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Towards a Traceable Enterprise Architecture for Small- and Medium-Sized Enterprises

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Disclaimer

TOWARDS A TRACEABLE ENTERPRISE ARCHITECTURE FOR SMALL- AND MEDIUM-SIZED ENTERPRISES

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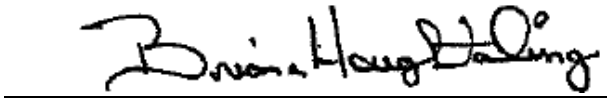
BY



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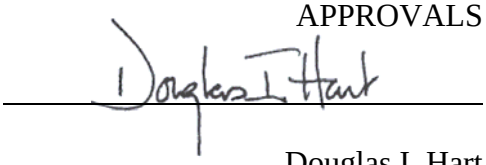
APPROVALS



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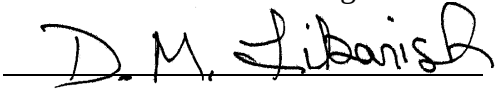

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Abstract

The practice of Enterprise Architecture (EA) continues to develop. Many large organizations are using EA processes and practices to help manage their complex set of integrated processes and applications. The set of integrated processes and applications required to meet their unique business requirements. Large organizations inherently recognize that an effective EA assists the enterprise to determine its desired direction. The resulting EA is then used to help manage the changes required to achieve the enterprises chosen destination. In a similar manner, Small- and Medium-Sized Enterprises (SMEs) can benefit from EA practices. Achieving these benefits requires EA practices and tools be appropriately scaled to the size of the enterprise. My objective is to address the EA needs of SMEs by researching appropriate EA best practices, building artifacts that embrace these practices, and then evaluating these artifacts to determine how well they meet the need.

Acknowledgements

I would like to thank the individuals who contributed their input to the fulfillment of this project. I would like to recognize Greg Hollmann, Chuck Boudreau, and Ted Vail for their feedback on Compassion's Information Architecture and for the development of sufficient wiki page content to allow for evaluation. I would also like to recognize Steve Brock for his help in interviewing users and helping to define the next version of the framework. This project would also not have been possible without the continued support of my enterprise architecture efforts by Compassion International's forward thinking leadership.

Finally, and most important, I would like to thank my wife for allowing the opportunity and time to complete this project.

Table of Contents

List of Figures

List of Tables

Chapter 1 – Introduction

Enterprise Architecture (EA) is a coherent body of principles, methods, and models used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure (Lankhorst, 2005). Properly executed, enterprise architecture creates a holistic view of the enterprise that is independent of Information Technology (IT) solutions. This holistic approach guides the selection of IT solutions that assist the enterprise to achieve its goals. Enterprise architecture enables an organization to determine how they want to operate, before they continue to create a digitized platform of business processes, IT systems, and data to execute on their operating strategy (Weill & Ross, 2009).

EA matters to Small- and Medium-Sized Enterprises (SMEs) because it can help leadership develop a clear enterprise wide approach to selecting and implementing systems that support the organization's strategy. Without implementing some level of EA practices, SMEs will likely take a piecemeal approach to IT investments. A piecemeal approach often results in some valuable IT-based products and services, but may require the organization to spend more and more time integrating independently designed systems and data into holistic enterprise solutions. Guided by EA practices, leadership can develop the competence and confidence needed to approach IT investments in a more rational business driven manner.

Purpose

The purpose of this study is to examine current EA practices, select appropriate practices, and develop a traceable EA framework. The traceable EA framework will enable Compassion International to determine, communicate, and guide the implementation of its digitized platform. I selected Compassion International for this study because it is a medium sized organization confronting problems that are typical of many growing/changing enterprises. The organization is

taking prudent steps to improve its processes and systems; its leadership is actively seeking to gain value from enterprise architecture.

Selected EA practices and modeling techniques define a cost effective EA framework that can be implemented by Compassion International. This framework will also be developed in a manner that is suitable for guiding the creation and implementation of a digitized platform for other enterprises of similar size and complexity.

