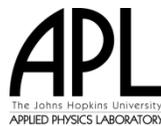


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Business Rules White Paper
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Draft Issue

It is important to note that this is a draft document. The document is incomplete and may contain sections that have not been completely reviewed internally. The material presented herein will undergo several iterations of review and comment before a baseline version is published.

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Review and comments to this document are welcome. To comment, either post your feedback in the [NHSIA Drafts Comments](#) library or send comments to NHSIAArchitectureTeam@jhuapl.edu.

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1 Introduction

The National Human Services Interoperability Architecture (NHSIA, pronounced niss'-e-a) is being developed for the Administration for Children and Families (ACF) as a framework to support comprehensive eligibility determination and information sharing across programs and agencies, improved delivery of services, prevention of fraud, and better outcomes for children and families.

Business rules are an integral component of business operations. The recommended best practice is that business rules not be imbedded in applications but rather be maintained separately in a repository and executed using a rules engine. This paper summarizes this and other key guidance regarding business rules and discusses NHSIA considerations pertaining to rules.

2 Background

Business rules are an integral component of business operations. The Health Information Technology (HIT) Policy & Standards Committee Enrollment Workgroup describes a business rule as “anything that captures and implements business, policies and practices and can be used to: 1) enforce policy (e.g., program hierarchy, exception handling), 2) make a decision (e.g., eligibility determination, point in time verification), and/or 3) infer new data from existing data (e.g., persons with the same address live in the same household).”¹

Gartner defines business rules as “implicit and explicit business decision points (for example: requirement, constraint, option, mandate) that guide or direct business actions.”² Implicit rules are typically buried in applications. Rules, or rule instances, are defined and managed by domain experts.³

A business rules engine (or rules manager) is an application that executes codified business logic in a portable (i.e. platform independent) format. Ideally, the definition and format of the rules are resilient to technology and platform changes and the engine can create audit trails that trace the what, why, and when for any action.⁴

¹ HIT Policy and Standards Committees Electronic Eligibility and Enrollment Recommendations, adopted by HHS Secretary Kathleen Sibelius September 17, 2010.

<http://healthit.hhs.gov/portal/server.pt?open=512&mode=2&objID=3161> See Appendix D

² http://blogs.gartner.com/jim_sinur/2009/02/19/if-you-bury-key-business-rules-then-you-will-bury-yourself/

³ <http://www.infoq.com/articles/Agile-Business-Rules-Taylor>

⁴ National Council on Aging, Benefits Eligibility Rules Engine, Marlene Schneider & Stephen Engels, June 30, 2011

A business rules engine executes one or more business rules in a runtime environment. These rules might come from laws, government regulations, company policy, or other sources. In any case, a business rules engine enables such rules to be defined, tested, executed and maintained separately from application code. This provides a mechanism to adapt to changing rules without the need for major system updates.

A business rules engine typically includes a repository that permits rules to be externalized from application software. Most include a rule definition tool that allows business experts to define and manage decision logic that was previously buried in software. Finally, the rules engine allows complex and inter-related rules to be executed based on specific business context, using a combination of data inputs, sets of applicable rules, and execution algorithms that define how to process the data and rules to provide an output.⁵

The general consensus is that business rules should not be imbedded in applications but rather managed explicitly using a rules engine and rules repository. The following insight was provided in a blog entry title *If You Bury Business Rules, then You Will Bury Yourself*: “Just because a business rule is buried away in code or is a policy that has been applied over decades within an enterprise, it does not mean that they are not rules, or rules to be followed. However, unlike explicit rules that have been exposed, clearly defined and documented, implicit rules are difficult to harvest, document, manage and evolve.”⁶

Additionally, “in successfully deployed rules engines, business logic (rules) are stored in readable form so they can be changed by non-technical staff with a text/rule editor.”⁷ The business rules capability should be agile, adaptable and nimble and allow for rules to be easily changed in order to keep up with changing business needs.

⁵ “NHSIA Infrastructure Viewpoint Document D0.1”. December 2010”. Contact NHSIASharePointAdministrator@jhuapl.edu to request access to the SharePoint site hosting NHSIAI D0.1 documents.

