different DRL files are provided to easily manage.	Many files will be created for single state specific business validation rules.
2.	For any little change we need to test those specific rules only. No need to test entire state business rules.	Deployment activity should be done in proper manner to handle the changes of various rules.

5.2.4 Extend Core business layer for State specific implementation

The core business logic for the ACCESS MRM application will reside in the Core component of the application. For requirement of business logic that cannot be part of the core component and is required to be implemented as state specific peace, State specific peace can extend the core business component and override the business method for the state specific functionality.

The framework will be enhanced to provide framework methods to dynamically provide the state specific instance of the business object if available to the Service layer. This will require change in the application code instantiating the business object to use the framework method of getting the business instance.

5.2.5 Mobile Application

This section outlines the requirements and strategy of mobile application development for ACCESS system.

Some components of ACCESS would be developed for mobile platforms. The target platforms are - Android and iOS.

Since we are targeting two different mobile platforms, a comparison of different possible approaches for developing apps for multiple platforms follows. Basically, there are two ways to developing applications for multiple mobile platforms.

1. Using Native SDKs
2. Using Non-Native SDK

Using Native SDK – This is the straight-forward approach, using the native programming languages (Java for Android and Objective-C for iOS) to code.

Pros and Cons for Native SDK

S. No	Pros	Cons
1.	No 3 rd party dependency.	For each platform, a separate development.
2.	No extra licensing and cost.	Requires knowledge of each multiple platforms' development tools and native programming languages.
3.	Development tools and programming languages are used and recommended by the platform developers.	
4.	All the features that the platform has to offer are readily available for the application to utilize via software frameworks and libraries provided by the platform developers.	
5.	Application performance is always better than the non-native.	
6.	Less chances of platform upgrade on the device breaking the application.	
7.	Smoothen distribution process.	

Using Non-Native SDK –

In this approach, a non-native SDK can be used to develop an application that could be built for multiple (supported) platforms.

An example of such framework is the Corona-SDK (most popular in the market), which uses the Lua programming language for coding. It claims to support the platforms like iOS, Android, Kindle, and Nook.

Pros and Cons for Non-Native SDK

S. No	Pros	Cons
1.	Develop one application but build and distribute for both the platforms.	Introduces dependency on a 3rd party.
2.	Knowledge of only one development framework, tools and programming language needed.	Requires extra licensing and cost.
3.		Upon new releases by the native platforms, have to wait till the new features are implemented by the 3rd party.
4.		Platform features limited to what the non-native SDK supports.
		Can introduce application inconsistency. Platform A might not have a feature which is available on platform B and the non-native framework.

Recommendation:

Based on the research, suggested approach for mobile app development is by using native SDKs.

Mobile Application Integration

Mobile application will be integrated with ACCESS system via WebService calls.

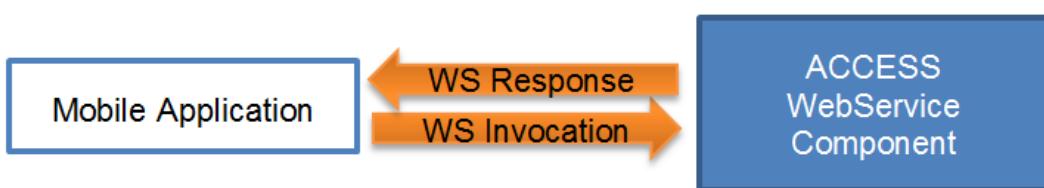


Figure 7: Mobile App Integration

5.2.5.1 Android

This section covers the mobile application development for ACCESS in Android OS (Operating System).

5.2.5.1.1 Targeted SDK and OS

According to the data collected by Google Inc., less than 5% of all android devices user uses Android OS version prior to 2.3 (Gingerbread). So the mobile application for ACCESS system would be targeted for all android OS running Android 2.3 to 4.3.

i.e. The minimum required SDK for the android devices to run ACCESS mobile application would be Android 2.3 (Gingerbread) with API 9 and targeted SDK would be the latest SDK available in the market, which is Android 4.3 with API 18.



Figure 8: SDK selection for Android App Development

5.2.5.1.2 Targeted Devices

The devices that use Android OS are divided into four different size based on their screen dimension viz. small, normal, large and xlarge.

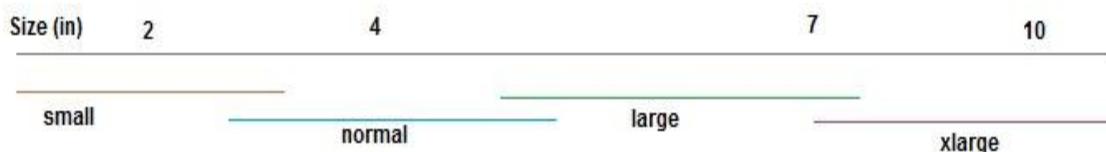


Figure 9: Hardware Classification by screen size

Application developed for one specific type of screen will automatically fit on the other size of screens however it may cause difference in display. Hence, the application will be targeted and tested primarily for normal screen. Dimension for the GUI objects will be provided in DP (density independent pixels) wherever possible; in order to minimize the variation in display caused by devices with different pixel densities per inch.

5.2.5.1.3 Development

During the Android mobile application development, Eclipse would be the primary integrated development environment (IDE). Targeted Android operating system will be 4.3 but the application will be compatible to as earlier as Android 2.3. Testing in the local environment will be performed in AVD (Android Virtual Device Manager) on virtual device Nexus 4 by Google.

5.2.5.1.4 Required Devices for Testing

During the development, the application can be tested on a local machine using AVD (Android Virtual Device Manager). But before sending it to the Google Play Store or in the market, it has to be thoroughly tested on real devices.

The application should be tested on at least one smartphone device. The preferred device for testing is the Nexus 4 by Google which has 4.7" screen (normal).

5.2.5.1.5 Installation Guidelines

There are two possible ways to install an android application on android devices.

The first and most widely adopted path is to publish the installable package in Google Play from where users can download and install it on their devices. To publish the application in Google Play, an organization has to be registered with the Google Play store which costs \$25. Google will test and verify the application before it actually publishes it in the market, and provides a certain level of security guarantee to the user.

The second option is to upload the Android installable package to our own server and provide the link to users. Users can click the link and start the installation process. Depending upon the device, a user may need to change the default settings (Users have to allow the unverified application to be installed) since Google does not verify the android applications that are not on Google Play. In this case, users are expected to have intermediate knowledge of their devices.

5.2.5.2 iOS

This section covers the mobile app development of ACCESS for iOS smartphones using native SDK.

5.2.5.2.1 Requirement for Development

A system with Mac OSX will be required to develop iOS app. Following table lists recommended specifications for hardware components that will be used for development

S. No	Hardware	Specifications
1.	Processor	3.x GHz Quad core
2.	RAM	16 GB
3.	Hard disk Drive	500 GB

Following table lists tools and software components that will be used for development

S. No	Software Component	Description
1.	Mac OSX	Operating System
2.	Objective-C	Programming Language
3.	Cocoa Touch	Software Framework collection
4.	XCode	Integrated Development Environment

5.2.5.2.2 Targeted SDK and OS

According to Apple Insider, as of June 06, 2013, below are the iOS version distributions on iOS smartphones –

1. iOS 6 – 92.7%
2. iOS 5 – 5.5%
3. iOS 4 – 1.7%
4. iOS 3 – 0.1%

Based on the above iOS version distribution information, the target iOS smartphones should be running iOS version 6, but the app will also support version 5.

5.2.5.2.3 Development

All the development will be done using XCode (free official IDE for iOS app development) on a Mac OSX system. Objective-C will be the programming language for coding. Cocoa Touch - the collection of application frameworks, the will used by to develop application components. The SDK for the target iOS version will be used for development, keeping compatibility for the least supported version. During development the application will also be tested on an iOS device simulator.

5.2.5.2.4 Testing

During the development, the application can be tested on the iOS device simulator within the development system. But before sending it to the App Store for distribution, it should be thoroughly tested on real devices running the target iOS versions.

5.2.5.2.5 Installation Guidelines

The application would be available on App Store from where users can download and install it on their mobile devices.

6. Application Framework

A framework is a set of common and prefabricated software building blocks that programmers can use, extend or customize for specific computing solutions. With frameworks, developers do not have to start from scratch each time when they are building different parts of the application. Frameworks are built from a collection of objects so both the design and code of the framework may be reused.

6.1 Framework Services

ACCESS application framework will have two sets of services and they are:

- **Business Services:** A group of services that directly drive ACCESS business requirements.
- **Essential and Support Services:** A group of services that collaborate with each other to constitute the core application framework and provide an infrastructure to facilitate business services.

Figure 10 depicts various services that fall into the above two categories. These services are spread across the different layers of the middle tier.

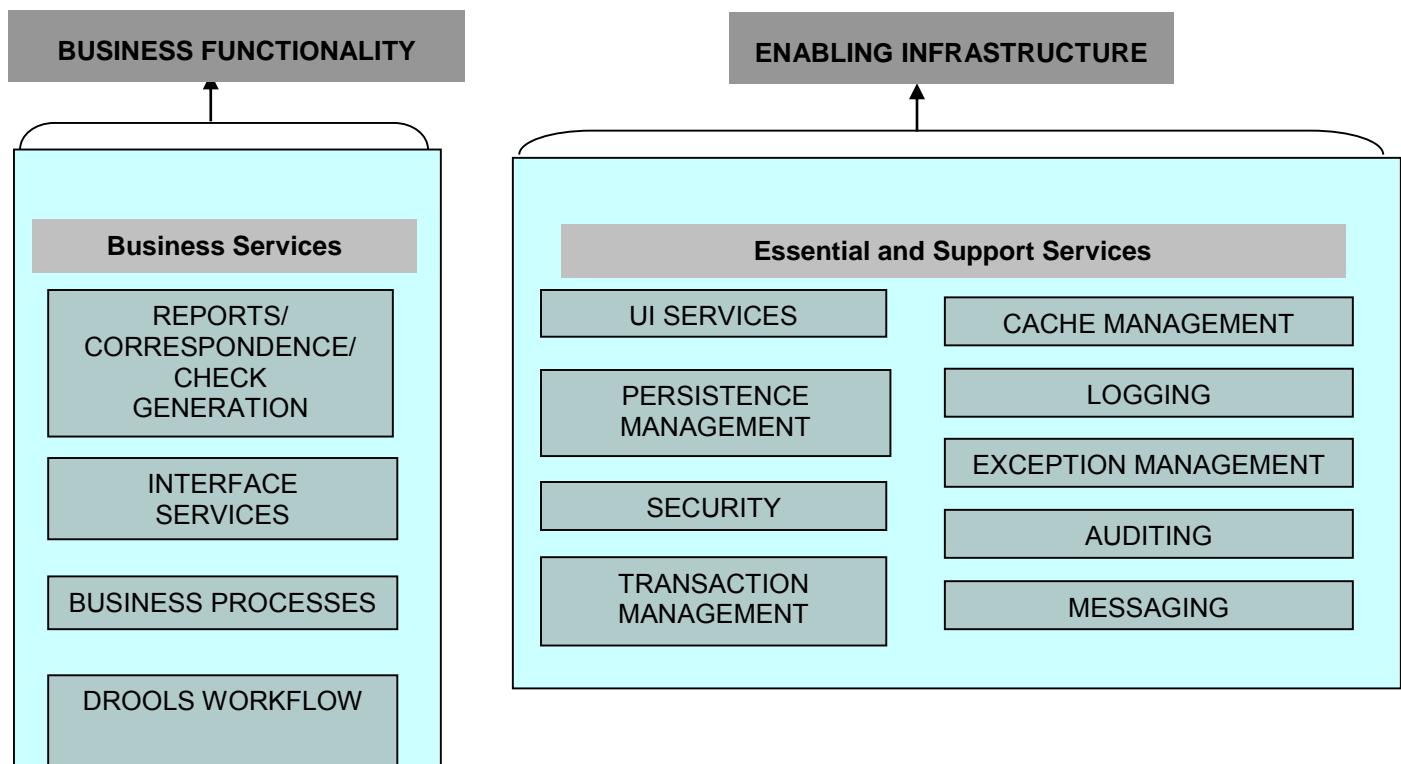


Figure 10: Application Framework

6.2 Essential and Support Services

6.2.1 UI Services

UI services will implement both the UI view and UI model of the presentation layer. This facility will not build any user interface but will help in building the user interface and transferring the user request into a form that is suitable for business functions (data transfer objects) to use. This service will maintain meta-information about the user interface components such as display labels of controls and data constraints on various fields among others. Meta data repository will supply the information required to build the UI. In addition to this, the UI services will use field level security information, provided by the security services, to provide/deny access to the fields on the UI. UI Services will use Struts, Tiles, Custom Tag Libraries and Java Standard Tag Libraries (JSTL).

Several configuration files will be used to supply necessary meta-data to UI services to carry out its responsibilities. Some of these configurations files are:

Struts Action Configuration: This xml file will provide all the configuration data for the presentation layer. It will maintain information about a web page e.g. list of commands that can be issued using a page, page navigation rules among others.

Struts Tiles Configuration: This xml file will be used to map a physical file to the logical name of the web page that will be used in the struts action configuration.

Meta data repository serves the configuration data (Website and UI Model), and the security layer provides necessary information to the UI services for managing the security of the UI component.

The following JEE components will form the UI services and they are:

- Servlet: For page navigation
- Java Server Pages (JSP)/HTML/Cascading Style Sheets (CSS)/ Custom Tags:
For web page generation
- eXtensible Markup Language (XML): For UI services configuration

6.2.2 Persistence and Data Access Management

Transferring the state of any business object to any underlying persistent store is referred to as persistence. Access to data varies depending on the source of the data for example relational database, Lightweight Directory Access Protocol (LDAP) server, flat files, legacy systems and so forth. Often the performance of the data source and the strategies that are used to access it, will dictate the performance and scalability of a JEE application. One of the key tasks is to achieve a clean and efficient interface between business objects and data source.

Data Access Goals

These are some of the important data access goals that should be handled by the data access facility and they are:

- It should be efficient.

- It should ensure data integrity.
- It should ensure correct behavior on concurrent attempts to access and manipulate the same data.
- It should be possible to change an application's persistence strategy without rewriting its business logic.
- Data access code should be maintainable.

Business and Persistence Logic

Business logic is concerned with the application's core workflow and is independent of the persistent data storage. In contrast to business logic, persistence logic concerns the application's access to and manipulation of persistent data. Persistence logic normally has the following characteristics:

- It does not require the application of business rules.
- It is unlikely to change on updates to business rules.
- It does not need to handle security issues.
- It involves preserving data integrity.
- It requires knowledge of the target persistence store to implement operations.

Persistence and Data Access Strategies

There are several ways of achieving persistence and data access in the JEE environment and they are as follows:

- Java Persistence Architecture (JPA)
- Java Database Connectivity (JDBC)
- Java Data Objects (JDO)
- Object Relational Mapping (ORM) Software

For any complex web based application, just one method of persistence will not adequately meet the requirements and hence a combination of methods will often be used. O/R mapping solutions are a good choice in On-Line Transaction Processing (OLTP) systems, in which users typically perform operations on a small dataset. For ACCESS, a combination of the following persistence strategies will be used:

- Hibernate (ORM) – will be used for simple OLTP queries
- JDBC – will be used for complex and batch queries
- Stored Procedures – will be used for handling a complex business process that requires access to a large number of records

6.2.3 Security

The security architecture identifies the criteria and techniques associated with protecting and providing access to ACCESS information resources. It facilitates identification, authentication, authorization, and administration services.

Authentication

This is a mechanism to ensure that a user (person or another application component) trying to use the system has legitimate access to do so. It is used to confirm his identity, establish a certain amount of trust on the system for the user. There are two types of authentications.

One-Way Authentication: This authentication is done by the system using the question "Who are you?" This helps the system in establishing the identity of a user and allowing or disallowing access to the system depending upon the credentials supplied by the user.

Bi-directional Authentication: This authentication by the system examines the user's credentials and at the same time provides its own credentials to the user (Who are you? I'm Access System), this helps in improving the confidence level of the user to provide sensitive information with trust e.g. credit card details. LDAP authentication provider will be responsible for proving identity.

There are three primary mechanisms by which a user can be authenticated:

- Basic Authentication: This is an authentication mechanism in which a Web server authenticates an entity with a user name and password, obtained using the Web client's built-in authentication mechanism.
- Form Based Authentication: This is an authentication mechanism in which a web container provides an application specific form for logging.
- Mutual Authentication: This is an authentication mechanism employed by two parties for the purpose of proving each other's identity to one another.

Authentication Solution for ACCESS

ACCESS will be using form-based authentication over Secure Sockets Layer (SSL). The rationale for selecting form-based authentication is to keep the look and feel of the login form in agreement with the look and feel of the ACCESS application. Hypertext Transfer Protocol (HTTP) over SSL communication has been chosen for securing the communication, as it is not advisable to transfer sensitive information about the user's security (Userid and password) as plain text to the web server.

Single Sign On

Single Sign-on is a capability of systems where user logs in one system and gets access to multiple systems without providing login details again. Single Sign on (SSO) capability will be provided to have a seamless integration between Tax and Benefits applications for all state. This SSO feature for ACCESS would be custom built rather than any third party software.

However, SSO capability of ACCESS to other ES (Employment Services) application for RI and ME is beyond the scope of this document.

Mississippi has decided to implement OPEN AM for SSO between ES application.

Authorization

Authorization is the process whereby the interactions between users and application resources are controlled, based on user identity or other information. In other words, authorization answers the question “What a user can do?” Authorization is used to limit the interactions between users and application resources to ensure integrity, confidentiality and availability.

Authorization is based on the concept of security roles. A security role is a logical grouping of users. Each security role is mapped to the users. A security role can be used with declarative security or programmatic security.

Authorization Solution for ACCESS

Authorization information will be maintained at two levels.

- Authorization at the business function level
- Authorization at the field level

Authorization at business function level is about the capability of a user i.e. what a user can do. Authorization at field level shows the permissions granted to a user. This approach helps in implementing security policies, for instance, multiple users can have different level of access (read, modify) on different data of the same entity. Maintaining field groups and defining access rights on these field groups will implement field level security. The system will be designed in such a way that it only maintains the fields in the Meta-Data repository that do require security profiles.