Background

Compassion International exists as a Christian child advocacy ministry that releases children from spiritual, economic, social, and physical poverty and enables them to become responsible, fulfilled Christian adults. Established in 1952, Compassion International has steadily grown from a small child sponsorship organization to an organization that currently sponsors over one million children. To ensure that the organization can serve its beneficiaries with excellence, Compassion International's leadership has recognized the need to modernize its digitized platform. A series of fundamental and innovative efforts are currently underway to prepare the organization to meet the opportunities as outlined in its "2020 Vision." This vision focuses on all four of Compassion's Ministries (Child Survival Program, Child Development through Sponsorship, Leadership Development Program, and Complementary Intervention) and sets goals for both the quality and growth of each.

Managing a complex set of integrated applications requires that an enterprise have a clear understanding of the role each application plays in meeting the enterprises unique requirements. An enterprise must also integrate its solution portfolio to improve end-to-end business processes and decision-making. Success requires an organization to address more than independent improvement of business processes; an organization must also leverage skills in service-oriented

architecture (SOA), application integration, and enterprise information management (EIM). Unfortunately, in Small- and Medium-Sized Enterprises (SMEs), the documentation and traceability of business processes, application integration, and information flows do not enable the organization to govern and manage an increasingly diverse solution portfolio.

Large-sized enterprises increasingly use Enterprise Architecture (EA) to bring clarity by modeling and tracing the integration between business processes, application integration, and information flows. SMEs can find value in EA practices, if the cost of the endeavor is in line with the benefit provided to the enterprise. To achieve these benefits, SMEs could develop an EA practice based on the use of inexpensive social networking and modeling tools, combined with appropriate business process and architecture frameworks. Exploration of the current state of EA practices and tools will enable the creation of a proposed, cost effective approach, for the development of a traceable enterprise architecture for small- and medium-sized enterprises.

Rational

Researching the current state of EA and developing a suitable framework can define a traceable enterprise architecture that meets the needs of small- and medium-sized enterprises. This EA framework can be developed using cost-effective tools that result in traceable models, enabling the enterprise to guide the creation and exploitation of its digitized platform. The scope of this project includes the following:

1. Defining the practice of EA and exploring the value of EA.
2. An analysis of the current state of EA, exploring what contributes to or hinders enterprises from receiving value from EA and exploring how to overcome hindrances to effective EA.

3. Researching the current frameworks, tools, and methods that enable enterprises to gain value from EA practices.
4. Designing and developing a cost-effective traceable enterprise architecture framework for Compassion International.
5. Developing and testing the framework to ensure that it is suitable for guiding the creation and implementation of a digitized platform for Compassion International and other enterprises of similar size and complexity.

Chapter 2 – Review of Literature and Research

Enterprise Architecture (EA) is increasingly being used by large organizations to get a grip on the complexity of their business processes, information systems, and technical infrastructure (van der Raadt, Bonnet, Schouten, & van Vliet, 2010). One of the first uses of the term "enterprise architecture" can be contributed to Dr. Steven Spewak. In 1993, Spewak described EA as the process of defining architectures for the use of information in support of the business and the plan for implementing those architectures (Spewak & Hill, 1993). Since that time, the practice of EA has evolved and an increasingly rich set of academic literature has been created, that both defines and enables the practical application of EA.

Enterprise Architecture Defined

EA is concerned with planning the development of the enterprise, including its business processes, information systems and technical infrastructure (van der Raadt et al., 2010). An EA provides the overall design of a complex, multisystem solution (Perks & Beveridge, 2001). An EA acts as the target blueprint that provides a long-term view of the organization's processes, systems, and technologies (Ross, Weill, & Robertson, 2006). EA provides a description of the goals of an organization, how business processes realize these goals, and how these business processes can be better served through technology (Sessions, 2008).

Enterprise Architecture Value

The ability to adapt is an important characteristic of any organism. Responding and correctly adapting to change can make the difference between the life and death of an organism. In essence, change is a life enabler and is a constant in any enterprise that is growing. If change is life and we have no problems only when we are dead, then slowing down the rate of change – one way to reduce problems – is tantamount to committing suicide (Adizes, 1999). An effective

EA assists an enterprise to determine its desired direction and then helps manage the changes required to reach its destination.