⁶ “If You Bury Key Business Rules, then You Will Bury Yourself”, Jim Sinur (Gartner Blog Network), February 19, 2009, http://blogs.gartner.com/jim_sinur/2009/02/19/if-you-bury-key-business-rules-then-you-will-bury-yourself/

⁷ National Council on Aging, Benefits Eligibility Rules Engine, Marlene Schneider & Stephen Engels, June 30, 2011

3 Guidance Pertaining to Business Rules

3.1 HIT Policy & Standards Committees

The 2010 report issued by the HIT Policy & Standards Committees provides guidance which is appropriate for NSHIA. Specifically, the report advocates that “*business rules should:*

- *Adopt a consumer-mediated approach by supporting efficient and timely eligibility determination, renewal and enrollment for the programs and in the context preferred by the consumer;*
- *Support consistent, technology-neutral expression of rules along a continuum of implementation modalities (e.g., enhancing legacy systems to developing new systems);*
- *Support the augmentation of current State systems;*
- *Support interfaces between State eligibility systems and other systems that may support consumer enrollment, such as those used by community-based organizations, providers, and portals;*
- *Accelerate States’ ability to comply with ACA requirements;*
- *Support integration across systems and across programs to support a seamless user experience by addressing program hierarchy and providing capacity for addition of other programs;*
- *Guide the adoption and utilization of federated core data;*
- *Where necessary and possible, “buffer” the impact of imperfect information and data whether from verification sources (e.g., automated and point-in-time) or others; and,*
- *Minimize maintenance and allow for scalability.”⁸*

The report provides the following guidance regarding rules language standards and a rules repository:

- *“Recommendation 3.1: Federal agencies and States should express business rules using a consistent, technology-neutral standard format, congruent with the core data elements identified through the NIEM process. Upon identification of a consistent standard, Federal agencies and States should clearly and unambiguously express their business rules (outside of the transactional systems).”⁹*
- *“Recommendation 3.1 also recommends that Federal agencies and States express their rules outside transactional systems. The primary reason for this*

⁸ HIT Policy and Standards Committees Electronic Eligibility and Enrollment, Appendix D: Business Rules, adopted by HHS Secretary Kathleen Sibelius September 17, 2010.
<http://healthit.hhs.gov/portal/server.pt?open=512&mode=2&objID=3161>

⁹ HIT Policy and Standards Committees Electronic Eligibility and Enrollment, Recommendations, adopted by HHS Secretary Kathleen Sibelius September 17, 2010.
<http://healthit.hhs.gov/portal/server.pt?open=512&mode=2&objID=3161>

is to develop a consistent, reusable set of business logic that can be written once and applied broadly. In contrast, business rules which exist only as computer code are harder to understand, enforce, extract and modify. This recommendation provides optimal flexibility during the implementation phase, as Federal agencies and States will be able to choose amongst a number of implementation options for new and existing systems including:

- *Hand coding business rules into existing legacy systems;*
 - *Parameterized and consumed by new or existing systems; or*
 - *Creating a comprehensive eligibility determination engine to apply new business rules.”¹⁰*
- *“Recommendation 3.2: To allow for the open and collaborative exchange of information and innovation, we recommend the Federal government maintain a repository of business rules needed to administer ACA health insurance coverage options (including Medicaid and CHIP), which may include an open source forum for documenting and displaying eligibility, entitlement and enrollment business rules to developers who build systems and the public in standards-based and human-readable formats.”¹¹*
 - *To ensure maximum utility of this resource, we believe three representations of each Federal and State business rule should be included in this repository:*
 - *Business representation: A consistent business representation of the rule (e.g., SBVR) such that an eligibility determination can be consistently interpreted and understood by business analysts;*
 - *Technical representation: A consistent technical representation of the rule (e.g., RIF) such that common, Federal rules can be maintained and centrally reused; and*
 - *Consumer-friendly representation: A consistent consumer-friendly representation of the rule such that consumers with varying literacy skills and language competency can clearly understand the basis for an eligibility determination using the rule.¹²*

¹⁰ HIT Policy and Standards Committees Electronic Eligibility and Enrollment, Appendix D: Business Rules, adopted by HHS Secretary Kathleen Sibelius September 17, 2010.
<http://healthit.hhs.gov/portal/server.pt?open=512&mode=2&objID=3161>

¹¹ HIT Policy and Standards Committees Electronic Eligibility and Enrollment, Recommendations, adopted by HHS Secretary Kathleen Sibelius September 17, 2010.
<http://healthit.hhs.gov/portal/server.pt?open=512&mode=2&objID=3161>

¹² HIT Policy and Standards Committees Electronic Eligibility and Enrollment, Appendix D: Business Rules, adopted by HHS Secretary Kathleen Sibelius September 17, 2010.
<http://healthit.hhs.gov/portal/server.pt?open=512&mode=2&objID=3161> .