Security Information

Application security related information will be stored in an LDAP enabled directory server. Currently options being explored for Red Hat JBoss Directory server deployment which will be utilized for the security of the ACCESS System. The security service will encapsulate all the security functionality, including communication with the LDAP Server using the Java Naming and Directory Interface (JNDI) Application Programming Interface (API).

Infrastructure Security

The infrastructure required for hosting the ACCESS System is:

- Domain Name Server
- Web Server
- Application Server
- Database Server
- Sub systems like Email Server, Reports Server, Drools Workflow Server, Data Warehouse Server and DMS Server.

The application server, database server and sub system servers should be protected by an inner firewall. The Internet edge servers and the Internet web servers should be placed in the De-militarized zone (DMZ), which is a layer between the outer firewall and the inner firewall.

Encryption

All system access data transfer and web page access will use 256 bit encryption. Any insecure protocols that are currently being used by the application will be updated with secure protocols unless any third party software / server are not capable of handling 256 bit encryption or secure protocols.

<http://www.irs.gov/uac/Encryption-Requirements-of-IRS-Publication-1075>

Information Encryption

For information encryption across the web, SSL protocol with 256 bit keys will be used. To operate a Web Server in a secure SSL mode, a signed certificate from the certification authority (CA) needs to be obtained for the consortium member states and installed on the web server. SSL accelerators will be used for the encryption and decryption of the transactions between the users and the system. The process of encryption and decryption can severely overload the server and these SSL cards can take over this responsibility and help reduce the load.

Business Data Encryption

The sensitive data that is required to be encrypted, as per the business requirements will be making use of the Java Cryptography encryption/decryption method to store these values in the database.

Tool for Application Security

IBM Security App Scan 8.7 will be used for application security testing. It automates application security testing by scanning applications. It will do vulnerability assessments including SQL-injection, cross-site scripting, buffer overflow, and Web 2.0 exposure scans. It also generates reports with intelligent fix recommendations to ease remediation.

6.2.4 Auditing

Audit trails will be maintained in the system using the logging framework of the ACCESS System. The Log Information will contain the User ID, Timestamp, Internet Protocol (IP) Address (this only will be stored once when the user logs into the system, Edge server should be able to send the sender IP) of users computer and the business process name. This facility enables the administrator to track user actions. For all the transaction records in the database the following information will be maintained irrespective of any other auditing facility:

Created By	Created Date	Updated By	Updated Date	Update Process

The application log and the database information will assist in managing user actions. System logs will also be maintained in the Web Server, Application Server and the drools workflow.

6.2.5 Cache Management

Caching is a tried and tested method for dramatically speeding up applications. High performance applications should cache the data that is fairly static and is used often throughout an application. Various data that qualifies for being cached in the application server are:

- Application Configuration Meta data
- Lookup Database Tables
- Application Static Data

Caching Solution

One of the most prominent open source caching solution is OSCache from OpenSymphony. It is a widely used, high performance JEE caching framework. OSCache can be used as a generic caching solution for any Java application. A few of its generic features include:

- Caching of Arbitrary Objects – It is not only restricted to caching portions of JSP pages or HTTP requests. Any Java object can be cached.
- Comprehensive API - The OSCache API gives full programmatic control over all of OSCache's features.
- Persistent Caching - The cache can optionally be disk-based, thereby allowing expensive-to-create data to remain cached even across application restarts.
- Clustering - Support for clustering of cached data can be enabled with a single configuration parameter. No code changes are required.
- Expiry of Cache Entries – It provides the developer with great control over how cached objects expire, including pluggable cache refresh rules if the default functionality does not meet the system requirements.

Caching Solution for ACCESS System

ACCESS System will use OSCache.

6.2.6 Messaging

This component will serve all the messaging needs of ACCESS. A repository of functions that need to send messages will be maintained by this service. There will be an event monitor that will keep observing all the business functions being executed by controller and as soon as a business function registered with messaging service is executed, a message queue (message provider) is updated storing details of business function and context in which the message was executed. There will be message consumers that subscribe to the messages from the message provider on certain topics. These consumers will be updated as soon as the message provider is updated. Finally these consumers will execute the necessary messaging commands.

Messaging Solution for ACCESS System

Messaging will be implemented with the Java Message Service (JMS) provided by the JEE container of the application server.

6.2.7 Transaction Management

Transaction management is a mechanism for simplifying the data integrity and the development of distributed multi-user enterprise applications. JEE platform provides this as a standard service. Transaction management frees an application programmer from dealing with the complex issues of data access, including synchronized updates, failure recovery, and multi-user programming. A transaction is a logical unit of work that either modifies some state, performs a set of operations, or both.

JEE platform and the Java Transaction API (JTA) define the overall transactional behavior. There are two different ways to start the transaction, either explicitly in code or the EJB server starts it.

Transaction Management Solution for ACCESS System

In ACCESS solution all calls to the Business Delegate are initiated within a transaction.

Transaction management services are provided by following mechanisms:

- Container Managed transactions provided by the EJB container from the Application Server. All the transactions initiated within the Application server are initiated and managed by the JEE Application Server.
- Transaction Manager managed transactions provided by Bitronix Transaction Manager. For the BizServer functionality ACCESS implements transaction management using the Bitronix Transaction manager. The Bitronix Transaction Manager (BTM) is a complete implementation of the JTA 1.0.1B API. It provides all services required by the JTA API for while trying to keep the code as simple as possible.

6.2.8 Logging

Logging is an important component of any software system. Logging offers several advantages. First and foremost, it provides precise context about a run of the application. Once inserted into the code, the generation of logging output requires no human intervention. Secondly a log output can be saved in a persistent medium to be studied at a later stage. Logging is merely a process of creating logs, documenting and storing certain system or user activities for various reasons such as debugging and security. From a security point of view, logging can provide proof of malicious activity or acts as an indicator for potential malicious activity.

Logging Solution for ACCESS System

ACCESS System will use Log4j.

6.2.9 Exception Management

The design of the system must ensure that the exceptions do not cause problems to the end users of the system. One of the key requirements in maintaining the system is the ability to detect errors when they occur and to obtain sufficient information to enable the diagnosis and repair of the underlying root causes of the problems.

Principles of Exception Handling

The errors that occur in an application can be classified as ‘Domain errors’ and ‘Technical errors’. Domain errors are those that can be caused by the errors in the business logic or business processing. Technical errors are those that are caused by problems in the underlying technology platform (e.g. could not connect to database, LDAP server and others).

ACCESS is designed to handle these kinds of errors and a proper message is being displayed to the user, hiding any details that might confuse him. Full stack trace of the errors gets logged so that the developers can take a look at it for the resolution of the problem. In a production system, when an exception is thrown it is likely that the system is unable to process the user’s request. When such an exception occurs, the end user normally expects the following:

- A message indicating that an error has occurred
- An unique error identifier that the user can use while reporting it to a support person
- Quick resolution of the problem

The following are some of the generally accepted principles of exception handling:

- If you cannot handle an exception, do not catch it
- Catch an exception as close as possible to its source
- If you catch an exception, handle it, do not swallow it
- Log an exception where it is caught, unless the plan is to re-throw (send the exception back to the caller) it

- Preserve the stack trace when you re-throw the exception
- While logging the exception, generate an unique identifier to the exception so that it can be analyzed easily when the user reports the error
- There should be a way to inform the system administrators in real time when any severe error occurs in the system.

Logging of Exception

For any system, without proper logging of the errors and exceptions, it would be difficult to have a quick resolution of the problems. ACCESS System will be making use of Log4j an open source java library for logging the exceptions and errors.

6.3 Business Services

6.3.1 Business Processes

These set of components form the integral part of the system. This is where the business processes will be implemented. Business Process components will be created as plain old java objects (POJO). Requests from the user to initiate any business processes will be first handled by the framework controller.

The presentation layer interacts only with the Controller. The Controller helps in coordinating business services provided by various sub-systems to serve the user request and produce the required output. This component functions as follows.

- It receives a service request from the user and performs a look up to resolve the request by referring the business function configuration repository.
- After the request is resolved, the controller makes use of the various system resources that are necessary to fulfill the request for any business process.
- Controller notifies the event monitor about the business function being invoked and the context in which the business function is invoked.
- After the request is validated, the appropriate business function(s) is executed and subsequently, the presentation will be performed by the UI services.

6.3.2 Drools Flow

This system/component helps in maintaining the repository of business processes and lists of persons, systems, and business functions involved in those business processes. The drools workflow system will keep track of all the workflows that are initiated. Drools platform provides a unified and integrated way of combining rules and processes into a single software product. Drools 5.0+ is split into 4 sub projects and they are:

1. Drools Expert → This provides the rule engine functionality.
2. Drools Flow → This provides the process & workflow functionality.
3. Drools Fusion → This provides the Complex Event Processing (CEP) functionality.
4. Drools Guvnor → This provides the Business Rules Management System (BRMS) functionality.

ACCESS system will be making use of the Drools Flow product to provide the workflow functionality in the system. For the Business Rules Implementation ACCESS will use the Drools Expert product.

6.3.3 Interface Services

The interface services will be responsible for hiding the intricacies/details of any internal or external system. Hence, any changes in the interface systems will not have any ripple effect changes across the system. All the external and internal systems will register with this service before they can be used by any business component of the system.

6.4 Architecture Collaboration

Figure 11 depicts the ACCESS architecture collaboration showing the various services and systems interacting with each other and also provides the holistic view of the ACCESS System architecture.

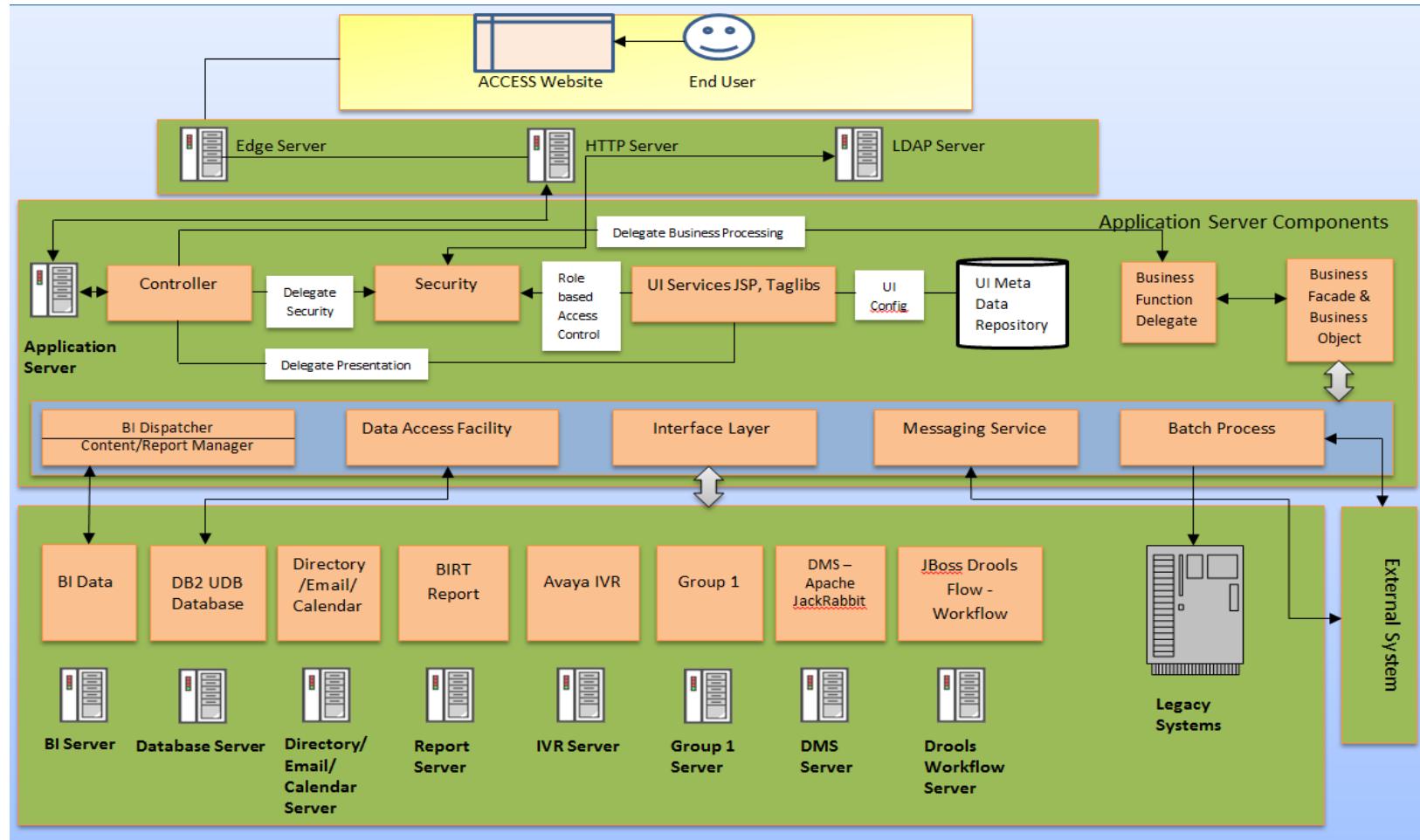


Figure 11: ACCESS - Architecture Collaboration Diagram

6.5 Component Diagram

Figure 12 depicts the framework component interaction diagram. It shows the high level model of the framework for the ACCESS System.

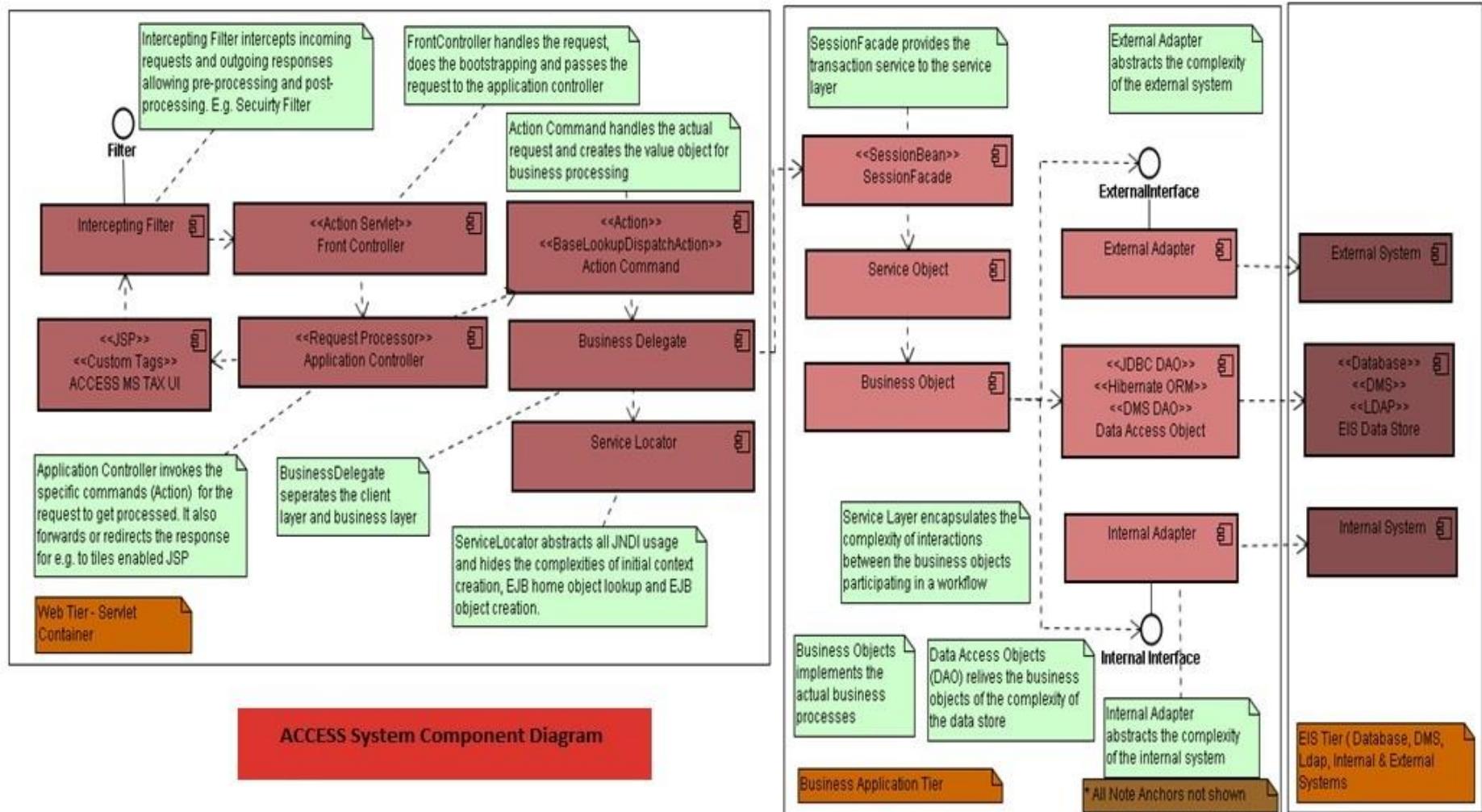


Figure 12: Framework Component Diagram

6.6 Sequence Diagram of Generic Business Function

Figure 13 and Figure 14 depict the sequence diagram of the execution of a generic business function at a very high abstraction level.

