Part III– TECHNICAL ARCHITECTURE
Chapter 2 – TECHNICAL MANAGEMENT STRATEGY

CMS
CENTERS for MEDICARE & MEDICAID SERVICES

MITA
Medicaid Information
Technology Architecture

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Introduction

This chapter discusses the Medicaid IT Architecture's (MITA) Technical Management Strategy (TMS) and addresses the application design and technology opportunities currently available for the State Medicaid Enterprise. Transforming typical outdated state-mechanized claims processing and information retrieval systems or eligibility determination systems is no trivial task. The move to a State Medicaid Enterprise is cause for increased attention to building out the Medicaid environment through sound strategic designs.

This chapter introduces the challenges facing the existing State Medicaid environments and how technical solutions help increase the ability to perform the core Medicaid functions (i.e., claims adjudication, eligibility determination, provider registration, etc.), and satisfy the numerous government mandates the States currently face, or will face in the future. The information in this chapter provides the foundation necessary to understand the MITA Technical Architecture (TA) presented in later chapters. This chapter is not a detailed reference to major technical offerings (i.e., Cloud Computing, Hub Services, Service-Oriented Architecture (SOA), etc.), but provides the MITA context required for planning purposes.

This chapter covers the following topics:

- Transformation Challenges
- MITA TA Principles, Goals, and Objectives
- TMS Approach and Transition Planning
- Transition to State Medicaid Enterprise
- Benefits of TMS
- TMS Components
- Using the MITA TMS

Purpose

The purpose of the TMS is to document the technologies needed to achieve optimal sharing of State Medicaid Enterprise services and information. The premise is to leverage the foundational properties of the previous versions of the MITA Framework (i.e., three architectures, SOA-based, business and technical services, maturity models, etc.) and expand the framework structure to emphasize a more Health and Human Services (HHS) enterprise perspective. For this reason, the primary audience for the MITA TMS is state HHS executives and lead architects.

Scope

The scope of the MITA Framework expands beyond the operations of the state's mechanized claims processing and information retrieval or eligibility determination system. Current government mandates and the natural progression for increased processing, capabilities, and supported entities require the MITA Framework to include the state HHS

environment as a whole (i.e., State Medicaid Enterprise) and to investigate alternative technologies such as “cloud-first” strategy for Information Technology (IT) procurements.

The TMS addresses the common Medicaid services and high-level information needs of the State Medicaid Enterprise at the logical level. MITA requires the States to extend the MITA TMS for state-unique system requirements and all processes, techniques, and products required by the physical environment. The following points describe the scope of the TMS:

- It is technology, location, and organization neutral. States are responsible for adding their own strategies for their individual organization and location(s).
- It addresses common services with other state HHS organizations and other entities that share the state Enterprise Service Bus (ESB).
- It has extended responsibility to the Health Information Exchange (HIE), including possible cloud-based portions of any extended mechanized claims processing and information retrieval system and eligibility determination system.

Transformation Challenges

The Health Care Industry has current challenges such as competing demands for services and decreased budgets all the while increasing the number of members served. In addition to these challenges, the State Medicaid Agency (SMA) is operating information systems founded on outdated architectures that are expensive to maintain, and do not easily share information across the boundaries of the State Medicaid Enterprise. The tightly-coupled interfaces for these systems contain system elements (e.g., program, database, etc.) highly dependent and interconnected through individual, point-to-point interfaces, as represented in **Figure 2-1**.

Changing business rules, policies, and legislation affect the State Medicaid Enterprise, including processes, applications, databases, and interfaces. It is becoming exceedingly costly to maintain systems, both from the financial and intellectual property perspective. Different systems run in their own platform-specific environment. Each includes its own components that do not communicate across functional or technical boundaries. This causes situations where each new system addition or modification creates a unique environment; therefore, the stakeholder loses the advantage of transporting certified systems from one state to another.

There are other challenges as well. For example, users may have difficulty identifying which subsystem performs what function, or they might have to sign on to multiple systems in order to perform a single task (e.g., eligibility, enrollment). In addition, difficulties arise whenever stakeholders or system users request or require new changes. A non-mandated change may take so long to deploy that the user forgets why the change was initially necessary.

Obsolete, expensive software applications and out-of-date technology constrain the States, federal government, vendor community, and entire industry. Although these solutions worked in the past, prior methods of software integration are not sufficient to support the evolution of the State Medicaid Enterprise. For those States that recently updated their mechanized claims processing and information retrieval systems or eligibility determination

systems, there are many new demanding requirements necessary to deal with that are sure to test the system's ability to expand without causing extra rework.

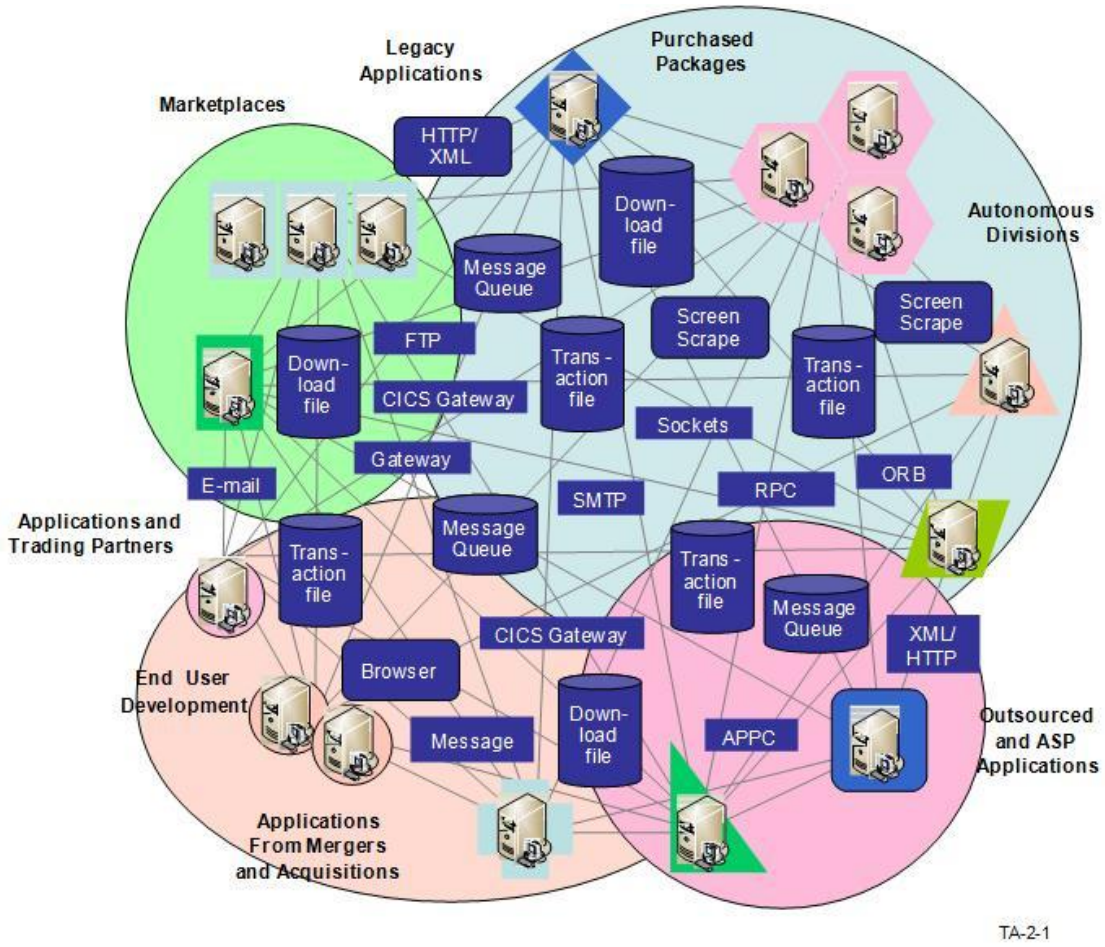

Figure 2-1. Legacy Mechanized Claims Processing and Information Retrieval System

The listing below is an extract from the National Association of State Chief Information Officers (NASCIO) *State CIO Top Ten Policy and Technology Priorities for 2011*:

1. **Consolidation/Optimization –** Centralizing, consolidating services, operations, resources, infrastructure, and data centers.
2. **Budget and Cost Control –** Managing budget reduction, strategies for savings, reducing or avoiding costs, and activity-based costing.
3. **Health Care –** The Affordable Care Act of 2010, health Enterprise Architecture (EA), assessment, partnering, implementation, health information exchange, technology solutions, and Medicaid systems (planning, retiring, implementing, purchasing).
4. **Cloud Computing –** A service delivery strategy; models, governance, service management, provisioning, security, privacy, and data ownership.