The workgroup advocated an open forum (cited in Recommendation 3.2) as “a resource for developers to use to exchange best practices, code and other information to ease development of Federal and State technology solutions implementing business rules. The open source forum would be a resource for States and others to store their own business rules (to support their own system development and generate consumer-friendly guidance), as well as a resource for States to share their business rules to reduce cost, complexity and time of development.”¹³

3.2 Centers for Medicare and Medicaid Services (CMS)

CMS guidance titled “Enhanced Funding Requirements: Seven Conditions and Standards”¹⁴ issued April 2011 states:

States should ensure the use of business rules engines to separate business rules from core programming, and should provide information about the change control process that will manage development and implementation of business rules. States should be able to accommodate changes to business rules on a regularized schedule and on an emergency basis.

States should identify and document the business rules engines used, the manner in which the business rules engine(s) is implemented in the state’s architecture, the type of business rules engine (e.g., forward-chaining, backward-chaining, deterministic/domain specific, event processing, inference-based, etc.); the licensing and support model associated with the business rules engine(s); and the approximate number of rules the business rules engine(s) executes for a given business process.

States should be prepared to submit all their business rules in human-readable form to an HHS repository, which will be made available to other states and to the public. In their APD, states must specify when they expect to make those business rules available. CMS will provide additional detail and specifications about how to submit those rules. If the states want to protect distribution of any specific business rules (e.g., those that protect against fraud), states may specify their desire to protect those rules.

4 Considerations

Industry best practices and government guidance advocate flexible management of business rules. But, what should be managed as a business rule? Practitioners caution that business rules are not well equipped to manage workflow and process

¹³ HIT Policy and Standards Committees Electronic Eligibility and Enrollment Recommendations

¹⁴ CMS, “Enhanced Funding Requirements: Seven Conditions and Standards”, MITS-11—01-v1.0, April 2011

executions and that workflow engines and process management tools are not designed to execute rules. The amount of rules required to characterize workflow would be very significant and potentially unmanageable.

At a minimum, NHSIA recommends that policy guidance, e.g., eligibility criteria, authorization protocols, and authoritative verification sources, be managed as business rules. A variety of stakeholders need visibility into these policy rules and jurisdictions and responsible agencies must be able to modify these business rules as needed.

The following different types of policy-related business rules have been identified for NHSIA; additional categories may be included as the architecture evolves:

- Federal and state rules pertaining to program eligibility and enrollment. These rules are typically unique to each human services program though in select cases, enrollment in one program enables automatic enrollment in another human services program.¹⁵
- Rules dealing with eligibility for specific services or level of service.
- Rules dealing with authorization of referral, service, or level of services.
- Rules dealing with access to information. Federal and state legislation may place constraints on the sharing of client-related information. Clients grant permission to share information. Federal and state agencies have policies and procedures that govern access to information. Automated workflow must comply with all these conditions.
- Rules regarding communications with clients and citizens.
- Rules that enable the triggering of processes based on pre-defined criteria.

Another significant consideration is the standard adopted for health and human services business rules. The fact of the matter is that there is no current implementation standard for business rules defined within a business rules management system, although there is a standard for a Java Runtime API for rule engines: Java Specification Request 94 (JSR-94). Further, many standards, such as domain-specific languages, define their own representation of rules, requiring translations to generic rule engines or their own custom engines. Section 5 provides a limited survey of initiatives dealing with business rules standards and business rules repositories.

At a minimum, the NHSIA effort should propose a common standard that all federal programs use to document program business rules. If a state adopts a different standard, at least it will not have to deal with different standards for

¹⁵ The topic of eligibility and enrollment is addressed in detail in “NHSIA Eligibility White Paper”, January 2012. Contact NHSIASharePointAdministrator@jhuapl.edu to request access to the SharePoint site hosting NHSIA documents. Section 3 deals with program-specific criteria and the implications for data exchange.

different federal programs.

5 Relevant Initiatives and Efforts

This section discusses initiatives addressing rules standards and rules repositories.