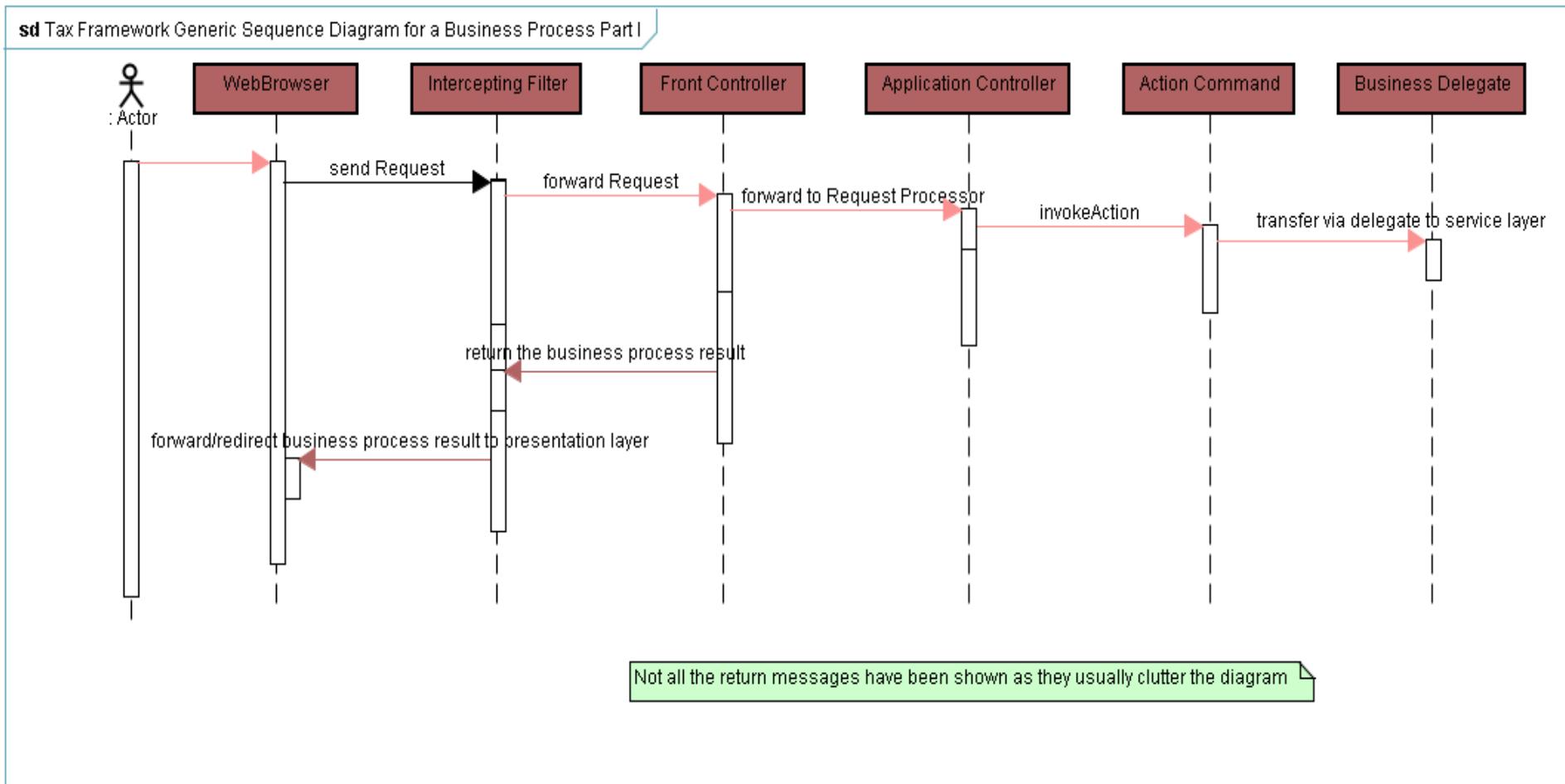


Figure 13: Sequence Diagram – Part I - Generic Execution of Business Function

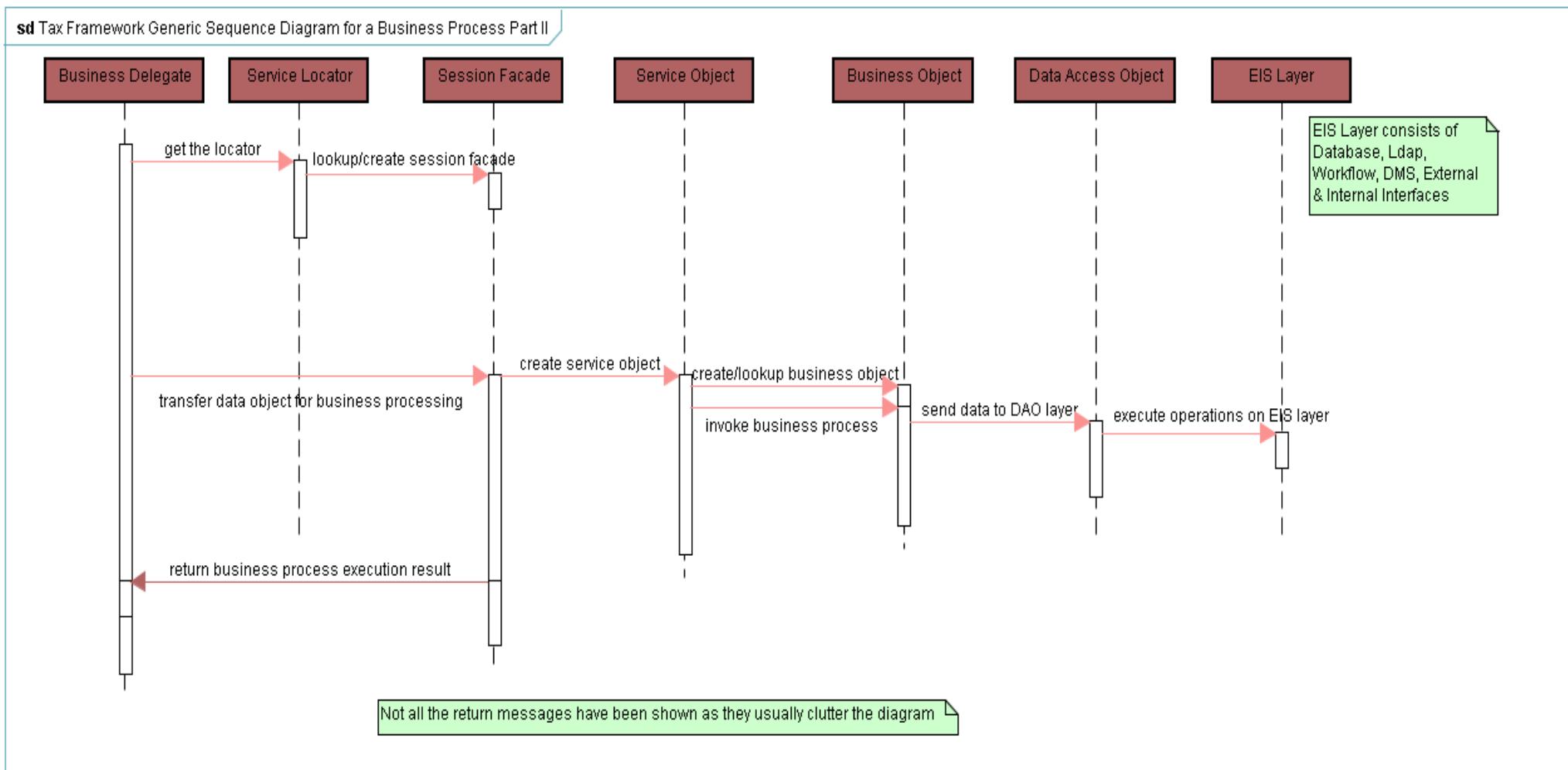


Figure 14: Sequence Diagram – Part II - Generic Execution of Business Function

7. Interfaces

Interfaces for the ACCESS system are classified as Internal or External.

The ACCESS system can communicate with the external/internal systems either in a synchronous or an asynchronous mode. In the case of a synchronous communication, the interaction will always be real time and can be triggered by a user action or any other application component. In the case of an asynchronous communication, the interaction can be real time or in a batch.

7.1 Internal Interfaces

The ACCESS system will have application level integration with the internal systems. The table below lists the various internal interfaces that impact the technical architecture and design of the system.

S. No.	Interface Name	Communication (Synchronous /Asynchronous)	Real-Time/Batch	Integration Software
1.	JBoss Drools Flow	Both	Both	JBoss Drools Client API
2.	Report	Both	Both	Report Server Java API
3.	Document Management System	Synchronous	Both	Java API
4.	Directory Server (LDAP)	Synchronous	Real-Time	JNDI
5.	Interactive Response (IR)	Synchronous	Real-Time	Web Services
6.	Email	Asynchronous	Both	Java Email API's
7.	Address Validation	Synchronous	Both	Spectrum Address Validation Java API
8.	Address PreSort	Synchronous	Batch	Mail Stream Plus API
9.	Employment Services (ES)	Asynchronous	Batch	Secure FTP

7.1.1 Mainframe Connectivity

The ACCESS system and the legacy system need to exchange data on a regular basis for the member states legacy systems. Data files (pre-defined format) will be transferred at regular intervals with File Transfer Protocol (FTP). If on the mainframe operating system, secure FTP can be installed, configured and used for maintaining the security of the data transmission.

7.2 External Interfaces

The ACCESS system will have application level integration with the external systems. External interfaces¹ are referred to those components that will interact with the application hosted by an external agency. The table below lists the various external interfaces that impact the technical architecture and design of the system.

S. No.	Interface Name	Communication (Synchronous /Asynchronous)	Real-Time/Batch	Communication Protocol	Integration Software
1.	MDES to Payroll Service Companies (vice versa)	Synchronous	Batch	FTP	Flat File
2.	Internal Revenue Service (IRS)	Synchronous	Batch	SSH	Flat File
3.	Bureau of Labor Statistics (BLS)	Synchronous	Batch	FTP	Flat File
4.	Bank (Regions and others)	Synchronous	Batch	SSH	Flat File
5.	ETA Sun System	Synchronous	Batch	FTP	Flat File

¹ Detailed requirements will document the complete list of external interfaces

8. Business Intelligence

Business Intelligence is a set of theories, methodologies, processes, architectures and technologies that transform raw data into meaningful and useful information for effective decision making and predictive analysis.

8.1 Business Intelligence Topology

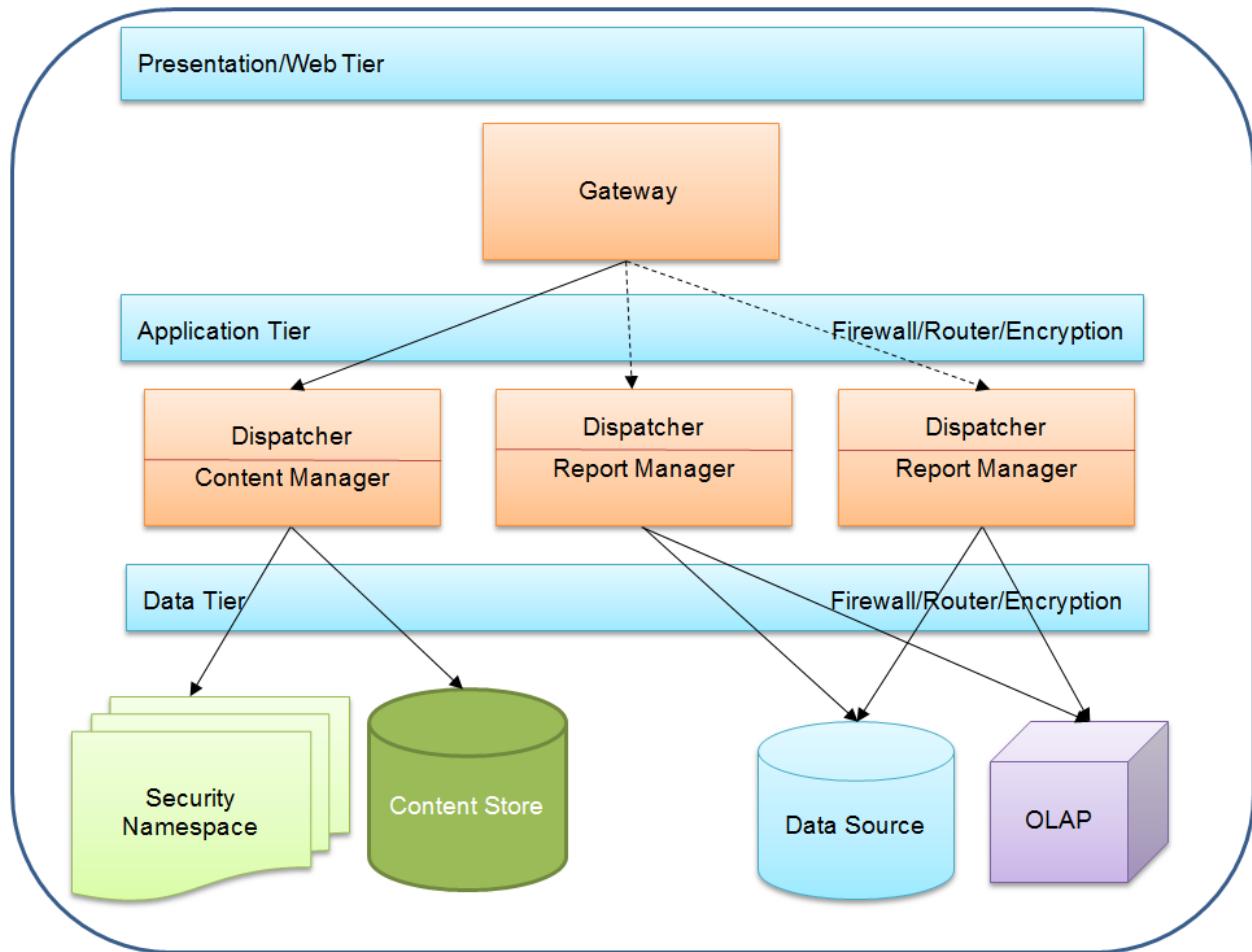


Figure 15: Typical Distributed Topology of Business Intelligence

8.2 Technical Aspects

Below are the technical aspects of using Business Intelligence.

- Graphical interpretation of data in different dimensions.
- Interactive data interpretation (Ad hoc reporting).
- Data interpretation integrated with maps, charts and widgets.
- Separate administrator and user privileges.
- Real-time monitoring.
- Auto scheduling of graphical reports.
- Ease of integration with existing products.
- Integration with LDAP server.
- Web based analytics.
- Enhancements to Mobile BI possible in future.
- Open access to all data sources.
- Common integrated security model.
- Enterprise class SOA platform architecture.
- Can be integrated into existing application.

8.3 Benefits

The key benefits of using BI are,

- Eliminates guesswork.
- Instant answers to department questions.
- Instant department metrics and reports as and when needed.
- Effective streamlining of operations.
- Improve efficiency.
- Greater insights into each component.
- Easy usability and self-generation of analytics reports by users requiring less IT intervention.
- Future Prediction with higher probability.
- Where is, was, will be the trend of MDES.

8.4 Data Movement (Extract, Transform and Load)

The Data movement services run and schedule builds and job streams on remote computers Connection. Extract, transform, and load (ETL) is a process in data warehousing that involves extracting data from outside sources, transforming it to fit business needs, and ultimately loading it into the data warehouse.

The ETL features are used to extract data from various sources, transform that data through encoded business rules, and load the transformed data into a data mart. During this process, operational data is retrieved from the product source, normalized, and mapped to fact and dimension tables.

8.4.1 Extraction

The ETL framework accepts extracts data through direct database access and through ODBC drivers, including the Rational Insight XML ODBC driver. An organization stores data in traditional relational databases or in other source formats (such as XML). Since Data Manager supports data in tabular format, incoming XML must be converted to relational form prior to the core ETL extraction process.

8.4.2 Transformation

This step is to transform the data using business rules. This is done in a two-step process.

- Normalize the data and modify using business rules. These business rules, when executed, perform business logic such as calculating or deriving a column based on other columns.
- Store it into physical tables. These physical tables implement the star schema convention, and add dimensions and facts – the characteristics elements of a data warehouse.

8.4.3 Loading

The last step is to load this transformed data into the data mart, a separate area of the warehouse.

8.4.4 Implementation

In Data Manager, each piece of ETL process is a fact or dimension build. The builds can be organized into job streams for different sets of data or tables. The job streams can be executed in the Data Manager directly, or published as a data move task, and then scheduled for execution in the Insight report server. The primary ETL builds are normalized form builds, non-entity builds, look-up builds, dimension builds, and fact builds.

8.5 BI Tool Evaluation

8.5.1 IBM Cognos BI

The key capabilities of Cognos Enterprise edition are,

- Reports – View business information.
- Analysis – Explore BI data from different angles & perspectives
- Scorecards – Monitor & track performance.
- Dashboards - Offer an at-a-glance view of what's most important to department.
- Mobile BI - Enables to view information on the road or offline.
- Self-service BI - Adds the flexibility to visualize and analyze information and more without its help.
- Collaborative BI - Makes it easier to share insights with colleagues and stakeholders.
- Modeling - Presents alternative scenarios for more informed decision-making.
- Real-time monitoring - Shows current operational KPIs for up-to-the-minute decisions.

8.5.2 Jaspersoft BI suite

The key capabilities of Jaspersoft BI suite are,

- Reports – View business information.
- Analysis – Explore BI data from different angles & perspectives
- Mobile BI - Enables to view information on the road or offline.
- Data Integration – ETL capabilities
- Interactive Report Viewing – Browser based report viewer.
- OLAP server – Analyze large relational data sets with powerful analytic queries.
- Server Repository – Centralized repository to store data.