Effective use of the inherent flexibility and adaptability of Information Technology (IT) is one way in which organizations can maintain a competitive edge, but all too often, because of its complexities, IT proves to be more of a burden than a benefit (Wilkinson, 2006). EA creates value by bringing clarity to business processes and by enabling these business processes to be better served through technology. While effective technology is a result of an effective EA, focusing on technology alone will not result in sufficient benefits. To add value to an enterprise, EA efforts must result in the development and continual renewal of its digitized platform. A digitized platform is an integrated set of electronic business processes and the technologies, applications, and data supporting these processes (Weill & Ross, 2009).

Current State of Enterprise Architecture

Considering the maturity and the focus of the contributions, there is no core topic or even a theory in the discipline of EA. Almost half of the approaches discussed in the papers are still coming with a low maturity level (Concept Phase) in the context of readiness to be used in an organization (Schöenherr, 2009). Practical guidance for tracing business processes all the way through to their implementation on supporting technical infrastructure tends to be deficient. Ideally, EA should yield an operational architecture that provides a solid point of departure for constructing the technical architecture and deriving specifications for enabling business systems (Hamlett, 2007). In practice, one finds that the current EA tools are better suited to large-sized enterprises and are cost prohibitive to SMEs.

Frameworks and Modeling Methods

Enterprise architecture promises to provide management with insight and overview to harness complexity (Land, Proper, Waage, Cloo, & Steghuis, 2008). Any endeavor that produces value will necessarily add some degree of complexity. The aim of EA models and frameworks are to assist an enterprise to manage complexity. A set of well-organized and clearly depicted models can help business leaders reduce complexity by enabling a better understanding of how the business actually works. At the moment there are no modeling languages that are specifically aimed at describing enterprise architectures (Lankhorst, 2005). However, there are several well-established modeling languages that, although tailored to specific domains, can be useful for describing business processes and business system designs. A review of several of the prevalent modeling languages and EA frameworks will enable us to select an appropriate set for use by SMEs.

Business Process Modeling

Modern enterprises accomplish their goals through a series of activities. These activities are often linked together to form business processes or value chains. It is increasingly common to support these value chains using coordinated and integrated combinations of applications and services. Business process models are used to describe such integration scenarios and their work flows, facilitating an intuitive common understanding of the business logic between customers and developers (Bryans & Wei, 2010). The emphasis of business process models is on how the work is done within an enterprise, rather than what work is done. It is an important tool in understanding the activities a business undertakes, and the kind of information it needs to successfully engage in those activities. Useful business process models must support the objectives of and be understood by different audiences. Business process analysts must be able

to visualize how the process creates value and how process efficiency might be improved. Technical process designers must be able to discern whether a business process can be realized "ideally," in some limited way, or not at all (Zdravkovic, Henkel, & Johannesson, 2005). The models should help enterprise architects identify business process patterns. Learning what patterns you already use, but perhaps did not recognize as such, helps you discover experiences that could prove useful in continuing your existing patterns or in adopting new or different patterns (Robertson & Sribar, 2002).

Historically, business processes have been modeled using a variety of modeling languages and notations. A critical problem has been the explosion in multiple methods of representing a process, with business analysts and organizations both tweaking existing representations to suit their needs (Pant & Juric, 2008).

UML Activity Models

In an organization that is familiar with the Unified Modeling Language (UML), activity diagrams are sometimes used for business process modeling (Woodward, Surdek, & Ganis, 2010). The UML activity model can be useful to visually represent how the basic and alternate paths of a use case are accomplished. The elements of a UML activity model are sufficient for modeling general activity flow; however, they may lack the elements required for modeling more complex modern business processes.

IDEF0

Organizations with a manufacturing emphasis, often model their production processes using a subset of a method known as the IDEF (Integrated Computer-Aided Manufacturing (ICAM) DEFinition) group. One of the methods in the IDEF group, IDEF0, is concerned with functional modeling. In 1998, Clarence Feldman wrote a guide to IDEF0, *The Practical Guide*

to Business Process Reengineering Using IDEF0. The focus of his effort was on simply understanding the nature of the enterprise and how it might be reworked (Hay, 2003).

An IDEF0 functional model consists of five elements that enable it to depict the activity being performed and the inputs, outputs, constraints, and mechanisms (resources) needed to for successful completion of the activity. Creating a series of activities by linking the output of one activity to another activity can depict an end-to-end process.