5. **Shared Services –** Business models, shared resources, services, infrastructure, and independent of organizational structure.
6. **Governance –** Improving IT governance, data governance, and partnering.
7. **Security –** Risk assessment, governance, authority and executive support; budget and resource requirements; inside threats; third party security practices as outsourcing increases; and security frameworks.
8. **Broadband and Connectivity –** Strengthening statewide connectivity, public safety wireless network, and telehealth services.
9. **Legacy modernization –** Enhancing, renovating, replacing, legacy platforms and applications, and business process improvement.
10. **Data and Information Management –** Enhancing the role of data, information/intelligence, and knowledge management.

Of the ten (10) priorities, it is not surprising that most directly relate to technology services and infrastructure; while a few concern operations, financial management and governance, or decision-making. Technology has evolved into practically everything we do and how we communicate. All ten (10) priorities have direct impact on the SMA, especially the third highest priority (i.e., Health Care) being the State Medicaid Enterprise itself.

Along with the priorities, three (3) key challenges facing the State Medicaid Enterprise are:

1. Highly interconnected systems using point-to-point interfaces require pervasive modifications to accommodate changes to business requirements, making them difficult to change.
2. Users navigate through multiple functional systems to perform a single task.
3. Systems are platform dependent and do not communicate easily across functional or technical boundaries. This causes difficulty in information sharing and reusability.

Given the sheer number of moving parts, an enterprise level strategy along with a transformation plan are imperative for striving forward in a structured manner.

MITA TA Principles, Goals, and Objectives

The State Medicaid Enterprise business requirements drive the MITA TA principles, goals, and objectives and closely align with initiatives from the following three entities:

- SMA expectations and standards
- Federal government mandates
- Commercial technology advancements

Because any of these initiatives may change based on legislation, regulation, economics, and technology changes, stakeholders will need to assess the MITA technical principles, goals, and objectives periodically to determine whether any updates are necessary.

MITA Technical Principles

Technical principles shape MITA's definition and the SMA maturity of the State Medicaid Enterprise. The MITA TA foundation originates from the following technical principles:

- **Business driven** – MITA uses technology when it supports a business goal or objective; technology should not exist for technology's sake alone. Technical solutions will map to specific business needs.
- **Implementation neutral** – States are responsible for selecting their own technology (e.g., Oracle J2EE, Microsoft.NET) to accomplish alignment with the MITA objectives.
- **Platform independent** – Stakeholders will develop reusable and platform-independent application software.
- **Adaptable, extensible, and scalable** – States will use SOA-based applications so that they can develop them in a modular fashion to accommodate future expanding business requirements.
- **Open technology and standards based** – Stakeholders will leverage the advantages of standardization (e.g., data sharing and interoperability).
- **Integrated Security and privacy** – States will maintain security and privacy of information throughout the MITA Framework.
- **Interoperability standards** – Stakeholders will establish and follow the MITA SOA design principles to insure seamless functionality between services and other entities.
- **Quality data** – States will design systems to establish the ability to provide the most current data so that they can make business decisions in a timely and accurate manner.
- **Current and proven technology** – Stakeholders will select up-to-date established technology to support current business needs.

MITA Technical Goals

MITA technical goals align to support the overall MITA goals and technical principles. The MITA technical goals are as follows:

- Apply Cloud Computing concepts where possible and feasible.
- Promote an enterprise view that supports enabling technologies aligned with state business processes and technologies.
- Utilize rules engines technologies, where possible, to extend the system configuration abilities to the business community.
- Provide performance standards for accountability and planning.
- Develop systems that can effectively communicate to achieve common program goals through interoperability and common standards.
- Promote an environment that supports flexibility, adaptability, and rapid response to changes in programs and technology.

- Provide data that is timely, accurate, usable, and easily accessible in order to support program analysis and decision-making.
- Reduce duplication of costs by collecting data already available elsewhere and using that data to administer the program more effectively.

MITA Technical Objectives

Within the premise that the MITA TA is location, technology, and organization neutral, below are the MITA technical objectives that the SMA is responsible for adopting to a MITA-aligned environment while meeting the needs of the state:

- Break down artificial boundaries between systems, geography, and funding (within the Title XIX program).
- Adopt data and industry standards and promote the development of appropriate standards when needed.
- Promote the use of data and technical standards to improve the cost effectiveness of IT development. The use of data standards provides better access to data by promoting data consistency and enhanced sharing through common data-access mechanisms.
- Adhere to technical standards, specifically open standards, to facilitate integration of Commercial Off-the-Shelf (COTS) solutions and the reuse of solutions within and among States, resulting in lower development costs and reduced development risk.
- Review national standards for health and data exchange and open standards for technical solutions, using existing national standards whenever possible. When Medicaid-specific standards are necessary, the Centers for Medicare & Medicaid Services (CMS) will support collaboration efforts of industry groups in the submittal of proposed standards to national standards organizations for review and approval.
- Promote reusable software and hardware components and modularity.
- Develop reusable services to allow a single service to pass eligibility information from a variety of program systems to a mechanized claims processing, information retrieval, or eligibility determination systems.
- Differentiate between the processes, data, and technical solutions common to the State Medicaid Enterprise and those unique to individual States.
- Identify common business processes in order to define and reuse common solutions that enable States to share development costs.
- Capture and represent state differences between common business processes that accommodate cost-effective solutions for state-specific needs.
- Encourage state participation in the development of MITA models and templates to ensure that they represent commonality and differences appropriately. Create a balance between commonality and differences that enable standard mechanisms for interoperability and data exchange. The objective is to maximize the benefit across the State Medicaid Enterprise, while promoting innovation and creativity in local environments.

- Enable data sharing without requiring extraction and loading of the data to a central location allowing each organization control and ownership of its own data.
- Use standard definition formats to map data to standard data elements, where appropriate, and provide the data descriptions when the data elements are nonstandard.
- Represent security and privacy access rules for each data element in a standard manner.
- Employ a collection of services to read the data descriptions and security/access rules in order to release information to authorized users for processing.
- Choose to host hubs that identify themselves to others through services and use of standards for the purpose of processing and exchanging data.
- Provide a beneficiary-centric focus of operations.
- Establish access channels, input device transparency, and built-in security and privacy in order to provide beneficiaries with “no wrong door” (i.e., single point) access to Medicaid services.
- Improve data quality by using data standards, applying standard performance standards, and relying on the availability of the enhanced data exchange and sharing provided by the hub architecture.
- Use statistical analysis for comparative and normative analyses in order to provide information to improve service to beneficiaries and the resulting health outcomes by more effectively monitoring patient safety and patient care.
- Enable and support interoperability, integration, and open architectures.
- Employ services that make it possible to deploy common interoperability (i.e., system-to-system communication) and access (i.e., system-to-person communication).
- Package common functionality and capabilities with standard, well-defined interfaces (i.e., services), used by new applications, legacy applications, COTS software, or all three, to invoke the functionality.
- Provide adaptability and extensibility. An adaptation (i.e., the capability that allows users to change the specifics of processes, data, or technical solutions using configuration files) enables States to customize MITA elements to meet their unique needs. An extension (i.e., the capability that allows users to add functionality and capabilities) enables States to add new functionality to MITA elements in order to meet their needs, while still meeting MITA goals and objectives.
- Promote secure data exchange. MITA defines and integrates security and privacy capabilities throughout the architecture by identifying access requirements in the business processes, defining them within the data models, and applying them through the MITA technical models.
- Promote good practices (e.g., the Capability Maturity Model (CMM), data warehouse).

- Use an EA framework and methodology that will allow States to align IT solutions with business needs. The MITA TA helps States to identify and then use common solutions to drive their State Medicaid Enterprise to support alignment with the state EA.
- Use the set of MITA Framework common business processes and data standards to make it possible to develop performance standards, measurement techniques, and corresponding utility services.
- Support integration of clinical and administrative data in order to achieve better health outcomes. This allows stakeholders to redirect dollars formerly spent on preventable diseases or on IT maintenance to more pressing business needs.

TMS Approach and Transition Planning

The TMS provides a structure that facilitates the development of technical artifacts that States can effectively share across the State Medicaid Enterprise boundaries to improve mission performance. The adoption of the TMS provides the techniques, processes, and products to meet Medicaid's need for timely, accurate information. It provides an impetus for the SMA to better understand its systems and how they fit into the state HHS organization standards. The TMS addresses fundamental aspects (e.g., syntax, semantic aspects of modeling) to enable information-sharing opportunities and to position the SMA to operate in an environment of extended information.