8.5.2.1 Comparison b/w Jaspersoft BI Enterprise Edition and Community Edition

S. No	Jaspersoft – Enterprise Edition	Jaspersoft - Community Edition
1.	Ad Hoc report Designer is available.	Ad Hoc report Designer is not available.
2.	Dashboard is available.	Dashboard is not available.
3.	Metadata layer is available.	Metadata layer is not available.
4.	Data Virtualization is available.	Data Virtualization is not available.
5.	Data Integration is available.	Data Integration is not available.
6.	Interactive visualization is available (HTML5).	Interactive visualization is not available.
7.	Multi-tenancy is available.	Multi-tenancy is not available.
8.	Audit logging available.	Audit logging is not available.
9.	Vendor support is available.	Support is available only through Forums & wiki.
10.	Commercial license.	GPL License.
11.	Supported Application Servers <ul style="list-style-type: none"> • Apache/Jakarta Tomcat • JBoss AS • JBoss EAP • IBM WebSphere (WAS) • GlassFish • Oracle WebLogic Server 	Supported Application Servers <ul style="list-style-type: none"> • Apache/Jakarta Tomcat • JBoss AS • JBoss EAP

S. No	Jaspersoft – Enterprise Edition	Jaspersoft - Community Edition
12.	<ul style="list-style-type: none"> SpringSource tc Server 	
13.	<p>Supported Portal Servers</p> <ul style="list-style-type: none"> Liferay Portal JBoss Portal 	<p>Supported Portal Servers</p> <ul style="list-style-type: none"> Liferay Portal JBoss Portal
14.	<p>Supported Databases</p> <ul style="list-style-type: none"> Oracle RDBMS PostgreSQL IBM DB2(9.7,10.1) MySQL Microsoft SQL server Infobright Vertica JBoss Metamatrix Enterprise Data Services Platform JBoss Teiid Greenplum Database Sybase ASE 	<p>Supported Databases</p> <ul style="list-style-type: none"> PostgreSQL
15.	<p>Supported Operating Systems</p> <ul style="list-style-type: none"> Microsoft Red Hat Enterprise Linux Apple Mac OS X Apple iPad iOS Android – Mobile SDK Solaris SPARC Fedora HP-UX FreeBSD IBM AIX Ubuntu Novell SUSE Linux Enterprise Server (SLES) 	<p>Supported Operating Systems</p> <ul style="list-style-type: none"> Microsoft Red Hat Enterprise Linux Apple Mac OS X Apple iPad iOS Android – Mobile SDK Solaris SPARC (not fully tested) Fedora HP-UX FreeBSD IBM AIX Ubuntu Novell SUSE Linux Enterprise Server (SLES)
15.	<p>Java Virtual Machines (JVM)</p> <ul style="list-style-type: none"> Oracle/Sun Java JDK / JRE IBM Java JDK / JRE (for WebSphere) OpenJDK RunTime Environment 	<p>Java Virtual Machines (JVM)</p> <ul style="list-style-type: none"> Oracle/Sun Java JDK / JRE

S. No	Jaspersoft – Enterprise Edition	Jaspersoft - Community Edition
16.	Jaspersoft ODBO Connect is available <ul style="list-style-type: none"> • Microsoft Excel • Microsoft Windows • Microsoft .NET Framework 	Jaspersoft ODBO Connect is not available
17.	Supports ETL capabilities.	Doesn't support ETL capabilities.

8.5.3 Pentaho BI suite

The key capabilities of Pentaho BI suite are,

- Operational and interactive reporting.
- Data discovery and interactive analysis.
- Integrated reporting, data visualization and analysis and predictive analytics.
- Data access and integration (ETL).
- Predictive analytics.
- Data warehousing.
- Big Data integration and job orchestration for Hadoop, NoSQL databases and Analytic Databases.
- Application consolidation.
- Data synchronization.

8.5.3.1 Comparison b/w Pentaho BI Enterprise Edition and Community Edition

S. No	Pentaho - Enterprise Edition	Pentaho - Community Edition
1.	Interactive Analysis & Visualization is available.	Basic reporting is available.
2.	Dashboard Reporting is available.	Dashboard Reporting is not available.
3.	Data Integration is available.	Basic Data Integration is available without auto scheduler.
4.	Expanded & Big Data source connectivity is available.	Basic connectivity is available.
5.	Secure Data Integration is available.	Secure Data Integration is not available.
6.	Mobile BI is available.	Mobile BI not available.
7.	Vendor support available.	Support through forums.
8.	Commercial License (Annual subscription).	Open source License.

S. No	Pentaho - Enterprise Edition	Pentaho - Community Edition
9.	Audit reporting is available.	Audit reporting is not available.
10.	Supported Application Servers. <ul style="list-style-type: none"> • JBoss 5.1.X • Tomcat 6.0.X 	Supported Application Servers <ul style="list-style-type: none"> • Liferay • Websphere (not tested)
11.	Supported Operating Systems <ul style="list-style-type: none"> • Apple Macintosh OS 10.7 & 10.8 • Microsoft Windows 7 • Microsoft Windows 2008 Server R1 & R2 • Red Hat Enterprise Linux 5 & 6 • Solaris 10 • CentOS Linux 5 & 6 • Ubuntu Server 10.X and 12.X 	Supported Operating systems <ul style="list-style-type: none"> • Windows XP SP 2 • SUSE Linux • Enterprise Desktop and Server 10 • Red Hat Enterprise Linux 5 • Solaris 10 • Mac OS X 10.4
12.	Supported Data sources <ul style="list-style-type: none"> • Apache Derby • AS/400 • InfiniDB • Exasol 4 • Firebird SQL • Greenplum • H2 • Hypersonic • IBM DB2 • Infobright • Informix • Ingres • Ingres VectorWise • LucidDB • MaxDB (SAP DB) • MonetDB • MySQL • MS SQL Server • Neoview • Netezza • Oracle • Oracle RDB • PostgreSQL • SQLite • Teradata • UniVerse database • Vertica • Other SQL-92 compliant 	Supported Data sources <ul style="list-style-type: none"> • AS/400 • Apache Derby • Borland Interbase • Calpont InfiniDB • ExtenDB • Firebird SQL • Greenplum • Gupta SQL Base • H2 • Hypersonic • IBM DB2 • Infobright • Informix • Ingres • Ingres VectorWise • Intersystems Cache • KingbaseES • LucidDB • MS Access • MS SQLServer • MS SQL Server (Native) • MaxDB (SAP DB) • MonetDB • MySQL • Neoview • Netezza • Oracle • Oracle RDB • PostgreSQL

S. No	Pentaho - Enterprise Edition	Pentaho - Community Edition
		<ul style="list-style-type: none"> • Remedy Action Request System • SAP ERP System • SQLite • SybaseIQ • Teradata • UniVerse database • Vertica • dbase III/IV/5
13.	<p>Authentication systems</p> <ul style="list-style-type: none"> • CAS • Integrated Microsoft Windows Authentication • LDAP • RDBMS 	<p>Authentication systems</p> <ul style="list-style-type: none"> • Acegi Security • Spring Security • LDAP

8.5.4 Recommendation

Following are the key differentiators between the three BI Tools:

S. No	Cognos BI	Pentaho BI	Jaspersoft BI
1.	Supports High performance load.	Supports Medium performance load.	Supports medium performance load.
2.	Ad Hoc report Designer is available.	Ad Hoc report Designer is not available in community Edition.	Ad Hoc report Designer is not available in community Edition.
		Ad Hoc report Designer is available in Enterprise edition.	Ad Hoc report Designer is available in Enterprise edition.
3.	Vendor support is available.	Vendor support is not available in community edition.	Vendor support is not available in community edition.
		Vendor support is available in Enterprise edition.	Vendor support is available in Enterprise edition.
4.	Compatible with all data sources.	Compatible with limited data sources.	Compatible with limited data sources.
5.	High reliability vendor.	Medium reliability vendor.	Medium reliability vendor.

		Low reliability vendor -for the community edition.	Low reliability vendor – for the community edition.
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Considering all the technical capabilities, we recommend to go for IBM Cognos BI Enterprise Edition.

9. Data Security

This section outlines various software products to be used to secure data in ACCESS System.

9.1 IBM Infosphere Guardium Data Activity Monitor

This software prevents unauthorized data access, alerts on changes or leaks to help ensure data integrity, automates compliance controls and protects against internal and external threats. Continuous monitoring and real time security policies protect data across the enterprise without changes to databases or applications or performance impact.

The key capabilities of IBM Infosphere Guardium Data Activity Monitor are given below:

9.1.1 Monitor and audit all data activity

- Understand and develop complete visibility into all transactions for all platforms and protocols by users including database administrators, developers, outsourced personnel and applications.
- Identify application users who make unauthorized changes from common service accounts.
- Provide user and application access monitoring independent of native database logging and audit functions.
- Improve data security by detecting unusual database read and update activity from the application layer.
- Automate sensitive data discovery and classification.

9.1.2 Enforce security policies in real time

- Monitor and enforce security policies for sensitive data access, privileged user actions, change control, application user activities and security exceptions.
- Use access policies to identify anomalous behavior by comparing data activity to a normal behavior baseline.
- Support exception policies based on definable thresholds such as SQL errors.
- Use extrusion policies to examine data leaving the database for specific value patterns such as credit card numbers.
- Support policy-based actions such as near real time security alerts, software blocking and user quarantines.

9.1.3 Create a centralized repository of audit data

- Aggregate data throughout your enterprise for compliance auditing and reporting, correlation and forensics without enabling native database audit functions.
- Provide a tamper-proof audit trail that supports the separation of duties required by auditors.
- Deliver customizable compliance workflow automation to generate compliance reports and distribute them to oversight teams for electronic sign-offs and escalation.

9.1.4 Support heterogeneous environments

- Monitor and audit Hadoop-based systems such as IBM Infosphere Big Insights and Cloudera.
- Support enterprise databases and operating systems including IBM DB2, Teradata, IBM Pure Systems, Sybase, Microsoft SQL Server, UNIX and Linux.

- Support key enterprise resource planning and customer relationship management applications as well as custom and packaged applications.
- Provide capabilities to track file-sharing activities on major platforms including Microsoft SharePoint.
- Discover and classify sensitive enterprise data for all platforms and protocols.

9.2 IBM Guardium S-GATE

This software safeguards critical enterprise information by continuously monitoring access and changes to high-value databases. Guardium's real-time database security and monitoring solution monitors access to sensitive data, across all major DBMS platforms and applications, without impacting performance or requiring changes to databases or applications.

- Blocks privileged users from viewing or changing sensitive data, creating new user accounts or elevating privileges.
- Implemented as a lightweight, host-based software agent with fine-grained security policies.

Guardium S-GATE provides automated, real-time controls that prevent privileged users from performing unauthorized actions such as,

- Executing queries on sensitive tables.
- Changing sensitive data values.
- Adding or deleting critical tables (schema changes) outside change windows.
- Creating new user accounts and modifying privileges.

9.3 IBM Infosphere Guardium Data Encryption

This software provides encryption capabilities to help safeguard structured and unstructured data and comply with industry and regulatory requirements. This software performs encryption and decryption operations with minimal performance impact and requires no changes to databases, applications or networks.

The key capabilities of IBM Infosphere Guardium Data Encryption are given below:

9.3.1 Transparent, rapid implementation

- Performs encryption and decryption above the file system or logical volume layer so it is transparent to users, applications, databases and storage subsystems.
- Requires no coding or modification to applications or databases.
- Protects both structured and unstructured data.
- Provides scalability for large and complex environments including thousands of systems and files. Infosphere Guardium Data Encryption also scales to help protect data in new computing models like cloud and big-data environments.
- Provides extensible protection to log files, configuration files and other database output.

9.3.2 Centralized key and policy management

- Provides a secure, centralized method of administering encryption keys and policies.

- Enables consistent and common best practices for managing the protection of structured and unstructured data.
- Supports established data classification and acceptable use policies.

9.3.3 Compliance-ready capabilities

- Enforces separation of duties by supporting separate database management system (DBMS) and security administration.
- Provides granular and configurable auditing and reporting of access requests to protected data, as well as changes to policies and keys.
- Provides audit management to reduce audit scope.
- Integrates with existing security information and event management (SIEM) solutions.

10. Products

This section outlines various software and hardware products to be used for the ACCESS System.

10.1 Software Products

This section outlines the various software products to be used for the ACCESS System.

10.1.1 Browsers

All the users (Customer Service Representative - CSRs, employers and third party agents) will mainly use Internet Explorer 6.0 (or above) and Netscape 7.0 (or above) to access the ACCESS System. User Interfaces will be designed to work equally on both types of browsers. Mozilla (1.7 above) and Mozilla Firebox (1.0 above) support will also be provided.

10.1.2 Web Server

International Business Machines (IBM) HTTP Server 7.0 and above will be used as the web server.

10.1.3 Application Server

IBM WebSphere Application Server (WAS - Network Deployment Edition) 8.0 and above will be used as the application server. The Network Deployment edition of WAS will be used to provide clustering capabilities. This product requires WebSphere Application Server Base Edition to be installed. Options are being explored if JBoss Enterprise Application Platform v 6.1 can be deployed instead of WebSphere 8.0 for substantial cost benefits.

10.1.4 Database

Legacy data related to ACCESS is present in Virtual Storage Access Method (VSAM) and flat files. This data will be migrated to DB2 Universal Database (UDB) as part of the ACCESS Project. ACCESS System will be using the DB2 UDB 9.7 or above.

10.1.5 Workflow Management

A successful implementation of a workflow system can be achieved only through an effective integration of the users and the infrastructure. JBoss Drools Flow will be used as the workflow management solution for the ACCESS System.

10.1.6 Reports Generation

For implementing the correspondence and report generation requirements, the Eclipse BIRT will be utilized. Eclipse BIRT Designer will be used for creating the report templates.

10.1.7 Document Management System

Apache Jackrabbit Document management system will be used for storing and retrieval of correspondences and reports. The product supports the following requirements of the document management system:

1. Electronically stores, organizes and manages documents, files and other business critical information.
2. Support for virtually any type of content

DMS is the centralized documents repository for the Tax and Benefits Applications. ACCESS system generates correspondences and reports in PDF format. These documents are stored in DMS in a structured format.

Figure 16 depicts the proposed node structure configuration for Active and Archive DMS system for each state. The ACCESS node is the root node which contain one YEAR node and it will contains 6 different nodes as Claimant, Employer, Appeal, Reports, FEIN and EEER. These nodes are further divided into child nodes like Claimant node will use the SSN number for further division and document related to all claimants will be stored using predefined SSN structure. Employer node will use the Employer account number (EAN), Appeal will use the Docket number and Reports will use the report name for further division. Year node will describe the storage of document year wise and this is use full for archival of data year wise.

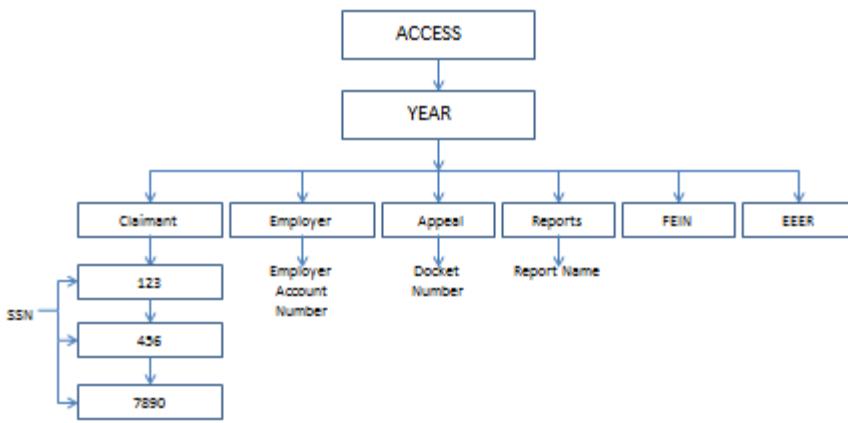


Figure 16: DMS Node structure

10.1.8 Imaging Solution

Existing Imaging systems for the state will continue to exist. ACCESS System can interface with the Imaging system by providing capability to upload the imaged documents to the Document Management System via:

1. Multiple file upload by batch processes.
2. On demand single file upload by the authorized users.

10.1.9 Interactive Response

Avaya will be used for the IR application for MS for ME & RI it is out of scope as of now. State will continue to use their existing software which the Application will Interface with Weekly Certification filing functionality.

10.1.10 Address Validation

Universal Coder will be used for the validation of the address. ACCESS System will use this software to validate employers or claimants physical and/or mailing address. The software provides Java API's for performing the address validation.

10.1.11 Batch Scheduler

The ACCESS System will have batch jobs in cases where an online transaction processing is not possible or in cases where the business functionality warrants batch processing. Open source software Quartz scheduler will be used to schedule the batches.

10.1.12 TOP (Treasury Offset Program)

TOP is administered by Federal government known as Financial Management Service or Internal Revenue Service (IRS). Under this program, two flat files are received and one is sent back to IRS weekly. Under TOP, there are limited numbers of software that can be used for these file transfers which includes Connect Direct, Cyber Fusion etc. For this purpose, MS uses Connect Direct 4.6.

As depicts by Figure 17 Connect direct need human interaction to complete additional processes which required movement of these two files to the physical batch box manually and execute on demand batch that follows execution of two child batches which applies all the repayments and also checks for the reversal. All the IRS data is encrypted before storing into database. Similarly, a single flat file is created once a week using the information from database and sent back to the IRS.

Guardium is implemented for audit of all the tables those are somehow related to the consumption and creation of flat files associated with IRS.