Rules Standards

As stated previously, except for the standard for a Java Runtime API for rule engines (JSR-94), there is no current implementation standard for business rules defined within a business rules management system. Other standards (under development) include:

- **OMG Production Rule Representation (PRR):** Represents rules for production rule systems that make up most BRMS' execution targets
- **OMG SBVR:** Targets business constraints as opposed to automating business behavior
- **SWRL:** Combines OWL and RuleML
- **OMG Business Motivation Model (BMM):** A model of how strategies, processes, rules, etc fit together for business modeling
- **OMG Decision Model and Notation (DMN):** Represents models of decisions, which are typically managed by a BRMS
- **W3C RIF:** A family of related rule languages for rule interchange

Several of these standards are highlighted below.

JSR 94: Java™ Rule Engine API¹⁶: This specification defines a Java runtime API for rule engines. The API prescribes a set of fundamental rule engine operations. The set of operations is based upon the assumption that most clients will need to be able to execute a basic multi-step rule engine cycle, which consists of parsing rules, adding objects to an engine, firing rules and getting resultant objects from the engine. The set of operations also supports variations of the basic cycle, particularly variations that would occur in J2EE server deployments.

A primary input to a rule engine is a collection of rules called a ruleset. The rules in a ruleset are expressed in a rule language. This specification defines generic API support for parsing rulesets, but does not define a rule language standard.

Production Rule Representation:

¹⁶ <http://jcp.org/en/jsr/detail?id=94>

“This specification provides a standard production rule representation that is compatible with rule engine vendors' definitions of production rules.

- *It can be used for interchange of business rules amongst rule modeling tools (and other tools that support rule modeling as a function of some other task).*
- *It provides a standard production rule representation that is readily mappable to business rules, as defined by business rule management tool vendors.*
- *It provides a standard production rule definition that supports and encourages system vendors to support production rule execution.*
- *It provides an OMG MDA PIM model with a high probability of support at the PSM level from the contributing rule engine vendors and others, and can be included to add production rule capabilities to other OMG metamodels.*
- *It provides examples of how the OMG UML can be used to support production rules in a standardized and useful way.*
- *It provides a standard production rule representation that can be used as the basis for other efforts such as the W3C Rule Interchange Format and a production rule version of RuleML.”*¹⁷

The Semantics of Business Vocabulary and Business Rules (SBVR): “is an adopted standard of the Object Management Group (OMG) intended to be the basis for formal and detailed natural language declarative description of a complex entity, such as a business. SBVR is intended to formalize complex compliance rules, such as operational rules for an enterprise, security policy, standard compliance, or regulatory compliance rules. Such formal vocabularies and rules can be interpreted and used by computer systems. SBVR is an integral part of the OMG’s Model Driven Architecture (MDA).”¹⁸

SWRL: “The SWRL rule language, which combines OWL and RuleML, has been an accepted part of the W3C semantic web technology stack for almost five years now.”¹⁹

¹⁷ **Error! Hyperlink reference not valid.**http://www.omg.org/technology/documents/br_pm_spec_catalog.htm

¹⁸ http://en.wikipedia.org/wiki/Semantics_of_Business_Vocabulary_and_Business_Rules

¹⁹ http://www.google.com/url?sa=t&rct=j&q=advances+in+business+rules&source=web&cd=8&ved=0CFkQFjAH&url=http%3A%2F%2Fwww.tmrfindia.org%2Feseries%2FebookV2-C2.pdf&ei=yCMLT7GGEKrr0gHw5tzfCA&usg=AFQjCNFKKeSTsg-ooqe_A3-tXQbF32uC2A

Rule Interchange Format²⁰: The *Rule Interchange Format* (RIF) Working Group was chartered by the World Wide Web Consortium in 2005 to create a standard for exchanging rules among rule systems, in particular among Web rule engines. RIF focused on exchange rather than trying to develop a single one-fits-all rule language because, in contrast to other Semantic Web standards, such as [RDF](#), [OWL](#), and [SPARQL](#), it was immediately clear that a single language would not satisfy the needs of many popular paradigms for using rules in knowledge representation and business modeling. But even rule exchange alone was recognized as a daunting task. Known rule systems fall into three broad categories: first-order, logic-programming, and action rules. These paradigms share little in the way of syntax and semantics. Moreover, there are large differences between systems even within the same paradigm.