This document provides descriptions of key areas of the TMS including COTS Usage, EA, Performance Management, SOA Compliance, TA, and Technical Service Governance.

The MITA TA addresses business processes and data access mechanisms and services. The MITA Framework focuses on the logical level; therefore, physical characteristics of the State Medicaid Enterprise regarding programming of the business processes or mechanisms used for data sharing are the responsibility of the States.

Practical Considerations in Technical Management

There are several practical considerations in the TMS:

- Technology is important only to the extent that it provides business value.
- The technologies may never completely match or be fully consistent for several reasons:
  - Projects have diverse starting points. Versions of hardware and software vary for many reasons.
  - Standards vary according to the business purpose of the technical functionality and will, in order to provide business value, continue to do so.
  - The business needs rapidly change, and the data to support operations will change. There is always a lag between the need and use of new technologies and the universal adoption of standards.

- The MITA TMS supports data in motion, data at rest, and data in process. The technology standards, exchange standards, and data standards are important for data in motion. Data at rest is of interest because it could become data in motion to fulfill a business need. Data in process is only of interest when it involves shared data with stakeholders. Other data in process is of interest to MITA to account for its presence in a process or systems failure.

TMS Approach

The TMS provides mechanisms to monitor and influence the environment in which Medicaid operates with respect to both the technical landscape and the enabling technologies. Technical landscape refers to the broad range of national initiatives, standards organizations, and other organizations engaged in defining or influencing standards such as the National Medicaid EDI Healthcare (NMEH) workgroups. Enabling technologies refers to open standards, protocols, middleware, and other mature or emerging technologies that facilitate sharing of data and application services. The TMS prioritizes activities based on business needs and measures the resulting business value. Business value continually evolves as standards, data sharing, and application service solutions become more refined. Refining standards does not necessarily mean increasing the number of standards; rather, standards apply where they provide evolving business value.

The TMS identifies enabling technologies to specify interoperable designs for data exchange by the associated processes and procedures. The resulting TA leads to the development of the target technical management environment. The efforts of many organizations develop the target technical management environment, each contributing according to standard specifications. Adequate documentation of the TA make this development approach feasible.

Key elements addressed by the TMS are as follows:

- EA adoption
- Performance Management validation
- Service hub architecture practice
- SOA alignment
- Cloud Computing justification
- Standards and technology maturity
- COTS usage
- Technical model artifacts

Technical Management Transition Planning

A state may use the following high-level steps for reference if it adopts a more formal EA methodology:

1. **State Medicaid Enterprise Strategy**: Use HHS vision and strategy as a guide for each of the steps in the transition process.

2. **Self-Assessment:** In the State Self-Assessment (SS-A) Phase, the SMA looks at its current (i.e., As-Is operations) business, information, and technical capabilities and develops a list of new or combined target capabilities (i.e., To-be environment).
3. **State Medicaid EA Development:** During this phase, the state uses its Medicaid, HHS and/or state EA to gather the information necessary for adequate project planning. An EA provides a cohesive blueprint for aligning the state's business with TA's and ensures that IT investments align with business needs.
4. **Transition Plan Development:** In the Transition Plan Development phase, the SMA identifies specific transition projects that deliver the target capabilities.
5. **Transition Plan Execution and Iterative Updates:** In this phase, the SMA reviews its progress periodically by collecting data on the business outcomes of its transition and makes any necessary business and technical changes in response to the degree of progress made. Many States report their progress during legislative sessions or as part of other stakeholder activities. One of the benefits of the MITA SOA approach is that it fosters and encourages an evolutionary approach – especially after the basic elements of the service layer are in place.

The MITA team highly recommends a general practice of involving stakeholders in a collaborative manner at each step.

Transition to State Medicaid Enterprise

As previously indicated, the MITA Framework covers the current mechanized claims processing and information retrieval systems (e.g., Medicaid Management Information System (MMIS)) and eligibility determination systems, as well as systems that extend beyond the typical SMA. These systems include the Health Insurance Exchange (HIX) and hub services (i.e., data, services). The adoption of SOA application creation principals creates opportunities like moving enterprise solutions to a cloud environment. The following sections provide definitions for the drivers and enablers of the TA.

Enterprise Architecture

The Gartner Hype Cycle provides a graphic representation of the maturity and adoption of technologies and applications, and how they are potentially relevant to solving real business problems. The Hype Cycle Information Technology areas have developed new opportunities over the past few years and have had expectations fueled by the following innovations:

- Increases in processing speeds and decreases in cost.
- Increases in memory size and decreases in cost.
- Ubiquitous use of computing through small, fast, and cheap processing.
- The emergence of the computer as a personal appliance.
- Increases in communication speeds and decreases in cost.
- Increases in processing capability and improvements in processing algorithms.
- Technology miniaturization and probability advance.

- Rapid improvements in absorption of technology among the nontechnical population.
- Fusion of business and consumer use of IT.

The phenomenon of enterprise spending in this explosion of technology innovation impacts state Medicaid environments. The reality is that general fascination with technology without a clear cost/benefit equation has been normal behavior. Over the last decade, there has been an emergence of EA as the "tool of choice" for matching IT investments to the business that they support. EA allows the traceability of IT investments to enterprise factors in terms of activities, locations, organizations, products, servers, lines of business, business areas, strategic goals/objectives, and the transformation processes of the enterprise. A seminal work in this area is the methodology for Enterprise Architecture Planning (EAP) by Steven Spewak.

In 1994, the Government Accounting Office (GAO) realized that IT had been a significant expense and that IT projects were expanding from sheer demand. The GAO recommended that the federal government embark upon measures that would address the issue of IT alignment to the business as well as measures to help architecture solve the problems with ad hoc projects that duplicated effort, created redundant capabilities and data, and required a huge cost in post-implementation interoperability measures such as data exchange interfaces to connect multiple systems. Congress agreed with the GAO's recommendations and passed the Clinger–Cohen Act, formerly the Information Technology Management Reform Act of 1996 (ITMRA). The Clinger–Cohen Act mandates the following, under penalties of law:

- Every agency must publish an EA that details the business structures of the agency.
- Every agency must appoint a formal position of Chief Information Officer (CIO) responsible for all IT operations and accountable for all IT expenditures.
- The CIO is responsible for the production of the agency EA.
- All agency IT investments must tie to the EA. States must produce business cases for major investments. No money would be available for initiatives not supported by a business case.
- The Office of Management and Budget (OMB) is responsible for governing the provisions of the CCA and maintaining the overall Federal Enterprise Architecture (FEA).
- The OMB will monitor and govern IT investments.

The National Institute of Standards and Technology (NIST) is responsible for developing standards for this new disciple called EA and published the Federal Enterprise Architecture Framework (FEAF) in 1999. The primary basis for the FEAF is Spewak's EAP. Spewak bases his technique on defining a view of the current IT infrastructure (i.e., As-Is) and postulating a vision of the future (i.e., To-Be). He also recommends the representation of the As-Is view to record the current inventory of the systems and the current structure of business operations. The representation of the As-Is analysis is to distill the EA, which is a combination of the data architecture, the application architecture, and the technology architectures respectively.

The Clinger–Cohen Act and OMB A-130 mandate the use of EA, but do not specify use of a single framework. Agencies can choose one of many frameworks that are available. Along

that line, there are many methodologies, some combine with particular frameworks, to select from. **Figure 2-2** below shows a few popular EA frameworks, and in some cases methodologies as well.