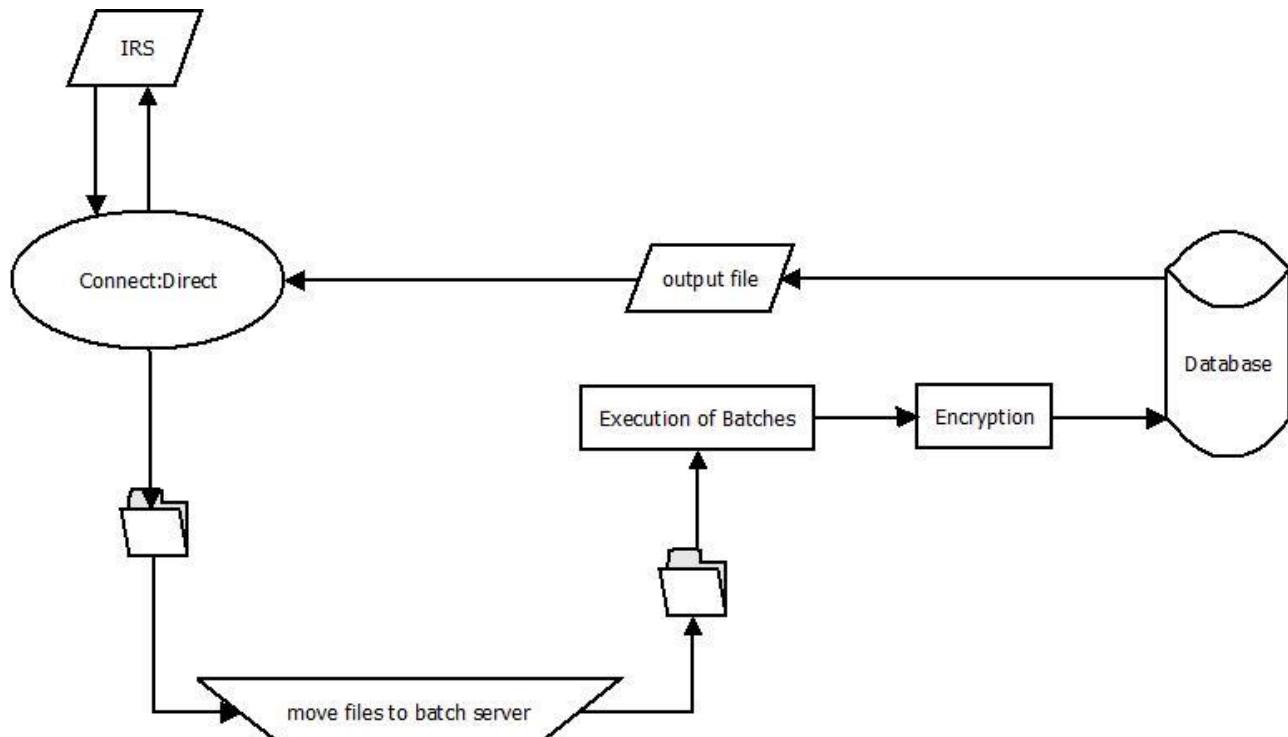


Figure 17: TOP Data flow diagram

10.1.13 Printing and Mailing

ACCESS Framework generates Correspondence in multiple runs depending on the business requirement. It has the capability to group correspondences in different runs and further group them based on the type of correspondence. These generated correspondences are then grouped in the form of a single PDF file for each group which can be sending to the print department. Currently for Mississippi these PDFs are uploaded to a file server and the links along with the print instructions are emailed to the printing department. In a cloud environment, the mode of sharing these generated PDFs with each state can be defined once the hosting is finalized.

The key features of the correspondence generation framework are:

- Configuration for Stuffers and Self Mailer correspondences.
- Address presorting on Bulk mailing.
- Correspondence grouping and merging for ease in printing.
- Upload to DMS for the configured correspondences.

10.1.14 Backup Process

EMC AVAMAR is used as software tools for all servers backup.

- Database server backup taken by DB2 software client itself within the server.
- Daily full backup of required files / folders are taken and put into disc or tape.
- These discs and tapes are encrypted.
- This disc or tape will be stored in disaster recovery site through manual process.
- At time of recovery this disc or tape will be used to restore the rest of the server.

11. Deployment Architecture

11.1 ACCESS MS Production Environment

The existing production environment for MDGES is architected with the objectives of handling a large number of transactions, where important factors like scalability, availability, and expandability among others are addressed.

Attached Spreadsheet contains the as-is Server details along with sizing information for ACCESS MS System.



AccessMS server
infrastructure info wit

Each of these servers will be migrated VMware/Linux infrastructure. Currently options are being explored for cloud based hosting for all three states. The sizing information for the upgrade will remain same as the as-is servers and the Server/Processor models will be finalized along with the Cloud Infrastructure RFP.

11.2 Existing System Overview

Requests from the Internet users are resolved to an Internet address by a Domain Name Server (DNS) server hosted at ITS. Once the connection comes through ITS's PIX the Internet IP address is translated to a local IP address on the internal Local Area Network (LAN). The request then hits the edge server that establishes a static connection with the Internet user and forwards the request back to one of the two http servers, load balanced by the edge server. The edge server has a cryptographic coprocessor installed to facilitate encryption processes. SSL sessions are kept static between the edge server and the end users browser. A Sun Access Manager client will reside on either the http servers or on the application servers and will communicate with a Sun Directory Server where user profiles and roles will be stored and read for authentication and authorization information. Application server will use the following software for the execution of business processing logic:

- IBM DB2 UDB Database
- JBoss Drools Flow
- Report Server
- Apache Jackrabbit
- Directory Server

All servers in the architecture (application server, http server, database server, drools workflow server, drools workflow database server, access manager, access & directory server, reporting server) will be implemented in a mirrored fashion for load balancing and failover recovery. These servers use Storage Area Network (SAN) as their external storage mechanism. The servers are connected to the SAN Storage hardware through Gigabit switches to enhance the system and network performance. Fiber channel connections are being used to connect the servers to the SAN. The Falcon Store software running on the blade servers manages the SAN. A tape backup system will be used to backup all servers to tape. Remote IP replication will be employed across the Wide Area Network (WAN) to the Disaster Recovery site utilizing a 45MB MB DS3 Link to Information Technology Services (ITS). The Servers are connected with Gigabit Switches. The routers and switches have Gigabit speed connectivity to enhance the network performance.

Figure 18 depicts various hardware and software and their interaction in production environment for MS.

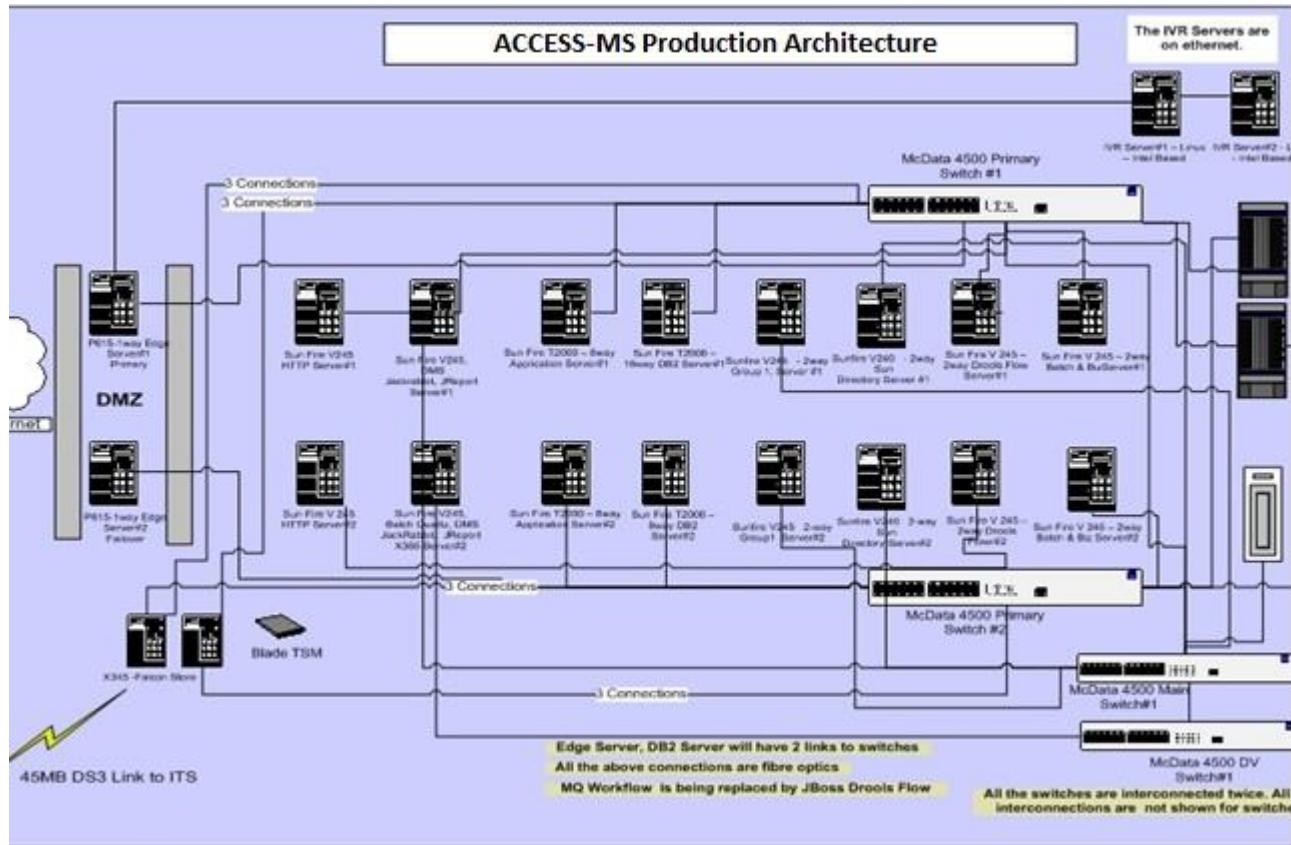


Figure 18: ACCESS-MS Production Architecture

Figure 19 depicts Logical architecture diagram for ACCESS MS System.

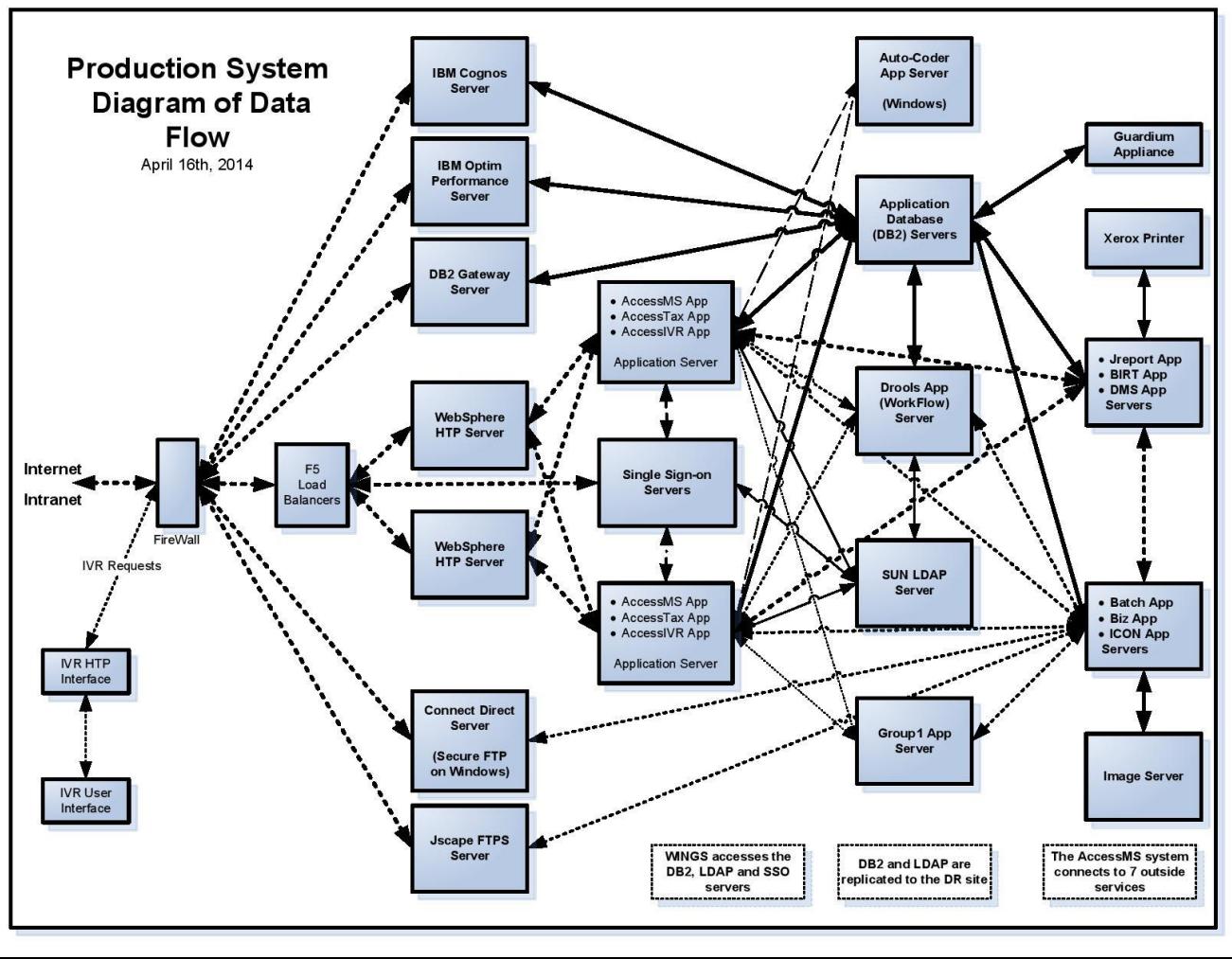


Figure 19: ACCESS-MS Production Logical Architecture

11.3 Proposed cloud based architecture advantages

Agility: It will improve with users' ability to re-provision technological infrastructure resources.

Application Programming Interface: (API) accessibility to software that enables machines to interact with cloud software in the same way that a traditional user interface (e.g., a computer desktop) facilitates interaction between humans and computers. Cloud computing systems typically use Representational State Transfer (REST)-based APIs.

Cost: Cloud providers claim that computing costs reduce. A public-cloud delivery model converts capital expenditure to operational expenditure. This purportedly lowers barriers to entry, as infrastructure is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is fine-grained, with usage-based options and fewer IT skills are required for implementation (in-house).

Device and location independence: It will enable users to access systems using a web browser regardless of their location or what device they use (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.

Virtualization technology allows sharing of servers and storage devices and increased utilization. Applications can be easily migrated from one physical server to another.

Multi-tenancy will enable sharing of resources and costs across a large pool of users thus allowing for:

- Centralization of infrastructure in locations will lower costs (such as real estate, electricity, etc.)
- Peak-load capacity will increase (users need not engineer for highest possible load levels)
- Utilization and efficiency - improvements for systems that are often only 10–20% utilized.
- Reliability improves with the use of multiple redundant sites, which makes well designed cloud computing suitable for business continuity and disaster recovery.

Scalability and elasticity via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time without users having to engineer for peak loads.

Performance is monitored and consistent and loosely coupled architectures are constructed using web services as the system interface.

Security can improve due to centralization of data, increased security focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford to tackle. However, the complexity of security is greatly increased when data is distributed over a wider area or over a greater number of devices, as well as in multi-tenant systems shared by unrelated users. In addition, user access to security audit logs may be difficult or impossible. Private cloud installations are in part motivated by users' desire to retain control over the infrastructure and avoid losing control of information security.

Maintenance: Maintenance of cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different places.

The Private Cloud Infrastructure should offer the following:

1. Hardware (Server, Storage & Networking)
2. Virtualization & OS software
3. Monitoring of Application and Infrastructure
4. Management - Usage & Billing
5. Backup
6. Business Continuity & Disaster Recovery
7. Security & Access Control
8. Compliance with IRS 1075 guidelines
9. Audit
10. Upgrades & patching (software & firmware)

12. Audit, Security, Compliance and Risk Management

12.1 Audit

All system logs, access logs, database transaction logs, application logs will be preserved for specified time period as agreed upon with the states. Since these logs will be residing on the Linux file systems in the event it is required for forensics purposes, the file systems can be exported to different target systems where it can be analyzed with the help of the forensic tools. The auditing can be done through the application tools & reports or it can be done through forensic tools which will analyze the available logs and present in a report format for easy detection of any irregularity that might exist.

12.2 Log Management

All logs need to be securely stored for future audit and forensics purposes. Logs from all the production systems for OS, databases and applications need to be collected and periodically analyzed for any discrepancy. There are various vendor and open source software available for these purposes. The forensics software can be integrated with the log management tool to provide a comprehensive forensics and audit of the entire platform if needed. The architecture of the log management system can be added once it is decided which software will be implemented. The following software is available:

1. SolarWinds
2. vCenter Log Insight
3. Splunk
4. OSSEC
5. Logalyze

Figure 20 depicts Log Management and Forensics details.

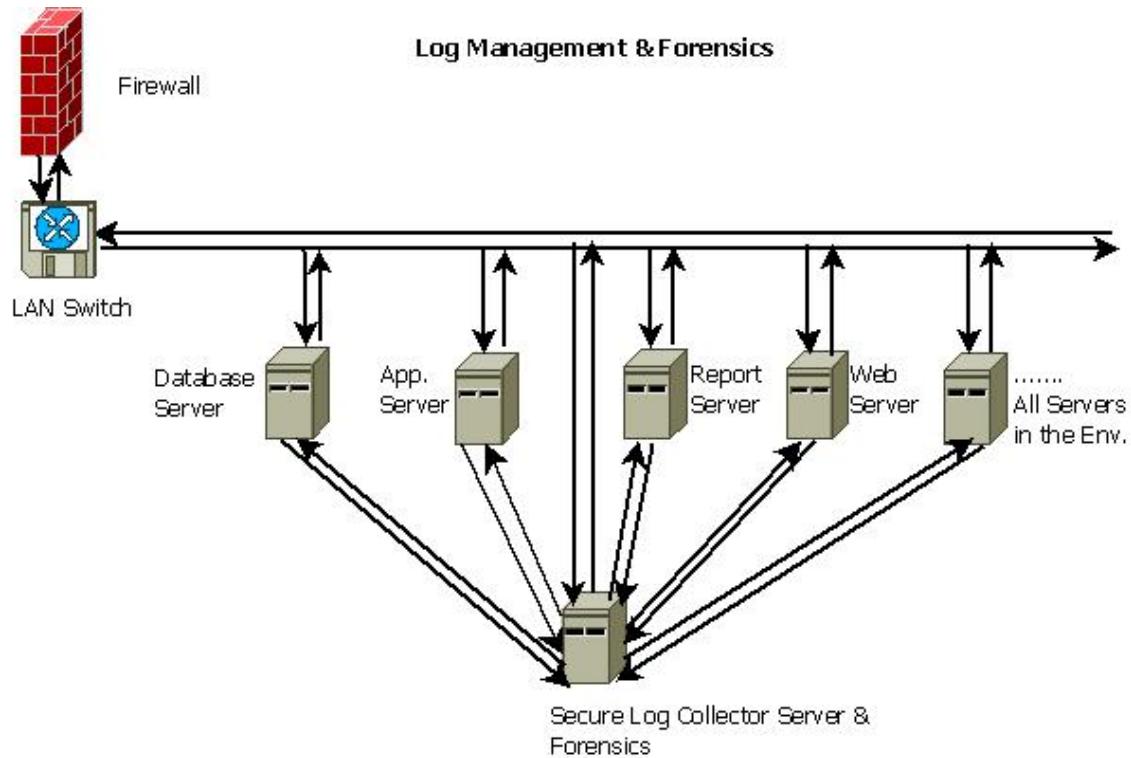


Figure 20: Log Management & Forensics

12.3 Security

All access to the UI system will through the application or the servers that house the UI application. Access will only be allowed upon following through the established access management process. The application will use AD/LDAP authentication and single sign on where needed for access purposes. A two-step access control process to be adopted by use of secure tokens. All access logs will be preserved for future reviews. All application web pages to use secure connections through the use of SSL certificates to reduce the risk of unauthorized access. There should be no developer access to production systems. All privileged access like that of system administrator, database administrator should be only allowed only after thorough review and approval. All records of access requests need to be preserved for future reviews.