Acceptance of IDEF0 modeling within the manufacturing domain is generally high, because depiction of a manufacturing process often requires an understanding of all five elements. There is less adoption of IDEF0 in non-manufacturing related enterprises, because the business processes do not generally require the depiction of the constraint and mechanism elements. It is also difficult to use IDEF0 to visualize the flow of a process across business domains, because IDEF0 lacks a mechanism for depicting messages that often span business domains. The lack of a messaging mechanism also hinders the ability to use IDEF0 to reduce complexity through partitioning. Partitioning has to do with separating large collections of things into independent subsets, each containing smaller numbers of things (Sessions, 2008). Architects can help reduce complexity and enhance understanding by helping the organization see its processes as a series of interrelated partitions.

Business Process Modeling Notation

In 2004, the Business Process Management Initiative (BPMI) published version 1 of the Business Process Modeling Notation (BPMN). The BPMN standard specifies a graphical notation that is to serve as a common basis for a variety of business process modeling and execution languages (Lankhorst, 2005). BPMN defines a Business Process Diagram (BPD), which is based on a flowcharting technique tailored for creating graphical models of business

process operations. It is a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes (Sparks, 2010). BPMN offers several major innovative notations that contribute to its increasing popularity as a standard for business process modeling.

Task Decomposition

The modeling of business processes often requires the creation of models that provide high-level abstractions. These higher-level models drill down (decompose) to lower levels of detail within separate diagrams. A BPMN task represents a unit of work that is synonymous with a UML or IDEF0 activity. Tasks can marked with a + symbol to indicate that the task is decomposed into sub-processes. The process of partitioning an enterprise starts with the highest possible view of the enterprise and treats the enterprise as a whole of discrete Autonomous Business Capability (ABC) types (Sessions, 2008). Decomposing tasks into sub-tasks is a key enabler for visualizing the process of partitioning.

Process Scope and Collaboration

Typically, the business process scope could either be limited to the organization, or could be a collaboration process that involves interfacing with external parties such as customers, suppliers, partners, and so on (Pant & Juric, 2008). BPMN provides two elements to enable clear definition of process scope. A pool and swim lane construct enable the BPMN modeler to define these interactions. Pools represent major partitions and swim lanes subdivide pools or other lanes hierarchically. Any interaction between two pools uses a message flow represented by a dotted line with a small circle at its origin (Pant & Juric, 2008). Constraining pool interactions to

only message flows provides a construct that supports partitioning and iterative design. A modeler or designer can focus on the interactions between the pools or partitions. .

Zachman Enterprise Architecture Framework

The EACommunity (www.eacommunity.com) defines an Enterprise Architecture framework as a blueprint for how an organization achieves current and future business objectives. Enterprise architecture frameworks began to emerge with the initial formal publication of the Zachman Framework in 1987. It proposes a logical structure for classifying and organizing the descriptive representations of an enterprise, in different dimensions, and with each dimension perceived in different perspectives (Pereira & Sousa, 2004).

The Zachman Framework organizes enterprise architecture into six perspectives and six descriptions, creating a table where the perspectives are represented as rows and the descriptions are represented as columns.

Perspectives

The Zachman Framework perspectives are organized into corresponding layers (Sowa & Zachman, 1992). It is important to note that the various perspectives are different with respect to nature, content, and semantics and not only in their detail level (Zachman, 1999).

The scope layer represents the planner's perspective. The purpose of this layer is to identify "... the size, shape, spatial relationships, and final purpose of the final structure." (Sowa & Zachman, 1992) and thus, the scope. On this basis, a planner decides whether to invest in the architecture.

The business layer symbolizes the owner's perspective. Architects describe the requirements from the owner's perspective, whereas the intention is to "...enable the owner to agree or disagree with the..." (Zachman, 1999) description.

The system layer corresponds to the designer's perspective. The purpose of this layer is to transform the enterprise model's artifacts into detailed specifications. The owner can use these specifications to negotiate with builders to implement the system (Scheithauer, Augustin, & Wirtz, 2009).

The technology layer represents the builder's perspective. The rationale of this layer is that the detailed specifications must be adapted into builder's plans to take into account the "... constraints, of tools, technology, and materials." (Sowa & Zachman, 1992).

The component layer symbolizes the perspective of a sub-contractor. Builder's plans are translated into shop plans. Shop plans "... specify details of parts or subsections..." (Sowa & Zachman, 1992) of builder's plans.