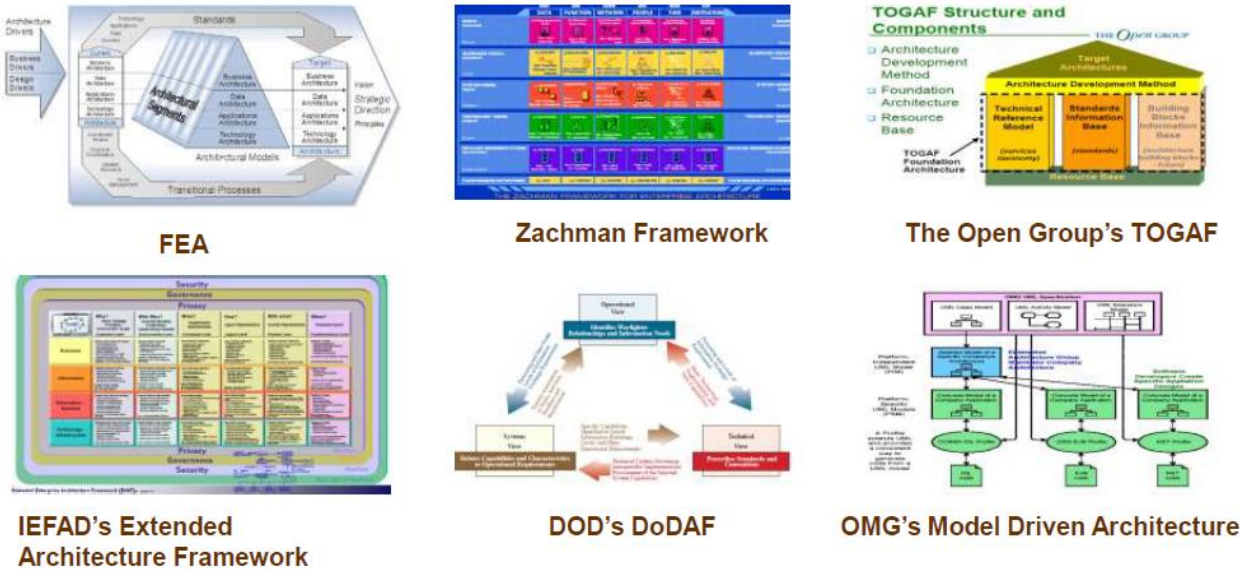

Figure 2-2. Popular EA Frameworks

Four (4) sample TA challenges regarding current updates and enhancements that are relevant to the MITA Enterprise consist of the following:

- **Common Interfacing:** Including the National Information Exchange Model (NIEM) core data model into the current communication environment, while developers are building out HHS NIEM Domains.
- **Platform/Operation Migration:** Incorporating Cloud Computing into the environment in an appropriate manner.
- **Development Alternatives:** Integrating Representational State Transfer (REST) web services as an alternative to the more tightly-coupled standard Simple Object Access Protocol (SOAP) based Remote Procedure Calls (RPC) style web service development process.
- **Modeling Capabilities:** Determining how Object Management Group (OMG) Business Process Model and Notation (BPMN previously known as Business Process Modeling Notation and Unified Modeling Language (UML) modeling (model-based design and metadata-based specification) and execution can play a part in the application development process.

These particular transitional advancements in technology are gaining popularity and have an impact on designing the current MITA EA. The strategic approach for incorporating these types of progressive technical options needs to align with major initiatives and priorities listed in the previous section (i.e., establishing sources of truth, data center migration, etc.). A thoroughly documented EA will provide supporting materials (e.g., transition plans for the

enterprise, established enterprise principles and standards, financial analysis for cost justification purpose, change management strategies) for the MITA State Self-Assessment (SS-A) process.

EA is a comprehensive set of guidelines used to manage and align a State's IT assets, people, operations, and projects with its operational characteristics. EA defines how information and technology support the business operations and provide benefit for the business. The MITA Framework defines EA as a meta-architecture of an organization, or the sum of all architectures within an organization. The Medicaid EA includes the three (3) spheres of influence:

- The domain where federal matching funds apply.
- The interfaces and bridges between the SMA and Medicaid stakeholders, including providers, beneficiaries, other state and local agencies, other payers, CMS, and other federal agencies.
- The sphere of influence touching or touched by MITA (e.g., national and federal initiatives, Development Standards Maintenance Organizations (DSMO) and other federal agencies such as the Internal Revenue Service (IRS)).

EA has two main concepts:

1. ***Business process integration***
2. ***Business process standardization***

EA is not an information technology issue – it is a business issue.

The EA strategies and transformation plans for the SMA include the State Medicaid Enterprise needs. These over-arching artifacts provide information for the foundation.

Performance Monitoring

The MITA Framework supports the requirement for the SMA to define and conduct system performance monitoring in accordance with the Guidance for Exchange and Medicaid Information Technology (IT) Systems (IT Guidance):

- Ensure quality, integrity, accuracy, and usefulness of functionality and information.
- Provide timely information transaction processing, including maximizing real-time determinations and decisions.
- Ensure systems are highly available and respond in a timely manner to customer requests.

An example of business-driven performance monitoring methodology is the FEA Performance Reference Model (PRM) as shown in **Figure 2-3**. The PRM framework articulates the cause-and-effect relationship between inputs, outputs, and outcomes. The PRM includes associated integration of data collection for strategic performance standards,

outcome analysis, and reporting. The PRM provides common output measurements as a way to correlate policy changes, program changes, and business process changes.

Do not confuse the PRM reference models with the MITA Framework. The PRM Business Reference Model (BRM) Levels 1-3 is not the same as the MITA Maturity Model (MMM) Matrix maturity Levels 1-5.

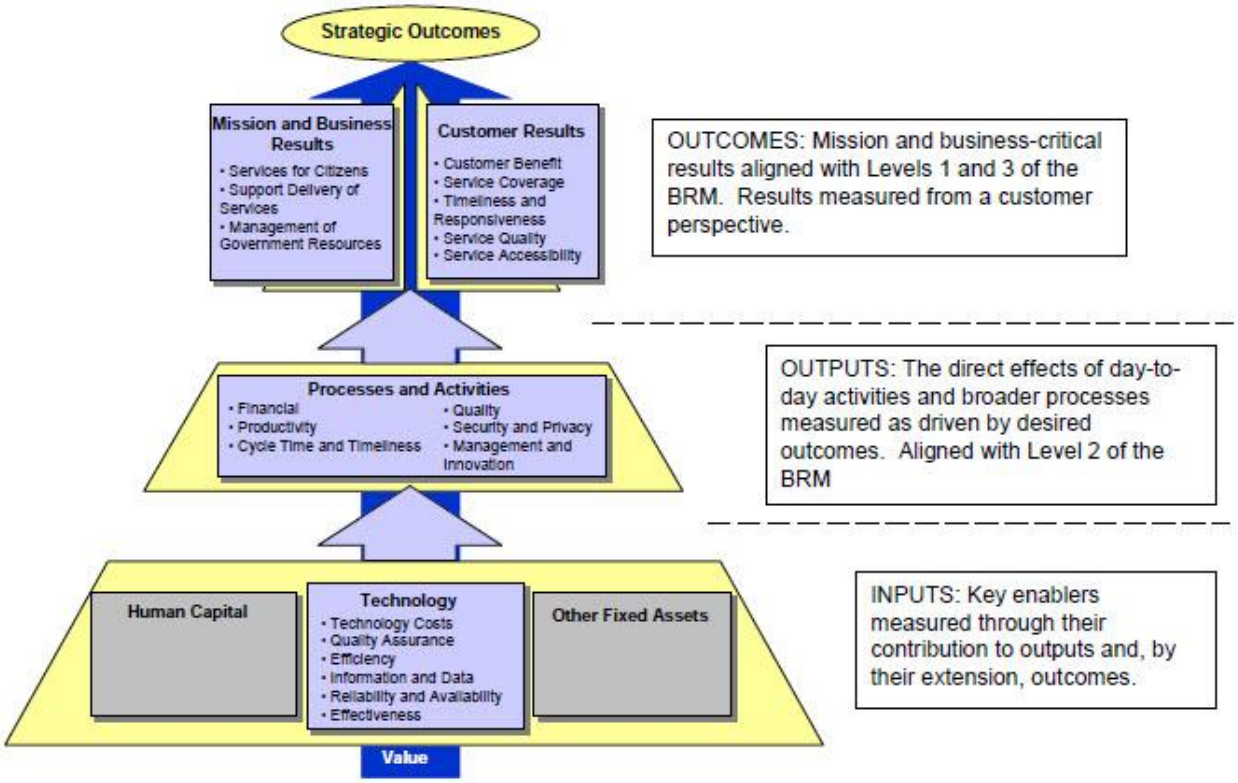

Figure 2-3. FEA PRM Example

According to the *FEA Consolidated Reference Model Document Version 2.3,* October 2007, the PRM includes a four (4) tier structure around Measurement Areas, Categories, Groupings, and Indicators. The following defines each hierarchy within the PRM framework:

- **Measurement Areas** – The high-level organizing framework of the PRM capturing aspects of performance at the output levels. This layer directly links to the performance objectives established at the agency and program levels.
- **Measurement Categories** – A collection within each measurement area describing the attribute or characteristic to measure.
- **Measurement Groupings** – Further refinement of categories into specific types of measurement indicators.

- **Measurement Indicators** – The specific measures (e.g., number and/or percentage of customers satisfied) tailored for a specific business reference model line of business of sub-function, agency, program, or IT initiative.