12.4 Web Services Security

TCS is currently exploring various options for securing the web services and will add the details in the next release of the document. The framework will be JAVA based since the current platform runs on JAVA. In the meantime, all existing vulnerabilities for the current platform will be checked and appropriate actions will be taken for mitigating the risk.

12.5 Compliance

Any server that contains tax payer information needs to be configured as per the Federal Tax Information Security Guidelines for Federal, State and local agencies, as stated in the IRS Publication 1075. Since the servers will be installed and managed by the third party, it is important to ensure that all relevant guidelines are being met. All changes to the systems housing the UI application should be done through the established change management process. In the event of problem management, an incident management process should be established and for every incident there should be a root cause analysis and a corresponding fix should be applied in order to avert such incidents in the future. All servers and applications should be monitored for proactive problem resolution and future capacity need purposes. Also, there should be segregation of duties i.e. the requester cannot be the approver. A configuration management process should be in place in order to validate all required server/software configurations are as per guidelines.

The MRM Consortium application will be following the IRS 1075 FTI guidelines. The link and the related documentation are attached below:

<http://www.irs.gov/uac/Safeguards-Program>

					
safeguards-multi-fac tor-auth-alert.doc	safeguards-scsem-d b-db2.xls	safeguards-scsem-e xi5x.xls	safeguards-scsem-fir ewall.xls	safeguards-scsem-m ot.xls	safeguards-scsem-n etwork-assessment.x
					
safeguards-scsem-sa n.xls	safeguards-scsem-u nix-linux.xls	safeguards-scsem-wi n-server2008.xls			

Appendix A. JEE and Design Patterns

ACCESS System will adopt open technologies for building the system. It will be very similar to the Object Modeling Group's (OMG's) model driven architecture approach where the architecture will provide platform independent design and wherever there is a need for the platform specific functionality, abstractions will be provided to hide the underlying technology, hence reducing the cost involved in porting to different platforms. The ACCESS System will have a framework that will be built upon the JEE model/environment with the JAVA programming language.

JEE

JEE is a platform that enables solutions for developing, deploying and managing multi-tier server-centric/Web based enterprise applications. JEE builds on Java to extend a complete, stable, secure, fast Java platform to the enterprise level. It delivers value to the enterprise by enabling a platform that significantly reduces the cost and complexity of developing multi-tier solutions, resulting in services that can be rapidly deployed and easily enhanced. The JEE platform consists of a set of services, API's, and protocols that provide the functionality for developing multi-tiered, Web-based applications. This model is intended to both standardize and simplify the kind of distributed applications required for today's networked information economy.

Major JEE Standard Services

The JEE standard services include the following:

- HTTP
- HTTP over SSL (HTTPS)
- JTA
- Remote Method Invocation – Internet Inter Object Request Broker (ORB) Protocol (RMI-IIOP)
- Java Interface Definition Language (Java IDL)
- JDBC
- Java Persistence Architecture (JPA)
- JMS
- JNDI
- Java Mail
- JavaBeans Activation Framework (JAF)
- Java API for XML Parsing (JAXP)
- JEE Connector Architecture
- Java Authentication and Authorization Service (JAAS)

Some of the above standard services are actually provided by Java Platform Standard Edition (JSE), the base services for Java platform. Figure 21 depicts the Sun JEE architecture.

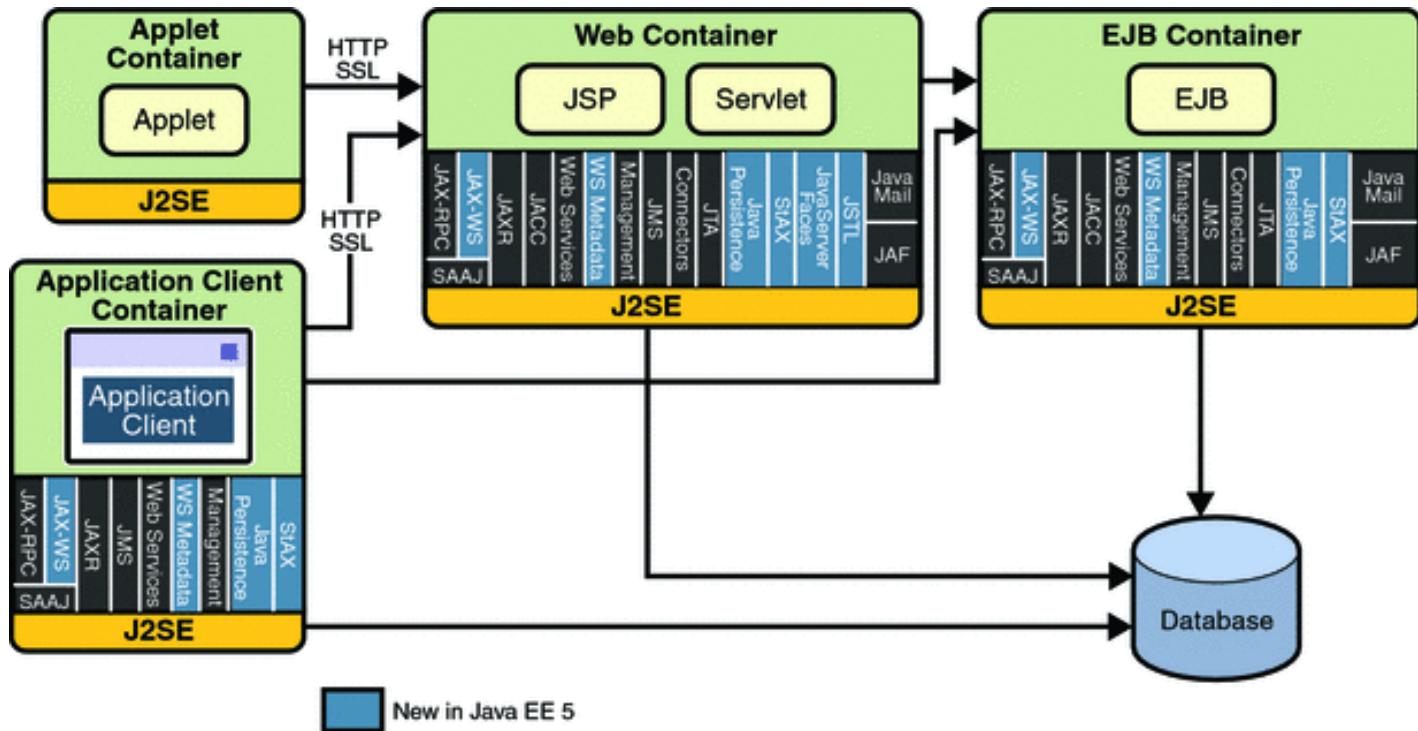


Figure 21: JEE Architecture – Courtesy Sun Microsystems

Design Patterns

The ACCESS technical framework will be built upon industry standard JEE design patterns.

Why Design Pattern?

A design pattern is a **solution** to a general software **problem** within a particular **context**.

- **Context:** A recurring set of situations where the pattern applies.
- **Problem:** A system of forces (goals and constraints) that occur repeatedly in this context.
- **Solution:** A description of communicating objects and classes (collaboration) that can be applied to resolve those forces.

Design patterns capture solutions that have evolved over time as developers strive for greater flexibility in their software. Patterns are generic, reusable design descriptions that are customized to solve a specific problem. The study of design patterns provides a common vocabulary for communication and documentation, and it provides a framework for evolution and improvement of existing patterns.

The section below outlines the Model-View-Controller (MVC) design pattern that will be used in ACCESS System.

Model-View-Controller Design Pattern

MVC is a classic design pattern often used by applications that need the ability to maintain multiple views of the same data. The MVC pattern hinges on a clean separation of objects into one of three categories:

- **Models** for maintaining data
- **Views** for displaying all or a portion of the data
- **Controllers** for handling events that affect the model or view(s)

Because of this separation, multiple views and controllers can interface with the same model. Even new types of views and controllers that never existed before can interface with a model without forcing a change in the model design.

The goal of the MVC design pattern is to separate the application object (model) from the way it is represented to the user (view) from the way in which the user controls it (controller).

How MVC Works

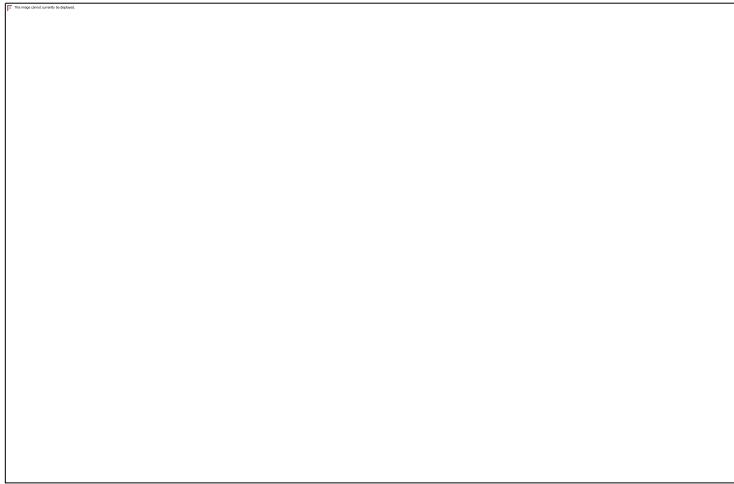


Figure 22: The MVC Abstraction

Events typically cause a controller to change a model, or view, or both. Whenever a controller changes a model's data or properties, all dependent views are updated. Similarly, whenever a controller changes a view, for example, by revealing areas that were previously hidden, the view gets data from the underlying model to refresh itself.

Dependency Injection

Ideally a Java class should be as independent as possible from other java classes. This forms the foundation of a loosely coupled and flexible framework. A Java class has a dependency on another class if it uses an instance of this class. Thus the java class cannot be tested independently.

Dependency Injection pattern describes how one object resolves or finds other objects on which it needs to invoke methods. Dependency Injection can be done manually using Factory Helper or automatically using annotation. ACCESS framework will employ Dependency Injection to reduce code dependency between various components of the framework.

JEE Design Pattern

MVC Design pattern will be making use of several others JEE design patterns to achieve the overall goal and they are:

- Application Controller – Manage the lifecycle of the individual commands and mapping the requests to specific commands.
- Command - An operation to process an individual request. In some cases multiple similar requests might be handled by the same command.
- Composite View - Provides a means of composing a single view from a set of individual views. The composition will be defined by the metadata present in an XML file.
- Data Access Object (DAO) - A generalized way of accessing a specific type of data. It helps to allow the change of the data access mechanisms independently of the business logic that uses the data.
- Dispatcher View - The dispatcher view is responsible for dispatching a request to a specified view based on the results of the Command processing.
- Session Facade – It encapsulate the complexity of interactions between the business objects participating in a business process. The Session Facade manages the business objects, and provides a uniform coarse-grained service access layer to clients.
- Fast Lane Reader – It provides a more efficient way to access tabular, read only data, as reading a list of read-only data using EJBs through individual bean instances can be costly and slow and incurs a high performance overhead.
- Front Controller - Point of entry for requests to update UI model. The controller is responsible for processing requests.
- Intercepting Filter - All requests are subject to Intercepting Filters, which allows an application to preprocess a request before it is handled by the controller. An intercepting filter can pre-process or redirect application requests, and can post-process or replace the content of application responses.
- Service Locator - Locate a service or resource needed within an application such as a JNDI resource, JDBC connection, or an EJB component.
- Transfer Object – These will be used to encapsulate the business data. A single business method call is used to send and retrieve the Transfer Object. When the client requests the enterprise bean for the business data, the enterprise bean can construct the Transfer Object, populate it with its attribute values, and pass it by value to the client.

- Value List Handler - This can be used to control query execution functionality and results caching. It will access a DAO that can execute the required query. It can also store the results obtained from the DAO as a collection of Transfer Objects. The client requests the 'ValueListHandler' to provide the query results as needed.
- View Helper – This can be used by the UI view components to access the UI model data. View helpers include JavaBean components, which may have been placed in the request. Tag libraries may also be used as view helpers.
- Figure 23 depicts the interactions between the different JEE patterns on which the ACCESS System will be based upon.

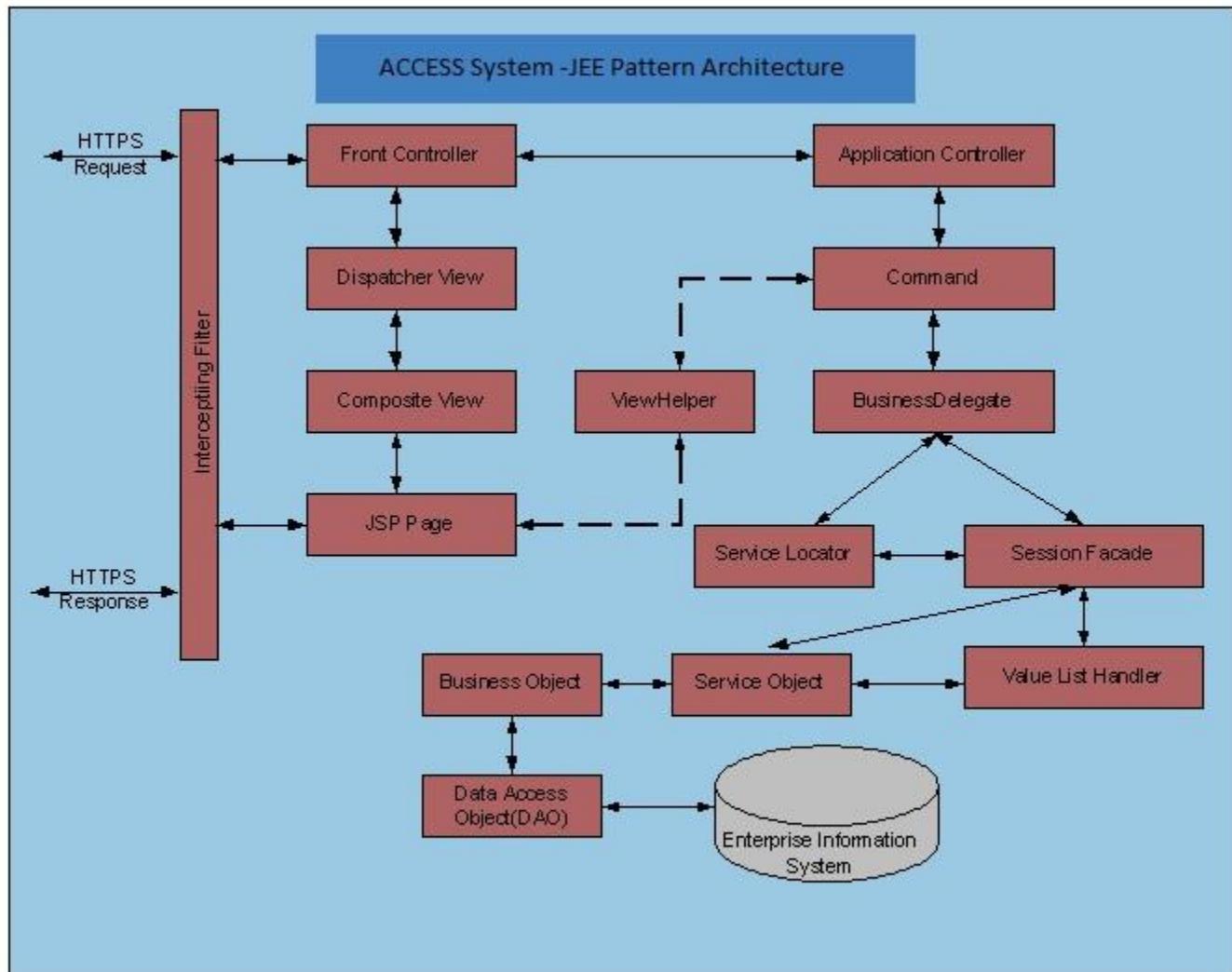


Figure 23: JEE Pattern Architecture

Appendix B. Review Comments

ITSC Review Comments

Questions & Comments from ITSC on the Architecture document:

Comment - Overall a good draft however need the following clarifications.

1. What is overall approach to multi-tenancy? 5.2.3 Covers BRMS aspect but what about runtime execution of state specific code? Or will everything that is state specific be implemented in DROOLS and only common functions in code? How will ACCESS be migrated and tested? **Answer:** Application code base will be categorized into CORE (Benefits, Framework & Tax) which includes Business Rules Implementation and State Specific Components (Benefits & Tax). Each state will have its own instance of Benefits and Tax application which will include CORE and the particular State Specific piece. Section 5.2 refers various Framework services to implement the State Specific functionality. Section 5.2.4 has some details on this item.

2. Was an ESB considered, particularly to accommodate changing I/Fs and adding states? **Answer:** Based on the Site visit and requirement sessions so far, the current architecture capabilities for Interfacing and messaging meet the MRM requirements.

3. For Web Services, is REST being considered vs. SOAP?

Answer: We currently have SOAP based WebService Implementation, REST based WebService if required will be implemented.

4. Need prototype/proof of concepts in the Phase I of benefits. This is generally going to happen but just to make sure.

Answer: Architecture changes will be implemented and rolled out in parts before the first phase of Benefits I is rolled out. Also, before rolling out any component, the changes will be going thru the development & testing cycles.

5. How will TCS manage interoperability of products into the future?

Answer: Current software list along with the versions and the planned upgrade version is maintained in the document. TCS will ensure these software versions are compatible.

6. Is there an overall approach to third party product substitution if needed?

Answer: Any third party software will be evaluated and then will go thru the development (for any changes that may or may not be required), & testing (integration & functional) cycles. If required, POCs will be carried out.