A specialized category of business rules is the set of rules that manage user access to data and applications. OASIS and GFIPM are two initiatives that deal with standards for identity and privilege management.

- OASIS is at the forefront in the areas of identity management and privileges management. OASIS, Organization for the Advancement of Structured Information Standards, is supporting the development of SAML (Security Assertion Markup Language) and XACML (eXtensible Access Control Markup Language).
- “The Global Federated Identity and Privilege Management (GFIPM) framework provides the justice community and partner organizations with a standards-based approach for implementing federated identity. The concept of globally understood metadata across federation systems is essential to GFIPM interoperability. Just as a common Extensible Markup Language (XML) data model was the key to data interoperability, a standard set of XML elements and attributes about a federation user's identities, privileges, and authentication can be universally communicated.”²¹

Rules Repositories

Benefits.gov and the Urban Institute's Welfare Rules Database are two examples of comprehensive compilations of eligibility rules. The former spans a large number of federal programs and the latter provides in-depth, state-specific information for select programs. Benefits.gov also leverages rules to provide an interface tailored for each user. Both repositories require effort on the part of the database manager to collect the information from states and ensure that information remains up-to-

²⁰ http://www.w3.org/2005/rules/wiki/RIF_Working_Group

²¹ <http://it.ojp.gov/gfipm>

date. To implement the rules repositories recommended by HIT Policy & Standards Committee Enrollment Workgroup and CMS, states will have to be mandated to provide rules information and keep this data current.

Urban Institute Welfare Rules Database

“The Welfare Rules Database provides a comprehensive, sophisticated resource for anyone comparing cash assistance programs between states, researching changes in cash assistance rules within a single state, or simply looking for the most up-to-date information on the rules governing cash assistance in one state.

The Welfare Rules Database includes:

- A detailed database of AFDC/TANF rules in effect for all 50 states and the District of Columbia by state for years 1996 through 2010.
- Information on rules that are in effect at a point in time (not proposals or legislation). Caseworker manuals are used to identify program rules. State administrators review the entries for each state to assure accuracy.
- A point-and-click interface for querying the database.
- The standard rule that affects most of a caseload for most of the year. The standard rule is available by state, year, and category of rule.
- Variations to the standard rule. This information details differences across geographic areas within a state, groups of recipients within a state, or months of the year.”²²

Benefits.gov²³

Benefits.gov is the official benefits website of the U.S. government. It informs citizens of benefits they may be eligible for and provides information on how to apply for assistance. This site allows users to find benefits by state, category and federal agency. Benefits.gov manages both federal and state rules and provides an interface tailored both to the needs of the client and the jurisdiction in which the client desires to receive benefits.

6 NHSIA Eligibility Vignette

A variety of vignettes that highlight different business processes should be examined to gain a comprehensive understanding of how business rules could be implemented. Given the current interest in Health Insurance Exchanges, the eligibility determination vignette shown in Figure 6-1 is an appropriate vignette to discuss in this paper.

²² <http://anfdata.urban.org/wrd/WRDWelcome.cfm>

²³ <http://www.benefits.gov/>

The operational thread in Figure 6-1 showcases the use of retrieval services, verification services, rules services, and rules repositories during initial determination of eligibility. In this example, client, program, and rules data are hosted in the state hub and the federal hub. Retrieval and verification services are employed to compile the data required to determine eligibility. Rules services are used to determine what data is required and how to apply program criteria.

The concept of a Federal Data Services Hub is a key component of the HIX strategy. To prevent multiplicity of point-to-point interfaces for the exchange of data and routing of queries, the Federal Data Service Hub will host data services for verifying consumer-provided information against required federal data sources (i.e., SSA, DHS, IRS). In this example, rules services are also hosted at the federal hub. Hubs deployed at the state level provide comparable functionality.