The PRM six (6) measurement areas include the following:

- Mission and Business Results Measurement Area
- Customer Results Measurement Area
- Processes and Activities Measurement Area
- Technology and Human Capital Measurement Area
- Other Fixed Assets
- Human Capital

The MITA Framework provides guidance for a basic three (3) tier performance monitoring structure that applies to the Business Process Template (BPT), Business Capability Matrix (BCM), and Technical Capability Matrix (TCM). The measurement categories including the following:

- **Performance Standard** - A management-approved expression of the performance threshold(s), requirement(s), or expectation(s) that CMS expects States to meet to appraise at a particular level of performance.
- **Performance Measure** - Based on established Performance Standards and tracks past, present, and future business activity.
- **Performance Metric** - A measure of an organization's activities and performance also known as a Key Performance Indicator (KPI). Often closely tied in with outputs, performance metrics usually encourage improvement, effectiveness, and appropriate levels of control.

Web Services

A web service is a reusable software service that interacts with other software components by exchanging messages typically using World Wide Web Consortium (W3C) and Organization for the Advancement of Structured Information Standards (OASIS). The following are web service standards:

- RPC
- SOAP
- Universal Description Discovery and Integration (UDDI)
- Web Services Description Language (WSDL)
- Extensible Markup Language (XML)

MITA leverages industry-standard message enablers of the Application Programming Language (API) and XML to create its own message formats for special Medicaid transmissions (e.g., Accredited Standards Committee (ASC) X12N Insurance Electronic Data Interchange (EDI) Standards). A set of standardized messages replace the individual

point-to-point interfaces. All interface modifications are local to a single set of interfaces for consistent maintenance.

A message is a structured set of data that follows a prescribed method of delivery. The industry calls the delivery method a message protocol. The message protocol results in a completely self-contained information exchange. Messages are the data requests and responses that flow between services and invoke services. A message may be a request for a service, a series of requests, or a response. The input message for one service creates an output message that is the input to the next service.

Despite the intent of the UDDI, a programmer's typical routine for engaging/instantiating a web service involves conversing with the individual(s) responsible for the creation of the web service (See **Figure 2-4**).

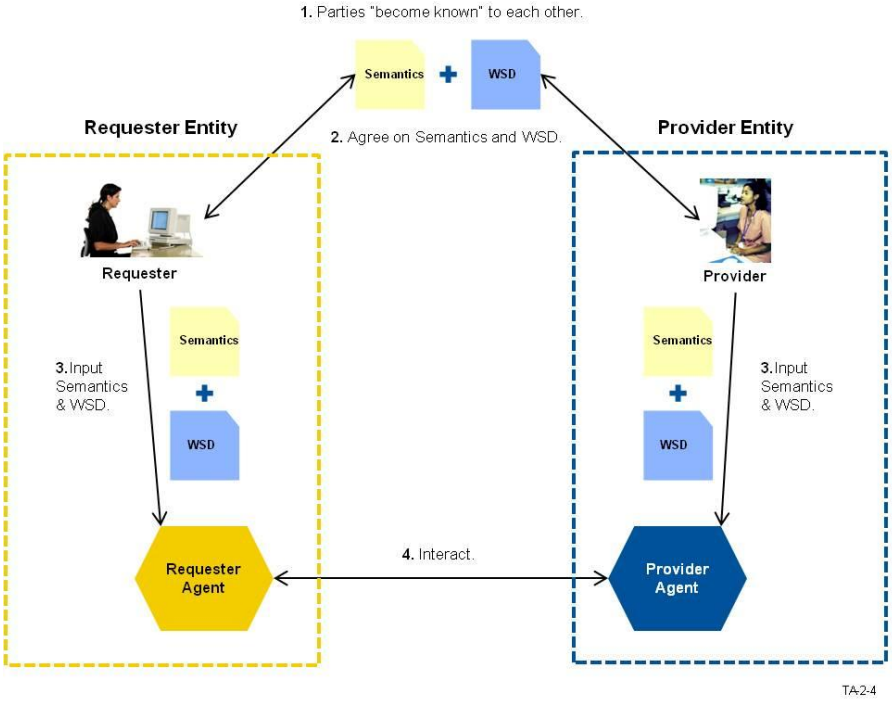

Figure 2-4. The General Practice of Engaging a Web Service

The MITA Framework standardizes the use of XML-based message interchange among business services and across organizational boundaries. XML messages are self-documenting, where each field in the message has a tag that defines the field (e.g., a field with the tag "Last_Name" contains a person's last name). Consumers of a message look for and use fields required for their processing and ignore optional or situational fields; therefore, if the stakeholder adds a new field (e.g., "Middle_Initial"), there is no need to modify the consuming service. This approach minimizes the impact of changes on Medicaid IT systems.

An alternative web service construction type to the popular SOAP/WSDL form is REST. The industry refers to conforming to the REST constraints as being RESTful. The REST Architecture and RESTful API provide a style of software architecture for distributed hypermedia systems, such as the World Wide Web (WWW). The industry developed the REST architectural style in parallel with the Hypertext Transfer Protocol (HTTP) protocol. The largest known implementation of a system conforming to the REST architecture style is the WWW. Many experts consider REST a post-hoc description of the features of the web that made the web successful. REST style architectures consist of clients and servers. Clients initiate requests to servers; servers process requests and return appropriate responses. Servers build requests and responses around the transfer of representations of resources. A resource can be any coherent and meaningful concept that developers need to address. A representation of a resource is typically a document that captures the current or intended state of a resource.

Web service standards enable the discovery and invocation of services in a location-independent manner across a network (i.e., via the SMA intranet or the Internet). While a service may be a web service, not all services are web services. For instance, some MITA services are web services because they require or benefit from this flexibility. The SMA may adopt other MITA services more economically as non-web services. In architecting the SOA, the MITA team considers each service's usage characteristics in determining the best approach to structuring and invoking the service.

SOA

SOA is a design principle that employs business functions and selected technical functions using documented interfaces. SOA is an architectural framework that incorporates and integrates many different technologies. MITA requires the use of a modular, flexible approach to systems development. Modularity is breaking down systems requirements into component parts. Extremely complex systems can be developed as part of a SOA.

Figure 2-5 illustrates a simplified view of an SOA with examples of typical MITA services. Services perform either business or technical functions within the MITA Framework. Business services such as Process Claim, Manage Provider Information, and Enroll Provider perform business processes. Services such as Portal Service (listed below as Access Services), Forms Management, Content Management, and EDI Gateway services perform high-level technical services shared by many business services.

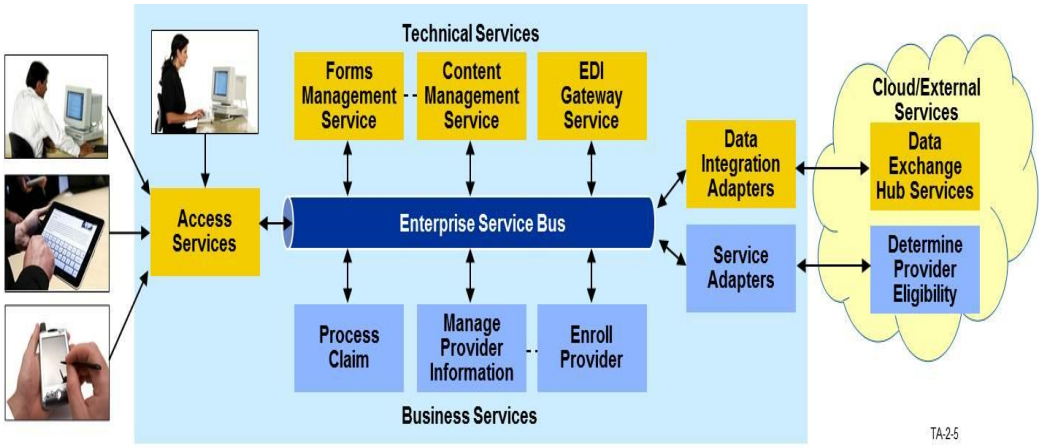

Figure 2-5. The MITA SOA

The diagram lists on the right technical services that interact with Cloud/external services. These adapter services connect with the ESB to allow for communications with external services. Simple or complex sets of services interconnect to the ESB. The ESB is a service layer that provides the capability for services to interoperate and invoke them as a chain of simple services that perform a more complex end-to-end process. The service layer handles normal conditions, responds to failures, and adapts to changes. The ESB provides the following functions:

- **Message Management** – This consists of reliable delivery of messages between services and built-in recovery.
- **Data Management** – This involves converting all messages between services to a common format and converting the common format to the application-specific format, within a service. To ensure interoperability, the message format uses XML standards. Stakeholders define information sharing and event notification standards to allow aggregated and integrated information.
- **Service Coordination** – This consists of orchestrating the execution of an end-to-end business process through all required services on the ESB. Services adapt to changes in environment and support a standards-based set of service management capabilities.