7. Great stuff on patterns. Will IOC/DI and/or AOP be used?

Answer: Dependency Injection is used in the current Architecture. It's depicted in the Sequence Diagrams for the architecture in section 6.6. We will add a description of the design pattern in the Appendix as well along with other design patterns.

8. Need to have architecture decision matrix for facets still under consideration e.g. WebSphere vs. JBoss. ITSC will provide a sample template.

9. As suggested, a data flow diagram added (Refer Figure 5: Component Diagram for Framework Services corresponding to Core and State Specific Implementation).

10. As suggested, the first paragraph for "Application Hosting has been updated to reflect IaaS and the items related to procurement removed.

11. How far did the POC go for Drools? Where all layers of the arch traversed? What about full scale performance and when more states are added?

Answer: We have installed JBoss Drools software and verified the second option (Refer Section 5.2.3 second option: state specific Rule package which contain several DRL files) which we chosen for implementation. "DROOLS framework changes will be moved to production before Benefits 1 release". Performance testing will be conducted during that time.

12. How far did the POC for mobile application development.

Answer: The attached PPT is describe the mobile application development POC.



Mobile_App_POC.ppt
x

Review comments given for Version 1.1

13. There are only 4 external interfaces listed. Further, there is no discussion regarding pros and cons of using an ESB which could promote onboarding downstream in a few areas including interfaces.

Answer: The four external interfaces were noted as examples for the types of interfaces that impact the architecture document. TCS will be evaluating the risks and requirements for moving to ESB based architecture for the MRM Consortium as a future plan.

14. Is the plan to comply with WS-Security? I think there should be a reference to the standards to which the solution will comply.

Answer: Yes, there is a plan to comply with Web Services security framework and the reference will be added to the technical architecture / standards documentation.

15. Where relevant, I believe there should be mention of proofs of concept, like the multi-tenant aspect.

Answer: TCS will update the coding standards doc. with the details of practices on common code and customization of state specific components.

16. There is no mention of each state being able to access their relevant data regarding log files (see page 75).

Answer: The current infrastructure plan is to house the three states in three logically separate platforms which will have a common underlying Virtualized IaaS base. Hence all the member states will have logs (application, database etc...) separately available for forensics purposes. These details will be updated in the application hosting part of the technical architecture document as discussed.

17. Page 82, the e-FISCAL reference needs further elaboration.

Answer: Appropriate changes will be made to this section of the document as pointed out.

18. Page 43, use of stored procedures has benefits for bulk complex processing but there should be mention of impacts on DB substitution.

Answer: Since there are only a few stored procedures in use and the member states are also going to use DB2, TCS will evaluate the conversion of the stored procedures to Java based queries in the future. This will be also useful for any DB substitution in the future. Since the use of stored procedures are limited, TCS doesn't perceive any problem in the conversion for a more efficient process for handling the related queries, at this time.

19. How will code quality be ensured? Any tools used in combination with build processes?

Answer: TCS mentioned Google Code Pro Analytics is being used for code quality and the technical architecture doc. will be updated with the details.

20. Page 16, what is the basis for the configurations? Were capacity analysis and tools used? Where the 3 state's workloads considered? The IaaS should be included in this.

Answer: TCS evaluated the capacity related data received from MS and MO along with the experience with the platform and came up with a standard configuration. It was also mentioned that since the infrastructure is based on IaaS, any changes / tuning that will be required can be easily achieved with very little turnaround time.

State of MAINE Review Comments

Questions & Comments from Maine on the Architecture document:

1. Mobile App. development for Java.

Answer: The Mobile App. components have been listed and Android SDK has been mentioned in the list of Development Software.

2. Struts 1 beginning end of life this year. Why is TCS continuing with Struts 1 which is not supported.

Answer: Struts 1.3.5 EOL announcement was released April this year. But moving from Struts to other framework is a major architectural change and needs re-development of application code. Also, the current application will not benefit from the additional features that the new framework will bring. However, at this time since Struts 1.3.5 has reached EOL we will evaluate the changes that will be required for migrating to Struts 2.0 <http://struts.apache.org/struts1eol-announcement.html>

3. Separate tax & benefits on separate servers, middle tier is duplicated on tax and benefits system?

Answer: The two applications will be running on one server as it does in the current MDES configuration. Both applications have the runtime code completely independent of each other with a common middle tier that includes the base code.

4. Deployed as separate independent Apps. - duplicated on tax & benefits.

Answer: The two applications - tax and benefits are to be deployed separately so that maintenance and deployments can be independently carried out. Currently, the two applications have similar configuration for MDES. A modular approach has been taken so that any future application can be easily ported on this platform.

5. One rule set vs smaller rule sets.

Answer: BRMS there was a question on the possible number of rules in the application for the approach, and we had mentioned that there would be many rulesets and hence our recommendation is the second approach which is more modular and easily manageable in terms of performance. During the development the rulesets a thorough testing will be done to avoid any failures in the later stages.

6. Native vs responsive web apps. for mobile devices; documentation for this comparison. **Answer:** The attached document and the links will provide you with the data comparison that we did for deciding which is a better option for us - native or the Web Application.

<http://venturebeat.com/2013/07/29/native-v-web-chart/>

<http://www.businessinsider.in/HTML5-vs-Native-Mobile-Apps--HTML5-Is-Down-But-Not-Out/articleshow/21829859.cms>



Mobile Development Approach.docx

7. Lack of awareness of how fast native environments are evolving. HTML 5 CSS 3 is agnostic, Corona, Sibco, Antenna etc.. Write in an intermediate language source to source comparison.

Answer: Same as in item 6.

8. Audit handled at DB level or business layer?

Answer: The audit is handled in both levels. The business layer produces the business level reports and the OS level audit logs can be used for DB level audit trails.

9. How is access to logs provided? Access is on server available to developer. Add information in document related to IBM Infosphere Guardium.

Answer: Application generates Debug and Error logs in the file system which are currently used by the developers. These logs can be mounted and made available on remote file servers. For the Forensics, and auditing tool like IBM Infosphere Guardium product can be integrated in the solution.

10. Why is Pentaho and Jaspersoft not suitable here? Can we assume nightly refresh?

Answer: This has been answered in the document, only pending item is BI part for which we have requested you to get in touch with Mohammed as IBM had some presentations and Use cases already presented to MDES and can be shared.

11. Update the paragraph on Application Hosting.

Answer: This paragraph is updated in the the Technical Architecture Doc.

12. We have added ection for Audit, Compliance, Security, and Risk management.

Review comments given for Version 1.1**1. Mobile Development**

- Request a detailed discussion on Responsive Web v. Native v. MEAP-Middleware.
- As of now, there is only a comparison between Native v. Corona-Lua-MEAP-Middleware; Please expand this...
- What if we adopted one unified Responsive Web UI w/ Mobile-first? If bandwidth could be released from native mobile development, perhaps we could choose a modern Web framework.
- Our concern is that different stakeholder groups' requirements be considered in arriving at this decision.

TCS response:

The details of the mobile application are given in the updated technical Architecture document - Section 5.2.5.

Maine response:

- Nothing new or relevant to our questions & concerns is presented in Section 5.2.5.
- TCS has simply refused to consider Responsive Web UI w/ Mobile First.

Meeting(10/21/2013) discussion:

Explained that the comparison and features of Native and Web development approach is included in the Appendix B Review Comments section and the recommendation of native development is due to the best GUI and performance which is the roadmap for mobile app development that is set for the Consortium.

2. Likewise, choosing a more modern Web Framework would also help us deal with the Struts 1 end-of-life dilemma.**TCS response:**

This was discussed in the meeting that the most logical step would be to migrate to Struts 2 however, nothing would be gained from the application perspective since whatever extra features Struts 2 offers, the application is not dependant on it. Also, moving to Struts 2 would add time to the development cycle which may delay in the porting of the application on the new platform. In the past, there were no support needed for the Struts 1.3.5 and until we decide to move/upgrade or not to different framework, it is expected to remain the same.

Maine response:

- Nothing new or relevant to our questions & concerns is presented in Section 5.2.5.
- TCS has simply refused to consider Responsive Web UI w/ Mobile First.

Meeting(10/21/2013) discussion:

Explained that the current architecture that is struts 1 based is been customized and upgraded for MS solution and suffice the solution requirements. Also, looking at the past record of Benefits and Tax development for MS, we have never faced any issue or need for support or bug fixes from struts community. So considering the effort required to move to struts 2 and the consortium timeline, we don't see any gains in moving to struts 2 yet.

3. Forensics & Log Management

- Request (1) more granular tracking of who-what-when-how, as well as (2) Exportability to external (third-party) SIEM toolsets.
- Restated, we believe that a manual forensics strategy is not the correct approach.

TCS response:

We have added more details on this topic in chapters 6.2.7, 6.2.9, 9 and 12 of the updated Technical Architecture Doc.

Maine response:

- Some improvement, yet there does not appear to be an awareness of the basic problem of log aggregation and correlation. Sections 6.2.7 and 6.2.9 referenced in this context have nothing to do with forensics. The suggestion to bring IBM Guardian product in is not addressing the SIEM problem. Also, adds another expensive piece of software without solid articulation of how that selection was made.
- Section 12 is not helpful in describing anything related to the ‘architecture’ of the system dealing with risk, compliance, or security.
- We need an architecture diagram from TCS that illustrates how one of these products would be integrated.

Meeting(10/21/2013) discussion:

TCS will provide a diagram showing the product and its integration with the system.

4. Request more details on the Distribution Model of Jars & Rules. What about wiring performance management into the various components & layers from the ground up? Also request more detailed Architectural Diagrams (both physical and logical) diagrams. Please see the attached examples.**TCS response:**

We have added more details as requested, in chapters 4.1.4 & 5.2.3. The deployment architecture have been attached in section 3.6, 3.7 and 11.

Maine response:

- Non-answer, the requested details have not been added.
- Our request to receive clean physical, logical, and deployment views of the architecture was not satisfied.
- Given that TCS is using the Rational toolset for development, we do not understand why the Rational Unified Process was not adhered to in the creation of the Architecture Document.

Meeting(10/21/2013) discussion:

Explained scenario of code movement to Production. This will be added to the architecture document. ME also requested an diagram of the physical architecture to be added.

5. BI Solution

We would like to review the Use Case examples (i.e., the customer –facing details in support of the solution proposal).

This information will help us support our business clients in assessing the delta between their current data warehouse solution and the proposed project offering.

TCS response:

The details of all BI related items can be found in chapter 8 of the updated Technical Architecture doc. As previously discussed, we would request Mohammed to forward you the details including the use cases received from IBM on the BI software.

Maine response:

- Non-answer; TCS has relegated their responsibility of working with our business clients to build the necessary Use Cases to MDES.
- Use Cases should NEVER originate from the vendor; conversely, the vendor's role is that of the facilitator, the analyst, the recorder of the Business Case obtained during interview sessions with the business clients.
- We strongly advise, that if the Use Cases have not been recorded, do not waste money on the BI tool this early in the project. A BI solution can always be bolted on when needed. Restated, there is no opportunity cost to not acquiring a BI solution until the Use Cases can be demonstrated. As a matter of fact, cost is typically minimized once the Use Cases are finalized and formally accepted by the Business Client.

Meeting(10/21/2013) discussion:

Explained that the decision to get a BI is already in place and currently MS is going ahead with procuring the BI solution outside the consortium and later it can be added for Consortium

6. Deployment & Change Management Strategy

How will changes to hardware/software be managed across the three tenants post-Go Live? Is there an SLA template you can share with us so that we can understand the metrics that will be used?

TCS response:

We suggest that one change management system be used for the new MRM or we can use the system that each state has, to start with and the processes will remain same for managing any hardware/software change in the platform.

Regarding the SLA part, we would request Mohammed to send you any template that the MDES team uses.

Maine response:

- Non-answer; the responsibility for this critical aspect of on-going support clearly belongs to TCS, not MDES. We would not expect that the current process in place for MS would be adequate for the consortium – it is an entirely different problem space to deal with three separate tenants/clients, each residing in different physical locations.

Meeting(10/21/2013) discussion:

This is covered under the examples of code deployment which was described in details during the meeting.

7. Disaster Recovery

While not mentioned explicitly on the 9/24 call, the comment regarding the high cost of securing the remote hosting vendor/data center for the project, brought this to mind for us. Is a full DR site still part of the overall plan?

TCS response:

We do not have the detailed information on the data center strategy yet. As we receive information from consortium member states, we update the document to reflect the details. Currently, Mohammed and team are working on the hosting with various vendors and we hope the details will be available soon.

Maine response:

- Non-answer; the DR strategy is a major consideration for Maine, as is the Data Center selection process, the former clearly dependent on the latter. Given the priority of both, we question the choice made by the project to focus on other much less critical areas such as selection of the Business Intelligence tool suite.

Meeting(10/21/2013) discussion:

For MRM cloud option is currently been explored, and its expected that the DR will be finalized along with that. ME expressed the need for them to test the DR site.

State of RHODE ISLAND Review Comments

1. Application hosting has been updated in Chapter 3 Architecture Validation.
2. Cloud base architecture has been proposed for Consortium states and related advantages has been given in section 11.1.2.
3. Detailed analysis for Mobile application development approach has been given in question no. 6 within Maine review comments.
4. Following required section added / updated.

Transaction Management: Section 6.2.7

Security : Section 6.2.3

Imaging Solution : Section 10.1.8

Printing & Mailing : Section 10.1.12

Backup Process : Section 10.1.13

TOP : Section 10.1.14

5. Chapter 9 has been added for data movement tools.
6. Chapter 12 has been added for Audit, security and Compliance specific which covers the required security standards like IRS.
7. All little changes like “Pros and Cons for bundled vs separate application”, “Workflow software version”, “Address validation software update”, “details for Guardium”, “Single sign on”, “External system interface” are updated in document at respective sections.

Review comments given for Version 1.1

- 1) “The infrastructure for ME, MS & RI will be hosted separately”

- a) This was originally supposed to be hosted together with a core system shared by all and a business rules engine specific for each state.

Answer: The system will be hosted on a multi-tenant cloud computing environment. It is logically a single system with business rules engine but hosted independently for each state.

- b) Will this new structure increase costs for licensing, maintenance, administration?

Answer: No. With multi tenancy and virtualization we will see a cost sharing of licensing fee. Maintenance and support costs for the software will see significant reductions.

- c) Is MS in the cloud or are they locally hosted?

Answer: All 3 states will be hosted identically on the cloud.

- 2) Why are we doing a mobile app now? Shouldn’t we concentrate on getting the core work done now and add enhancements later?

Answer: MS wrote a SBR grant to do a mobile app for weekly cert and work search. MS is obligated to complete this. This will be available to RI and ME as part of the core.

- 3) Hardware out of scope, where is it being located and who is paying for this? Is this an additional expense to be assessed to ME, RI, & MI?

Answer: Production hardware will be on the cloud. Test and Development will be in MS Data center. Majority of the cost will be paid from Mississippi's \$10 million. The rest if any would come from remaining \$60 million and/or state specific \$10 million.

- 4) SSO out of scope for ME & RI.
 - a) Will this mean that ME & RI users will be required to present logon credentials at different places as they pass through the different parts of the application?
Answer: The single signon only applies to the integration of Mississippi's ES and UI systems. ACCESS MS is a single integrated application where you need to login only once.
 - b) Will there be a central accounts database for all three states
Answer: We will use 3 different LDAP repositories, one for each state.
 - c) Active Directory/ LDAP authentication- will this be state by state or one AD?
Answer: Different LDAPs for each state. We do not use AD.
- 5) Overwhelming reliance on IBM proprietary software versus the original open source vendors
 - a) Analysis of recommended software has pro & cons but lacks reason why one vendor was recommended over another. Need clarification on vendor selection
Answer: This is already discussed during the meeting.
- 6) Need clarification on SAN connectivity. "The servers are connected to the SAN Storage through Gigabit switches" "Fiber optic cables are used to connect the servers to the SAN"
 - a) the first statement seems to imply iSCSI SAN connection
 - b) the second statement seems to imply Fiber Channel SAN connection
Answer: This is already discussed during the meeting. Fiber channel related information will be provided in Architecture document
- 7) Costs: does MS/TCS have any idea of the yearly cost to operate and maintain the system.
Answer: We do not have an exact estimate of costs yet.
- 8) Employment Services -- Job Orders: MS currently matches customers to job orders during claim intake. I believe they indicated they can match to out-of-state jobs. Can RI take advantage of their job match process? Does it include all out-of-state job orders?
Answer: This is ES functionality and is considered out of scope for this project.
- 9) State-specific Imaging Systems: how will RI continue to use workflow in their existing OnBase application?
Answer: State imaging systems will operate independently of the ACCESS MS system. RI will not be able to continue the use of workflow present in their existing systems. Business Process Redesign has to be taken place to adhere to ACCESS MS process.
- 10) IVRs: will RI be required to develop their own system or can they use the Avaya solution used by MS? Would it be more cost effective for all states to use the same solution?
Answer: RI can use the MS system if they wish. The requirements need to match with MS. MS is trying to reduce its reliance on IVR systems and move to an internet based model. Less than 15% of claimants use IVR in MS.

11) Printing: there have been discussions in this area but nothing new to date. Where will RI's printing occur? What type of data will be sent -- pdf files or will RI continue to use Elixir/Xerox laser?

Answer: ACCESS MS produces PDF files and bundles the correspondence in various groups. RI can choose to use the Xerox printers to print them. Elixir will not be needed. Maine is planning to outsource.

12) The document states that hardware configuration is not part of the scope under the categories: Suggested Staging and Production Hardware List for each state, Suggested UAT and System Test Hardware List for each state.

Answer: This is already discussed during the meeting.

13) Will each state be responsible to purchase all hardware and software/licenses listed?

Answer: MS is taking the lead in all hardware and software procurement.

14) Reporting Tools: IBM's Cognos is listed. What staff will be generating ad-hoc queries -- contractors or state staff? If state staff, will each state be required to administer their own?

Answer: RI can decide who will have access to Cognos. Cognos will be administered centrally on the cloud jointly by the support team.