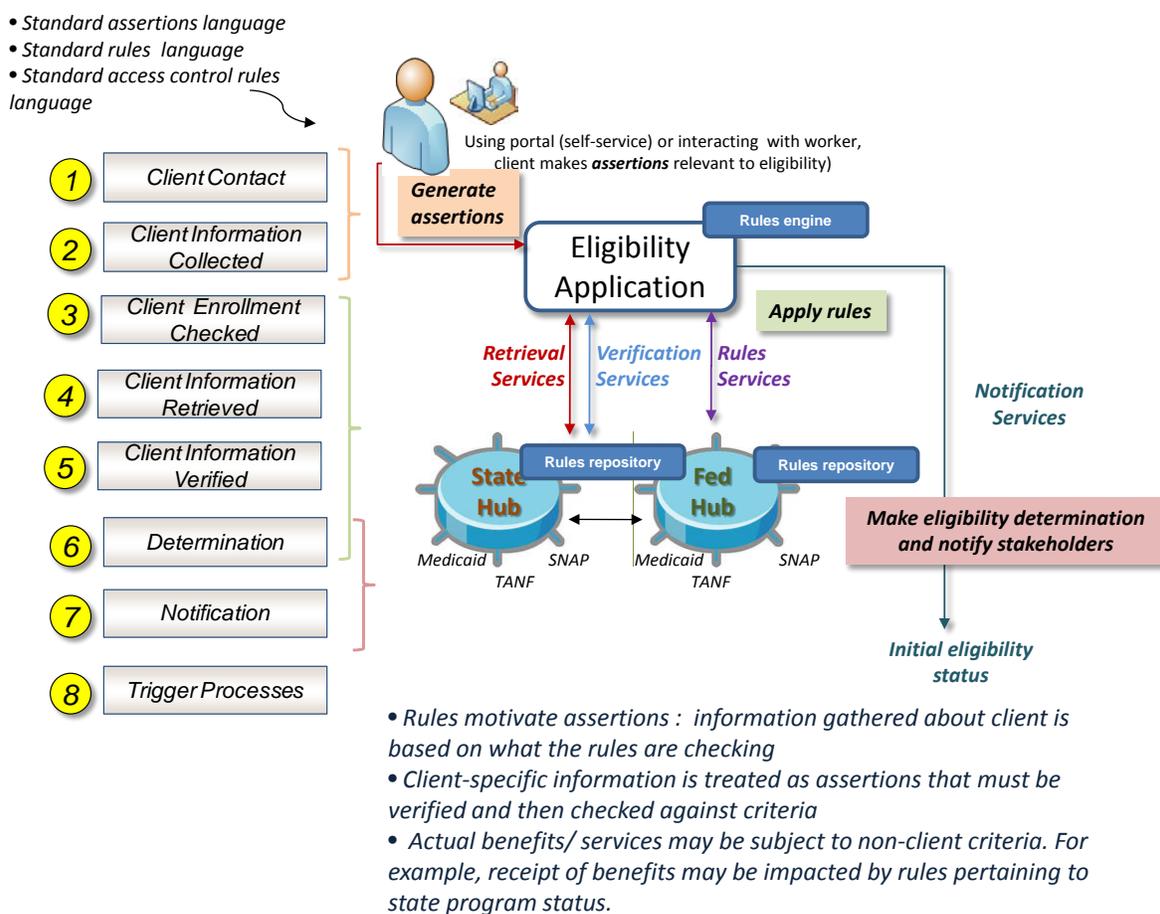
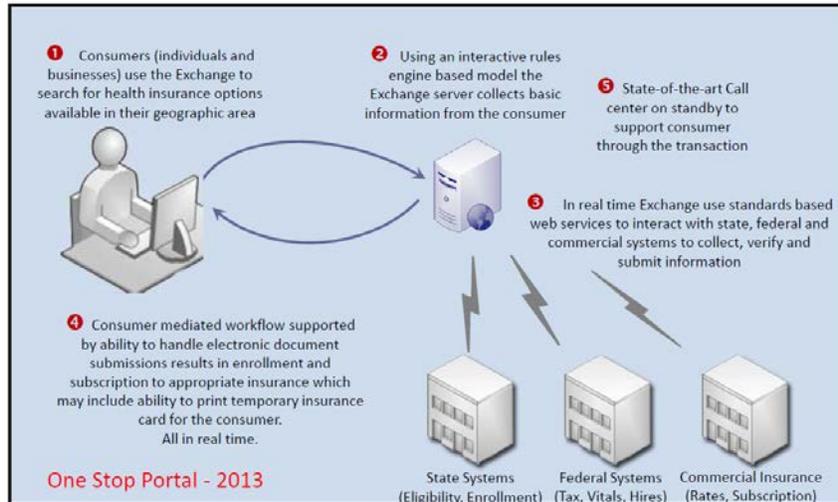


Figure 6-1. Eligibility Vignette - Use of Rules Engine and Rules Repository

Figure 6-2 and Figure 6-3 depict the notional approach defined by the New England State Collaborative for Insurance Exchange Systems (NESCIES) for implementing

their HIX. ²⁴ These figures were presented at the 2011 MMIS conference. Figure 6-2 highlights the use of rules to collect information required to make determinations. Figure 6-3 includes business rules as a component of business process orchestration.