There are many different vendor executions of an ESB, and the functions included in an ESB vary from one vendor to another. The list above identifies key functions required for realizing an SOA, and these functions are in the MITA Framework definition of an ESB.

A key feature of an SOA is that the SMA can adopt the network design independent of the underlying platform. The system invokes each service in a standard way using one or more messages and each message results in the invocation of one of the documented functions supported by the service, regardless of deployment details, as shown in **Figure 2-6**.

With SOA, systems invoke business functions as services with standard, message-driven interfaces. Systems can invoke services or reuse them in a platform-independent manner across the State Medicaid Enterprise.

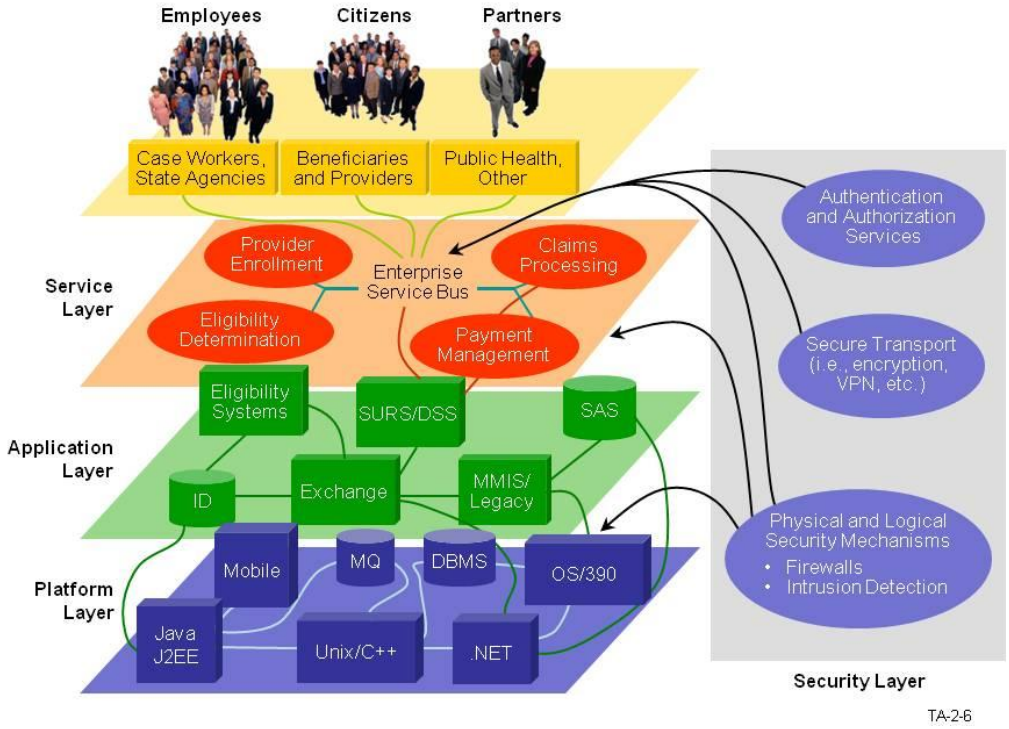

Figure 2-6. Layers Provide Platform Independence

The top layer is the Service Layer that focuses on the delivery of services to stakeholders using a variety of service access points (i.e., interfaces). The service interface to the state agencies are different from those to the citizens or provider community. Connections to the Service Layer handle interfaces and preferences.

The Service Layer provides a uniform and open standards-based way for end-users to interact with a system built on SOA principles and for high-level business and technical services to interact with each other. Applications execute each service at the Application Layer, but the Service Layer hides the nature of the application from the service consumers. Any combination of COTS packages, legacy systems, or custom code may build a service at the Service Layer. Application-specific details are not evident to the service consumers.

States can wrap and invoke existing applications as service-provider systems. The linking between service consumers and service providers can happen at run time via a service registry. A new deployment or modification can replace an individual service without affecting the rest of the enterprise.

Cloud Computing

IT managers, at the state and federal government, look to lightweight, distributed internet protocol-based systems and leverage reusable components where practical, in lieu of building solutions in-house. The action plan is to evaluate and adopt cloud-based options first for any new IT development where the security, reliability, and overall cost meet the requirements and expectations of the project. States pursue a service-based and cloud-first strategy for system development. States will identify and discuss how they will identify,

evaluate, and incorporate commercially or publicly available off-the-shelf or open source solutions, and discuss considerations and plans for cloud computing.

Cloud Computing combined with SOA enables end-users to access the State Medicaid Enterprise using a web browser regardless of their location or what device they are using (e.g., personal computer, mobile phone, etc.). Infrastructure may be off-site and allow users to connect from anywhere they have Internet access. These principles provide scalability alternatives via on-demand provisioning of resources on a fine-grained, self-service basis near real-time. A user automatically navigates through the services necessary to complete a task with a single sign-on and a consistent user interface.

Cloud Computing bases itself on the principle of multi-tenancy that enables sharing of resources and costs across a large pool of users, thus allowing for:

- Centralization of infrastructure in locations with lower costs (e.g., real estate, electricity, etc.).
- Increased peak-load capacity (e.g., users need not engineer for highest possible load-levels).
- Utilization and efficiency improvements for systems that stakeholders often only utilize 10–20%.

Cloud Computing facilitates the deployment of applications without the cost and complexity of buying and managing the underlying hardware and software layers.

From a purely technical perspective, Cloud Computing is about architecture, form, and structure; however, it is more encompassing than architecture. It also addresses issues such as business process design and service delivery processes. Cloud computing provides the State Medicaid Enterprise with architectural design alternatives. In its simplest form, offloading application processing and/or data storage needs to a cloud environment could satisfy the SMA needs.

There are compelling business cases for using Cloud Computing:

- **Increased Business Agility** – The basic doctrine that declares every State Medicaid Enterprise to operate the same year after year. Business changes and uncertainty are the rule, including changes in policies, procedures, laws, and regulations. States design the MITA Framework changes and include a built-in change deployment process. Business innovation enables this approach and allows changes to occur with business-oriented tools.
- **Business Drives the Enterprise** – The MITA initiative enables the user to interact in a business-centric way without being concerned with the IT implications. Conversely, it enables the introduction of IT without extensive change to the enterprise.
- **Facilitates Greater Reuse** – By following these standards constituent organizations develop reusable business and technical services. Reuse typically has three benefits:
  - Lower costs
  - Reduced development schedules
  - Lower implementation risk

- **Promotes Insertion of New Technology** – The layered environment establishes platform- or technology-specific characteristics that are separate from the top-level business and technical application services. As a result, the impact of inserting new technology is local to the layer that uses the technology.

CLOUD COMPUTING DELIVERY MODELS

Cloud Computing and service adoption use the term service to describe software, platform, and infrastructure offering (not as an application service from a SOA perspective). **Figure 2-7** below is an early version of a Cloud Computing ontology that illustrates five (5) layers:

- **Application**
  - Software as a Service (SaaS)
  - Browser-based web interface
  - Packaged software application
- **Software Environments**
  - Platform as a Service (PaaS)
  - Environment for building a managed application
  - Integrated Development Environment (IDE) with a rich class library that executes in a runtime container
- **Software Infrastructure**
  - Infrastructure as a Service (IaaS)
  - API interface
  - Environment for building a native application
- **Software Kernel** – Basic software management for physical servers
- **Hardware** – Physical components of the system

The three (3) top layers of the ontology are the most popular offerings. Given the condition of the Cloud Computing market and the lack of standards established, the delivery models vary from vendor to vendor.

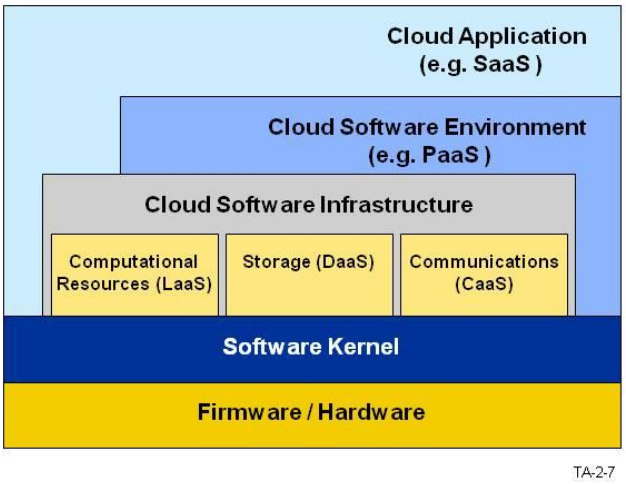

Figure 2-7. Cloud Computing Ontology

Figure 2-8 illustrates the three (3) most popular Cloud-based service offerings and how they fall within the optimization and flexibility grid. Software (SaaS) allows more optimization, but is less flexible while infrastructure (IaaS) tends to allow more flexibility, and has less optimization.