Appendix B - Deliverables and Pricing

Deliverable	Deliverable Frequency	Line Item #	Total Proposed Price (for deliverables and labor)	Basis of Estimate (include proposed hours and proposed labor rates, including a labor rate buildup, which must trace to Proposed Price)
Project Management Assessment Reports (monthly)	Multiple	1		
Requirements Management Repository and Traceability Report (quarterly)	Multiple	2		
Architecture and Design Refactoring Report	Once	3		
Unit, Component, Integration, System Testing (monthly, or as needed)	Multiple	4		
UAT Testing (Benefits/Appeals, Tax for each State)	Multiple	5		
UAT Test Plan Assessment Report	Once	6		
UAT Test Result Tracking	Multiple	7		
Data Migration Reports – Interim and Final	Twice	8		
Other (specify)				
TOTAL PROPOSED CONTRACT PRICE			Cannot exceed price of 2.5 FTE average level for the duration of the contract	

Appendix D



***Center for Employment Security Education and
Research 444 North Capitol St. NW, Suite 142
Washington, DC 20001***

CESER General Contract Terms and Conditions

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Appendix D

1. Definitions

- A. *Agreement* shall mean the Master Agreement entered into between Contractor and CESER, including the Scope of Work, these General Terms and Conditions, and any other attachments and exhibits.
- B. *Services* shall mean those services Contractor is to provide pursuant to the Agreement, including any Scope of Work.
- C. *Work* shall mean all work, deliverables, documents, data, goods, and other materials produced, developed, collected, or authored by Contractor pursuant to the Agreement.
- D. *Concerned Funding Agency* means any third party entity providing funding, in whole or in part, related to the Agreement.

2. Relationship

The Contractor is an independent contractor, and the relationship between CESER and the Contractor shall be solely contractual and not in the nature of a partnership, joint venture, or general agency. Neither party may speak nor act on behalf of the other, nor legally commit the other.

3. Arbitration and applicable law

Any controversy or claim arising out of or relating to this Contract or breach thereof shall be settled by arbitration to be held in the District of Columbia. Judgment upon the award rendered by the arbitrators may be entered in any court having jurisdiction thereof. This Contract will be governed by the laws of the District of Columbia.

4. Assignment and Subcontracting

This Contract or any interest hereunder shall not be assigned or transferred by the Contractor without prior written consent of CESER and is subject to such terms and conditions that CESER may impose.

5. Financial Record Keeping and Inspection

The Contractor warrants that it shall, during the term of the Agreement and for a period of three (3) years following the termination or expiration of the Agreement, maintain accurate and complete financial records, including accounts, books, and other records related to charges, costs, disbursements, and expenses, in accordance with generally accepted accounting principles and practices, consistently applied.

CESER, directly or through its authorized agents, auditors or other independent accounting firm, at its own expense, and the Concerned Funding Agency directly or through its duly authorized representatives, shall have the right, from time to time, upon at least ten (10) days notice, to audit, inspect, and copy the Contractor's records. The Contractor shall fully cooperate, including by making available such of its personnel, records and facilities as are reasonably requested by CESER or the Concerned Funding Agency. This Section shall remain in force during the term of the Agreement and for the three (3) years following the termination or expiration of the Agreement. If an audit, litigation, or other action involving the records is started before the end of the

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three (3) year period, Contractor agrees to maintain the records until the end of the three (3) year period or until the audit, litigation, or other action is completed, whichever is later.

6. Audit

The Contractor, at its own expense, shall meet the applicable audit requirements of OMB Circular A-133 if the Contractor has more than \$500,000 in expenditures in a year in awards (including contracts, grants, cooperative agreements, etc.) made by a federal agency. The Contractor must submit a copy of its A-133 audit report, prepared by an independent certified public accounting firm, to the attention of Chief Financial Officer, Center for Employment Security Education and Research, 444 North Capitol Street, N.W., Suite 142, Washington, D.C. 20001 within 30 days of its receipt of the audit report. In instances where non-compliance with federal laws and regulations has been noted in the Contractor's audit report, the Contractor must outline in writing its plan for corrective action and must affirmatively respond to CESER when its corrective action plan has been successfully completed.

Contractor shall keep audit reports, including reports of any of its sub-subcontractors, on file for three (3) years from their issuance. Contractor shall permit independent auditors to have access to the records and financial statements as necessary for CESER and Contractor to comply with OMB Circular A-133.

Contractor agrees that in the event that Contractor's audit report indicates instances of noncompliance with federal laws and regulations, including but not limited to OMB Circular A-133, that Contractor covenants and agrees to take any and all corrective actions necessary or required or as directed by CESER.

Contractor agrees to provide audits annually.

In the event that audits are not received, CESER may, in its discretion,

- a) withhold a percentage of the sums due and owing hereunder until the audit is completed satisfactorily;
- b) withhold or disallow overhead charges; or
- c) suspend this Contract until the audit is completed and all required reports are provided.

The Contractor shall hold harmless, indemnify and defend CESER and the Concerned Funding Agency or agencies, their consultants and each of their officers, partners, agents and employees from any and all liability, claims, losses, (including but not limited to the loss or threatened loss of tax exempt status), costs, fees, expenses, penalties, damages and/or obligations including but not limited to the costs of defense of such claims, attorney's and audit fees arising out of the failure to provide such audit reports. The Contractor shall include the provisions of this Section 15 in any subcontract executed in connection with this Project.

7. Allowable Costs

Allowable costs shall be determined in accordance with applicable Office of Management and Budget Circulars A-21, A-87, A-102, A-110, A-122, and A-133 as well

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as by the terms of the agreement between CESER and the Concerned Funding Agency, and any rules of, or guidelines issued by, the Concerned Funding Agency. The Contractor is responsible for reimbursing CESER in a timely and prompt manner for any payment made under this subcontract which is subsequently determined to be unallowable by CESER, the Concerned Funding Agency, or other appropriate Federal or State officials.

8. Right to Disseminate

Unless otherwise expressly set forth to the contrary in the Contract, CESER shall have the right to use and have used, for any purpose, unpatented information concerning the services performed by the Contractor which the Contractor may disclose to CESER during performance of this Contract if such information is furnished without restrictions on its use.

9. Remedies

The Contractor acknowledges that monetary damages alone will not adequately compensate CESER in the event of a breach by the Contractor of the restrictions imposed and therefore the Contractor hereby agrees that in addition to all remedies available to CESER at law or in equity, including, if applicable, under the District of Columbia Trade Secrets Act, or corresponding applicable State law, CESER shall be entitled to interim restraints and permanent injunctive relief for enforcement thereof, and to an accounting and payment over of all receipts realized by the Contractor as a result of such breach.

10. Ownership Rights

The services provided by the Contractor pursuant to the Agreement shall be "work for hire" and therefore all Work shall be sole and exclusive property of CESER. To the extent that the Services, or any part of them, may not constitute work for hire under the law, Contractor hereby transfers to CESER all right, title, and interest in and to the Work. Without limiting the foregoing, CESER shall have access to the Work at any time during the term of the Agreement.

11. Personnel

Any personnel identified in the Agreement as individuals who will be performing the Services or producing the Work may not be changed without the written approval of CESER.

12. Modification of the Contract

The Agreement may not be modified except by further written agreement signed by the parties.

13. Excusable Delays

The Contractor shall not be liable for damages, including liquidated damages, if any, for delays in performance or failure to perform due to causes beyond the control and

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without fault or negligence of the Contractor. Such causes include but are not limited to, acts of God, acts of the public enemy, acts of the United States Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, or unusually severe weather.

14. Inspection of Services

- A. All services shall be subject to inspection by CESER, to the extent practicable at all times and places during the Contract. All inspections by CESER shall be made in such manner as not to unduly delay the work.
- B. If any services performed hereunder are not in conformity with the requirements of this Contract, CESER shall have the right to require the Contractor perform the services again in conformity with the requirements of the Contract, at no additional expense to CESER. When the defective services performed are of such nature that the defect cannot be corrected by re-performance of the services, CESER shall have the right to: (1) require the Contractor to immediately take all steps necessary to ensure future performance of the services in conformity with the requirements of the Contract; and (2) reduce the Contract price to reflect the reduced value of the services performed. If the Contractor fails to perform promptly the services again or to take necessary steps to ensure future performance of the services in conformity with the requirements of the Contract, CESER shall have the right to either (a) by Contract or otherwise have the services performed in conformity with the Contract requirements and charge the Contractor any costs incurred by CESER that is directly related to the performance of such services; or (2) terminate this Contract.

15. Insurance Requirements

The Contractor shall effect and maintain with a reputable insurance company a policy or policies of insurance providing an adequate level of coverage in respect of all risks which may be incurred by the Contractor, arising out of the Contractor's performance of the Agreement, in respect of death or personal injury, or loss of or damage to property. The Contractor shall produce to CESER, on request, copies of all insurance policies referred to in this condition or other evidence confirming the existence and extent of the coverage given by those policies, together with receipts or other evidence of payment of the latest premiums due under those policies.

16. Confidential Information

Any information regarding CESER that is not generally publicly known or available, whether or not such information would constitute a trade secret under statutory or common law, that is disclosed to or discovered by the Contractor during the course of the Agreement (hereinafter, "Confidential Information") shall be considered confidential and proprietary to CESER, and the Contractor shall maintain all Confidential Information in confidence; shall employ reasonable efforts to ensure the security of the Confidential

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Information; and shall not disclose the Confidential Information to any third party or use the Confidential Information except as necessary to perform the Services or produce the Work. Should the Contractor receive a subpoena directing disclosure of any Confidential Information, the Contractor shall immediately inform CESER and cooperate fully with CESER in responding to the subpoena.

17. Laws and ordinances

The Contractor shall comply will all applicable laws, ordinances, rules and regulations including Federal, State, and Municipal authorities and departments relating to or affecting the work herein or any part thereof, and shall secure and obtain any and all permits, licenses and consents as may be necessary in connection therein.

18. Limitation of Liability

Notwithstanding any other provision of the Agreement, under no circumstances shall the liability of CESER to the Contractor exceed to the total amount of compensation to be paid to the Contractor.

19. No waiver of conditions

Failure of CESER to insist on strict performance shall not constitute a waiver of any of the provisions of this Contract or waiver of any other default of the Contractor.

20. Public release of information

Unless the prior consent of CESER is obtained, the Contractor shall not, except as may be required by law or regulation, in any manner advertise or publish or release for publication any statement or information mentioning CESER, or the fact that the Contractor has furnished or contracted to furnish to CESER the services required by this Contract, or quote the opinion of any employee of CESER.

21. Taxes

Unless prohibited by law or otherwise stated to the contrary to this contract, the Contractor shall pay and has not included in the price of this contract, any Federal, State or Local Sales Tax, Transportation Tax, or other similar levy which is required to be imposed upon the work or services to be performed.

22. Term and Termination

The Agreement shall be for such term as is set forth in the Agreement. The Agreement may be terminated by CESER prior to the end of any term on fifteen (15) days written notice.

In addition, this Agreement may be terminated by either party on written notice should the other party: (a) fail to cure a material breach within ten (10) days of delivery of written notice; (b) become insolvent; (c) be the subject of a bankruptcy filing; or (d) cease doing business. Upon termination, the Contractor shall deliver to CESER: all Work, whether in final or draft form, that has been produced as of the date of

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termination; all Confidential Information; and any materials or items previously provided to the Contractor by CESER. Upon receipt thereof by CESER, the Contractor shall be paid for work performed through the date of termination. In all instances of terminations, the Contractor shall use best efforts to not incur new costs and expenses after the notice of termination, and shall cancel as many outstanding obligations as possible.

23. Warranty of Services

The Contractor warrants and represents that: (a) the Services shall conform to the Scope of Services in all respects; (b) the Work shall be original to the Contractor and shall not infringe the copyright or other rights of any party; (c) the Contractor possesses, and shall employ, the resources necessary to perform the Services in conformance with the Agreement; (d) the Services shall be performed, and the Work produced, in accordance with high standards of expertise, quality, diligence, professionalism, integrity, and timeliness; and (e) the Contractor has no interest, relationship, or bias that could present a financial, philosophical, business, or other conflict with the performance of the Work or create a perception of a conflict or a lack of independence or objectivity in performing the Work.

24. Special Damages

Neither party shall be liable to the other for consequential or indirect damages, including lost profits, or for punitive damages, arising from breach of the Agreement.

25. Concerned Funding Agency

This Agreement is subject to the terms of any agreement between CESER and a Concerned Funding Agency and in particular may be terminated by CESER without penalty or further obligation if the Concerned Funding Agency terminates, suspends or materially reduces its funding for any reason.

Additionally, the payment obligations of CESER under this Agreement are subject to the timely fulfillment by Concerned Funding Agency of its funding obligations to CESER.

26. Review and Coordination

To insure adequate review and evaluation of the Services and Work, and proper coordination among interested parties, CESER shall be kept fully informed concerning the progress of the Work and Services to be performed hereunder, and, further, CESER may require the Contractor to meet with designated officials of CESER from time to time to review the same.

27. Entire Agreement

The Agreement constitutes the entire agreement between the parties relating to the subject matter of the contract. The Agreement supersedes all prior negotiations, representations and undertakings, whether written or oral.

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28. Flow down Provisions

The Contractor agrees to assume, as to CESER, the same obligations and responsibilities that CESER assumes toward the Concerned Funding Agency under those Federal Acquisition Regulations (FAR), if any, and applicable Concerned Funding Agency acquisition regulations, if any, that are mandated by their own terms or other law or regulation to flow down to subcontractors or subgrantees, and therefore the Agreement incorporates by reference, and the Contractor is subject to, all such mandatory flow down clauses. Such clauses, however, shall not be construed as bestowing any rights or privileges on the Contractor beyond what is allowed by or provided for in the Agreement, or as limiting any rights or privileges of CESER otherwise allowed by or provided for in the Agreement. The Contractor also agrees to flow down these same provisions to any lower-tier subcontractors.

29. Compliance with Applicable Laws

In addition to its general commitment to comply with all applicable laws, the Contractor specifically agrees to the following requirements, to the extent that such requirements are applicable:

- A. to comply with the Civil Rights Act of 1964 and all other Federal, State or local laws, rules and orders prohibiting discrimination. Consistent with the foregoing, Contractor agrees to comply with Executive Order 11246, entitled "Equal Employment Opportunity," as amended by Executive Order 11375, and as supplemented by U.S. Department of Labor regulations at 41 C.F.R. Part 60;
- B. to make positive efforts to utilize small businesses, minority-owned firms and women's business enterprises in connection with the work performed hereunder, whenever possible;
- C. to provide for the rights of the Federal Government in any invention resulting from the work performed hereunder, in accordance with 37 C.F.R. Part 401 and any applicable implementing regulations;
- D. to comply with all applicable standards, orders, and regulations issued pursuant to the Clean Air Act of 1970 (42 U.S.C. 7401 *et. seq.*) and the Federal Water Pollution Control Act (33 U.S.C. 1251 *et. seq.*), as amended;
- E. to comply with the certification and disclosure requirements of the Byrd Anti-Lobbying Amendment (31 U.S.C. 1352), and any applicable implementing regulations, as may be applicable, including: 1) certification that Sub-Contractor has not, and will not, use Federal funds to pay any person or organization for influencing or attempting to influence an officer or employee of any Federal agency; a member, officer, or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352; and 2) disclosure of any lobbying with non-Federal funds that takes place in connection with obtaining a Federal award.
- F. to certify that neither it, nor any of its principal employees, has been debarred or suspended from participation in Federally-funded contracts, in accordance with Executive Order 12549 and Executive Order 12689, entitled "Debarment and Suspension," and any applicable implementing regulations.

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30. Indemnification

Should one party (the “Indemnified Party”) incur or suffer any liability, damage, or expense, including reasonable attorney’s fees, in connection with the defense of a legal proceeding brought by a third party arising out of the negligent or other wrongful actions of the other party (the “Indemnifying Party”), then the Indemnifying Party shall indemnify and hold harmless the Indemnified Party for such liability, damage, or expense.

31. Acceptance

31.1 Submission and Review. Vendor shall complete all Services and Deliverables in accordance with the Specifications and by the mutually agreed completion dates. Vendor shall notify ITSC, or any applicable designee identified herein, upon the completion of any Deliverables or Services by the delivery of a completion notice in form and manner acceptable to ITSC (or such applicable designee). Vendor shall make available each Service and Deliverable to ITSC or its identified designee in accordance with the applicable instructions for such Service or Deliverable.

31.2 Acceptance. Unless otherwise set forth herein, or mutually agreed upon in writing by the parties, ITSC or its designee shall provide notice to Vendor of its acceptance (an “Acceptance”) or rejection (a “Rejection”) of an applicable Service or Deliverable following such Service or Deliverable having been made available for ITSC by Vendor. ITSC or its designee will provide such Acceptance or Rejection within a reasonable time period, such time period not exceeding any relevant period established herein. If ITSC or its designee rejects any Service or Deliverable, the Rejection for such Service or Deliverable shall set forth with reasonable specificity the basis for such rejection, the Service requiring re-performance or refactoring, and the defects in a Deliverable requiring correction.

31.3 Correction and Resubmission. Unless otherwise agreed in writing by the parties, Vendor shall correct all deficiencies in any Service or Deliverable identified in any Rejection within such time period for correction as is specified in the applicable Rejection. Upon completion of all required corrections and re-performance, Vendor shall again make the corrected Service or Deliverable available to ITSC or its designee. Unless otherwise provided herein or mutually agreed in writing by the Parties, ITSC or its designee shall Accept or Reject the corrected Service or Deliverable within a reasonable time period, such time period not exceeding any relevant period established herein. If the corrected Service or Deliverable are rejected by ITSC or its designees, ITSC shall provide a Rejection to Vendor. The parties shall thereafter repeat the foregoing submission, review, and approval or rejection process until all defects have been corrected and the applicable Service or Deliverable have been accepted by ITSC or its designee. Acceptance of any Service or Deliverable will not waive any available claims by

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ITSC, including any claims for breach of warranty or indemnification. Any Service or Deliverable receiving 2 or more Rejections from ITSC or its designee without an Acceptance will be deemed a material breach of this Agreement by Vendor.

32. Survival

Sections 3, 4, 9, 10, 16, 18, 20, 24, 30, and 32 shall survive termination of this the Agreement.