The operations layer represents the system itself.

Descriptions

The Zachman Framework descriptions depict an enterprise from different angles. However, each of them is unique and addresses a different purpose, they relate to each other (Zachman, 1999). Descriptions are the answers to the basic questions: What (Data Description), How (Process Description), Where (Location Description), Who (People Description), When (Time Description), and Why (Motivation Description). It is important to note, that for each description exists a set of terms (description model), which are valid for all perspectives (Scheithauer et al., 2009).

ArchiMate Enterprise Architecture Framework

ArchiMate is The Open Group's open and independent modeling language for enterprise architecture. The ArchiMate enterprise architecture modeling language provides a uniform representation for architecture descriptions. It offers an integrated architectural approach that

describes and visualizes the different architecture domains and their underlying relationships and dependencies (Jonkers, Proper, & Turner, 2009). From its philosophy, it does not model one specific architectural domain, but it focuses on a wider architecture that covers the whole organization (Meertens, Iacob, & Nieuwenhuis, 2010). Just like an architectural drawing in classical building architecture describes the various aspects of the construction and use of a building, ArchiMate offers a common language for describing the construction and operation of business processes, organizational structures, information flows, IT systems, and technical infrastructure (The Open Group, 2009).

Universal Data Models

Designing and building effective enterprise systems requires a degree of integration that is often challenging to achieve. An effective way to meet this challenge is to understand how the data within an enterprise and the relationships fit together in a holistic integrated manner. A Universal Data Model (UDM) is a template or re-usable data model that is generally applicable and that can be used by a great number of organizations to save time and effort while offering holistic perspectives. Universal Data Models include common data constructs applying to most organizations as well as industry specific data constructs. For example, common data constructs that apply to most organizations would include data models for information about people, organizations, roles, relationships between people and organizations, contact information, products, services, inventory, pricing, requirements, quotes, orders, agreements, shipments, projects, invoicing, payments, budgeting and accounting (Silverston, 2001).

Metadata Modeling and Management

Information sharing and operational collaboration is critical to any organizations success. As the size of an enterprise increases, complexities tend to increase and information sharing can

be hampered by inconsistent data definitions. Enterprises may acquire a verity of applications to help improve efficiencies or to simple meet the requirements of new services or processes. Deploying business applications across the enterprise, especially when application are selected by different lines of business, can lead to "islands of information coherence." Historically, business applications were designed to meet operational business needs for specific areas of focus; resources have been aligned for vertical success and to that end, the de facto application architecture evolved organically to support the operations of each line of business, with potential repercussions at the enterprise level (Loshin, 2008).

Effective data sharing across an enterprise relies upon carefully defined and agreed upon meanings and representations. The need to record and promote—and where possible, automate— the re-use of standard metadata elements across enterprises and initiatives has led to the establishment of metadata registries (Davies, Harris, Crichton, Shukla, & Gibbons, 2008).

ISO 11179

One of the prominent standards for addressing the need to define and manage metadata is the ISO 11179, a six-part International Standard for metadata registries. This standard addresses the semantics of data, the representation of data, and the registration of the descriptions of that data. Its purpose is to promote: standard descriptions, common understanding, harmonization, and re-use of data in different contexts.

Part five of ISO 11179, provides guidance for the naming or identification of the data constructs administered in a metadata registry. Names are assigned to data element concepts with naming conventions. While there are semantic, syntactic, and lexical rules used to form a data element concept, it is left to the implementer to determine the exact definition.

Ontologies

At its core, ontology means the study of properties of what exists. An ontological method provides a means for extracting the meaning of data concepts that cross business domains and applications. An ontological method enables an enterprise to identify differently named objects/concepts that actually describe the same objects/concepts. Useful enterprise ontologies are the result of an exhaustive and rigorous formulation of the conceptualization of its specific domain. This is a partial conceptualization because it is illusory to believe that one could capture the full complexity of a domain in such formalisms (Gargouri & Jaziri, 2010).

Universal Data Element Framework

The Universal Data Element Framework (UDEF) is an ontological framework for describing data to enable interoperability. Both enterprise and standard specialist vocabularies relate to each other within the UDEF. Support for equivalent vocabularies in different languages is a strong feature of the UDEF. It is easy to use, and its definitions are readily available on-line (The Open Group, 2011).