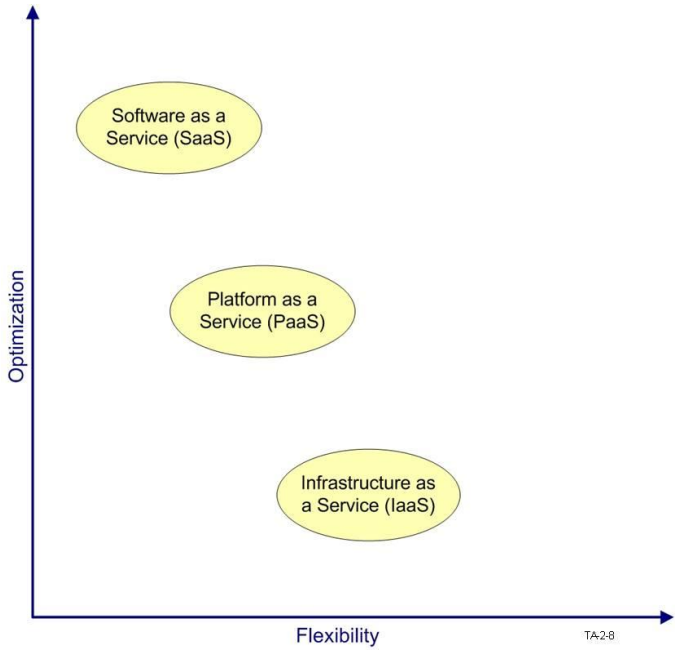

Figure 2-8. Optimization and Flexibility of Services

As listed, the access varies depending on the offering type. If choosing the IaaS option, the API access requires provisioning of resources, configuring and controlling them, and releasing them when complete. An API is necessary to engage the service of a cloud provider. An API is how a vendor exposes service features and potentially enables

competitive differentiation. Some vendors offer RESTful APIs while others do not. Cloud vendors typically issue X.509 public key pairs initially, and then require a key on every API call. This ensures that the caller has the credentials to access the infrastructure. Currently, there are no established API industry standards approved by a notable standards organization. There were API recommendations provided; however, the number of solutions currently available supports the notation that the recommendations are yet-to-be accepted standards.

CLOUD COMPUTING DEPLOYMENT MODELS

The following list describes various cloud deployment models that exists:

- **Public Cloud** – The cloud infrastructure is available to the public. This model dynamically provisions resources to the public on a fine-grained, self-service basis over the Internet, via web applications/web services, from an off-site third-party provider who bills on a fine-grained utility computing basis.
- **Private Cloud** – A single organization operates a private cloud infrastructure, whether managed internally or by a third party and hosted internally or externally. It attracts criticism because users still have to buy, build, and manage it and do not benefit from lower up-front capital costs and less hands-on management, essentially lacking the economic model that makes Cloud Computing such an intriguing concept.
- **Hybrid Cloud** – The cloud infrastructure is a composite of two or more clouds (private, community, or public) that remain unique entities bound together offering the benefits of multiple deployment models. This model has multiple cloud systems connected in a way that allows programs and data to move easily from one deployment system to another.
- **Community Cloud** – Community cloud shares infrastructure between several organizations from a specific community with common/shared concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third party and hosted internally or externally. The costs spread over fewer users than a public cloud (but more than a private cloud), so users realize only some of the benefits of Cloud Computing.

Only a few cloud models above are viable for the State Medicaid Enterprise. The more conceivable deployment models for the State Medicaid Enterprise would be a federal Community Cloud or a Hybrid Cloud that would allow for portions of the application solution to reside in a cloud environment. The Hybrid Cloud option allows a transition period where, over time, a SaaS offering may provide the best overall solution. Given the maturity of the SaaS offerings and the fact that there is currently no comprehensive Medicaid SaaS solution, the use of Cloud Computing consists of a variety of Application Service Provider (ASP) options and/or Cloud Computing vendor service characteristics.

CLOUD COMPUTING ESSENTIAL CHARACTERISTICS

Figure 2-9 below depicts the NIST high-level Cloud Computing breakdown of the essential Cloud Computing characteristics that are the differentiators from typical web hosting services.

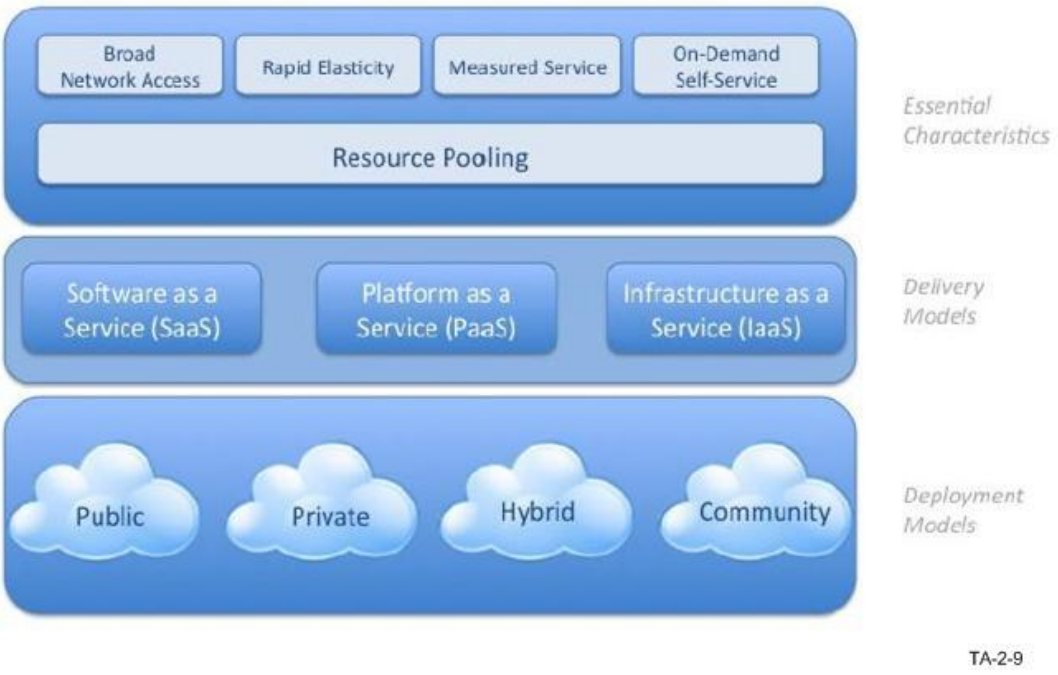

Figure 2-9. NIST Cloud Computing Breakdown

Since web hosting services have existed since the early 1990's, it is important to differentiate the two computing technology offerings. Web hosting services fall into the following categories:

- Shared server hosting
- Dedicated virtual server hosting
- Dedicated server hosting
- Collocation facilities

Web hosting services can provide operating systems, web server deployments, electronic mail processing, content storage, high-speed Internet connectivity, and related services; however, web hosting lacks the Cloud Computing essential characteristics listed below:

- **Broad network access** – Customer can access from anywhere by any device.
- **Rapid elasticity** - The system has the ability to provision resources automatically.
- **Measured service** - Providing a metering capability at a level of abstraction appropriate to the type of service (e.g., storage, processing, and bandwidth).
- **On-demand self-service** - End-users can provision resources when desired for special tasks (e.g., scientific calculation, storage for reporting period, etc.).
- **Resource pooling** - many users using single system based on usage levels.

A fundamental reference point, based on the NIST definition of Cloud Computing, is available as an online document titled *NIST Cloud Computing Reference Architecture*. Like the deployment and delivery model offerings, the essential characteristics for Cloud Computing currently vary drastically among vendors. Because of this variation, it is essential to have a full understanding of what the target (i.e., processing needs, disk storage, etc.) is for placement in a Cloud Computing environment before securing a vendor. Many of the current offerings are no more than web hosting services. For policy governance purposes, a Service Level Agreement (SLA) with vendors is a major component of the planning effort to utilize Cloud Computing services.

The NIST strategy is to build a U.S. Government Cloud Computing Technology Roadmap. This road map focuses on the highest priority U.S. Government Cloud Computing security, interoperability, and portability requirements. This leads efforts to develop standards and guidelines in close consultation and collaboration with standards organizations, the private sector, and other stakeholders. The NIST Cloud Computing program is new to the federal government. It supports the federal government effort to incorporate Cloud Computing as a replacement for, or enhancement to, traditional information systems and models where appropriate.