HIX High Level Functional Vision

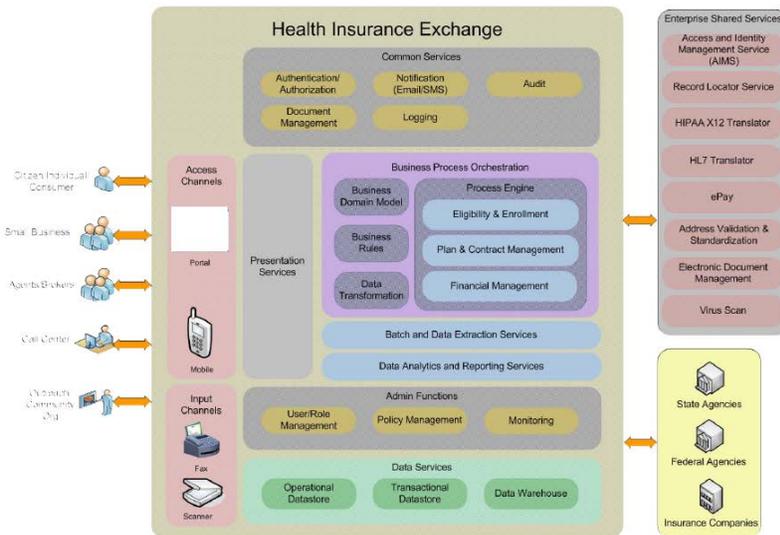


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Figure 6-2. NESCIES Concept for HIX (2011 Timeframe)

²⁴ “Health Reform and Health Insurance Exchanges: Early Lessons from The New England States Collaborative for Insurance Exchange Systems (NESCIES)”, MMIS Conference, Austin Texas, August 1, 2011
[Http://www.google.com/url?sa=t&rct=j&q=cms+hix+rules+engine&source=web&cd=1&ved=0CHcQFjAA&url=http%3A%2F%2Fwww.nescies.org%2Fsites%2Fwww.nescies.org%2Ffiles%2Ffinal%2520Himmelstein%2520August%25201%2520MMIS%2520HIX%2520development%2520%25203pmjh.pdf&ei=Ji2tT4-CDLGC0QHP9ND2Cw&usg=AFQjCNERoaIqMsXMNIHILa73mItOF_uTdA](http://www.google.com/url?sa=t&rct=j&q=cms+hix+rules+engine&source=web&cd=1&ved=0CHcQFjAA&url=http%3A%2F%2Fwww.nescies.org%2Fsites%2Fwww.nescies.org%2Ffiles%2Ffinal%2520Himmelstein%2520August%25201%2520MMIS%2520HIX%2520development%2520%25203pmjh.pdf&ei=Ji2tT4-CDLGC0QHP9ND2Cw&usg=AFQjCNERoaIqMsXMNIHILa73mItOF_uTdA)

Proposed System: Technical Components



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Figure 6-3. NESCIES Proposed HIX System (2011 Timeframe)

7 Summary of NHSIA Recommendations

The following recommendations pertaining to business rules are addressed in this paper:

- Policy guidance should be captured in business rules that can be viewed in human readable form and easily modified by domain experts
- Business rules should not be imbedded in applications but rather managed explicitly using a rules engine and rules repository.
- NHSIA should recommend a rules standard that is adopted by all federal programs to document their business rules.

To achieve this objective, the NHSIA governance structure should include a Standards Working Group that provides guidance regarding standards to include rules standards.

- The federal government should deploy a rules repository at the federal hub. The rules repository should host business rules for federal programs, defined per the common standard.

NHSIA should leverage the NIEM Human Services Domain to define the categories of business rules that will be shared between partners. NIEM would not be used as the standard to define rules, but the NIEM data model should be extended to accommodate human services business rules categories.

- Advanced Planning Document (ADP) guidance should require states to provide state-specific rules to the repository hosted at the federal hub and ensure the currency of this data.
- The federal partners should develop services that support submission of rules data to the repository and retrieval of rules data, and provide these services to states.