NIEM Adoption

The State Medicaid Enterprise will align with forthcoming NIEM agreed-upon messaging formats. This involves planning for the day when there are NIEM messaging formats provided for the health care committee. There are initiatives under way to build human services and health care domains. Until they are complete, the primary interest is in the ability to utilize the NIEM Core domain elements for transaction messages with the federal institutions that have sufficient NIEM domains created where the government requires the federal agency to use the NIEM as an implementation model. The MITA TA expects the NIEM to provide data naming and structure addressing for custom transformation services on the edge of the State Medicaid Enterprise environment.

Business Rules Engines

Since the Medicaid environment frequently deals with changing legal regulations and mandated policies, the use of rules engines is an effective way to make rapid changes to the logic of the system. The main reason they provide this benefit is because rules engines statements do not reside within the system application program code. MITA requires the separation of business rules from core programming, and the availability of business rules in both human and machine-readable formats. States ensure the use of business rules engines to separate business rules from core programming, and provide information about the change control process that will manage development and implementation of business rules. States are able to accommodate changes to business rules on a regularized schedule and on an emergency basis.

Business rules engines empower the business users of the Medicaid systems. Analysts simplify business rules into business-oriented statements that encode business decisions. Phrasing of these rules are often simply in an if/then conditional form, but also offer matching algorithms that determine what rules to run and in what order. Stakeholders investigate several considerations for deploying a business rules engine, such as how to integrate business process management, incorporate filters, provide conflict resolution, and assist with workflow.

Customer Relationship Management

CRM is a strategy that uses technology to organize, automate, and synchronize business processes. Originally applied in the private sector to determine the needs of company clients, this concept extends to the Health Care Insurance Industry. As applied in the MITA Framework, this concept focuses on member and provider access to Electronic Health Record (EHR) data and individual access to health insurance alternatives. Some areas that require CRM include:

- EHR
  - An electronic record of health-related information on an individual that conforms to nationally recognized interoperability standards, and that authorized clinicians and staff across more than one health care organization can create, manage, and consult.
- Health Information Exchange (HIE)
  - The electronic movement of health related information among organizations according to nationally recognized standards.

Benefits of TMS

The complexity and ad hoc architecture nature of current operational environments in the State Medicaid Enterprise result in a lack of interoperability. This problem grows exponentially as the SMA begins to use an EHR and share data among enterprises and other groups as part of normal business operations. The TMS provides guidance to the States and vendors to aid in this transition.

The TMS provides the SMA with a strategy for combining tools, procedures, and processes to handle future State Medicaid Enterprise application service needs.

The TMS provides the following benefits:

- Align the SMA technical and common application service activities and provide a roadmap to use in planning.
- Provide guidance for making decisions associated with application services, data sharing, and seamless interoperability of applications.
- Reduce cost by aligning and focusing similar (i.e., information, application services, etc.) development activities and deployment timelines.
- Provide a technical foundation that enables the State Medicaid Enterprise to share data resulting in consistent application architecture design across the enterprise.
- Reduce risk to system development by decreasing the number of custom solutions and promoting interoperability and data sharing.
- Provide a common set of processes, tools, and solutions for the information needs of Medicaid as a whole.

TMS Components

The TMS defines an enterprise wide technical strategy that addresses the business flow of information across the State Medicaid Enterprise and the enabling technologies to support the business requirements. The TMS involves architecture, modeling, standards, data, management, interoperability, security, privacy, access methods, and performance standards. The overarching goals of a TMS include:

- The State Medicaid Enterprise adoption of data and technical modeling standards for consistent messaging, systems, and services for the enterprise.
- Increased understanding of the EA and technologies through education, effective uses of systems while ensuring data is visible, accessible, and understandable.
- Increased capability to share application services and to improve universal application service sharing through Cloud Computing, the state HHS ESB setup, and a standardized IA and TA.
- Integration of both structured and unstructured data, and identification, documentation, and limitation of the number of source data locations and access points.
- Reducing or eliminating redundant data by improving communication about available data, as well as assigning owners and single sources of truth to promote enterprise standards.
- Conducting training for conceptual and logical technical modeling and data reporting.
- Adopting a technical services governance process and structure to promote and ensure trusted technical models support all business areas and controls redundancy.

The key considerations of the MITA TMS are as follows:

- **COTS Usage** – COTS products standardize applications across the department or state. COTS usage establishes a proven application with a known level of testing and can undergo further testing much easier than a custom-made solution. Its benefits increase model effectiveness, data sharing, ease of training, enterprise knowledge, and decreases resource expenditures.
- **EA** – EA standardizes information across the departments involved in the enterprise. EA establishes data standards that support enterprise-modeling capabilities. Its benefits increase model effectiveness, data sharing, enterprise knowledge, and decreases resource expenditures.
- **SOA Compliance** – Describes application design considerations for the State Medicaid Enterprise to participate in MITA initiatives. Based on business requirements, the MITA team defines the compliance requirements for making enterprise wide decisions regarding SOA standards for creating application services. The benefits decrease service replication, improve cost effectiveness of service sharing throughout the

enterprise, and increase application creation quality. Examples of SOA Compliance include the adherence to the following interoperability application design principles:

- **Standardized Contract** – Expresses purpose, capability, and interface content quantity to assure appropriate modularity and granularity.
- **Loose Coupling** – Contains dependencies between the contract, deployment, and customer.
- **Abstraction** – Hides as much of the details of the service to preserve loose coupling.
- **Reusability** – Positions servers as enterprise resource with agnostic function context.
- **Autonomy** – Design of service logic and realization of environment impact reliability.
- **Statelessness** – Managing excessive state information can compromise availability.
- **Discoverability** – Avoid the accidental creation of redundant service or services that implement redundant logic.
- **Composability** – Complex service composition places demands on service design.

- **TA** – Establishes standard technical management procedures for the technical models involving SOA services. The TA provides specific guidelines regarding technical documentation, service-sharing development and use applicable to both structured and unstructured data. These guidelines ensure that the SMA defines service entities and data attributes, data models, and relationships to convey the overall meaning and use of Medicaid business or common application service. Common architecture design methods improve the consistency in the development and deployment of systems, increase the data quality, increase performance, and decrease the complexity of the operations and necessary resource expenditures.

- **Technical Service Governance** – Standardizes services across the systems involved in the enterprise. The governance process establishes standards that support enterprise modeling capabilities and provides a means for making enterprise wide decisions. It provides the capability to determine ownership, determine data and technical standard adoption processes, address data integrity, define processes for business process development, and establish a mechanism for arbitrating differences. The benefits decrease data and application replication, improve cost effectiveness of data sharing throughout the enterprise, and increase data quality. Examples of Technical Governance include requirement of the following:

  - Registration of technical and application service solutions into an enterprise repository and registry (where applicable).
  - Design all proposed technical solutions by providing logical technical models and follow standards before proposed solution passes to the application developer for physical application creation.
  - The peer review groups, CMS, and the Architecture Review Board (ARB) approve all logical technical models and services.

- All application and technical solutions follow established enterprise naming standards.
- All application and technical solutions comply with security and disclosure.
- All application solutions have a data integration plan that supports the Data Service Model (DSM) efforts.

Using the MITA TMS

Using the MITA TMS is critical to the successful transformation and evolution of the State Medicaid Enterprise. The TMS is a tool that enables the SMA to transition its current TA to a MITA-aligned TA. States use the SS-A as a guideline for establishing and using the MITA TMS. Below are key actions the SMA will take in order to use the TMS:

- Use the TMS along with the MMM and BCM for planning their State Medicaid Enterprise.
- Extend the TMS to include any state HHS organization specific common practices, standards, and information.
- Develop the TMS associated with the physical systems and standard practices created during the design of State Medicaid Enterprise components.
- Identify business processes in their HHS environments that can contribute to the common pool of established services.
- Establish a process that requires the migration of redundant data to a single source of truth.
- List the processes and strategies of the TMS in the Request for Proposals (RFP) and require it to be part of the evaluation criteria.
- Identify a training program to assure the technical staff is obtaining business knowledge and vice versa.
- Adapt the TMS to their organization and establish collaborative governance practices to sustain adherence to standards.

Implementing Collaborative Governance

Although reuse of services is one of the contributors to the SOA value proposition, such reuse does not occur in a siloed environment. Potential users of services will define services collaboratively resulting in services that are flexible enough to meet the requirements of multiple users. Achieving this collaborative environment across States requires new approaches and tools for governance, and the MITA Framework provides the guidelines and tools for enabling this shift. States need to actively promote the TMS in their organizations to ensure that they leverage the full value of SOA to benefit the entire State Medicaid Enterprise.