Based on the concepts of International Standard 11179 and the World-Wide Web Consortium's Resource Description Framework (RDF), UDEF applies a clear alphanumeric naming convention. The articulation of the UDEF naming convention makes its implementation less complicated as compared to similar standards/methods. The Open Group designed the UDEF for use by the people that understand an enterprise's business operations, rather than specialists in semantic technology (The Open Group, 2011).

The UDEF is similar to the Dewey library-classification system in that it provides a controlled taxonomy to assign its alphanumeric tags. One can assign an index to any piece of data using the core UDEF vocabulary. The intent is to provide a mechanism for creating

alphanumeric UDEF IDs for each data element used by an enterprise. In a system-to-system transaction, embedding UDEF meta-data enables programmatic transformation of messages into another format.

Without a clear process for defining data element concepts, practitioners often use their individual experience. Complicated system interfaces can often result from individually defined ad-hoc processes that result in ambiguous and unsustainable definitions. By following the UDEF process, multiple practitioners can evaluate data elements and resolve to the same UDEF ID. This index will be the same as that assigned by other UDEF practitioners in your enterprise and other enterprises. The use of the index makes it easy to relate new information to information that an enterprise already has stored, which can significantly reduce the cost of configuring and programming interface software (The Open Group, 2011).

The Open Group's online training makes the UDEF easy to understand and operate. A practitioner requires only a small amount of training to become a UDEF proficient, able to index data consistently with other UDEF practitioners (The Open Group, 2011). The core UDEF vocabulary covers the kinds of information most commonly used by enterprises. The Open Group also facilitates a process for extending the UDEF.

Service Oriented Architecture Modeling

Service Oriented Architecture (SOA) is not a new concept, indeed it is a software design method, which is the combination and enhanced version of various existing software methods (Cho et al., 2008). Modeling of an SOA is often accomplished using Unified Modeling Language (UML) artifacts. While UML artifacts are useful, an enhanced modeling notation is emerging. Service Oriented Modeling (SOMF) provides a formal method of defining services at different levels of abstraction, along with a set of disciplines to guide practicing modelers

(Truyen, 2010). A service-oriented modeling diagram consists of two major building blocks: modeling assets and modeling operations (Bell, 2010).

Enterprise Architecture Tools

While the primary purpose of an enterprise architecture tool is to store, integrate and structure information related to EA, EA tools must support the creation, collection, analysis, and presentation of this information to meet stakeholder needs (Wilson & Short, 2010). For the purposes of this paper, a "tool" is defined as something regarded as necessary to the carrying out of one's occupation or profession. In general, enterprise architects need a tool set that helps them understand the concerns and demands of the organization's stakeholders and helps the map these demands to EA activities. Since the EA profession has been evolving, it somewhat hard to define what an EA tool set should contain. Commercial EA tools exist, however, they have often evolved from something other than simply EA and they may be focused completely on the underlying technology of the tool rather than how it used. Originally, many of these tools began as tools suited for other purposes such as business process management (BPM), computer-aided software engineering (CASE), or enterprise repositories. As the demand for understanding the impact of changes in the business and IT environments continues to grow, the need for tools that provide valuable information and analysis capabilities for strategic decision-making is increasingly important.

Chapter 3 – Methodology

Artifacts will be created that implement a traceable EA framework that is designed to enable Compassion International and similar small- and medium-sized enterprises to understand how work is accomplished. This understanding will help guide the planning and implementation of future processes and systems. Relevance and evaluation criteria will be established by selecting appropriate EA best practices – the practices that are relevant to most small- or medium-sized enterprise. The design will demonstrate how the businesses chosen operating

model can be clearly traced to the processes and the information required for the business to achieve its goals. Using this design, artifacts will be created that communicate the designs utility. Taken together, the design and the artifacts will be evaluated as a part of Compassion International's business process for evaluating its business solutions. The evaluation helps Compassion International determine the utility of CIA. The evaluation will also determine how well CIA helps solve the hitherto unsolved problem of creating and communicating the enterprise architecture for Compassion International and similar small- or medium-sized enterprises.

Figure 1 outlines a 6-phase design and development framework that acts as the framework for this study.

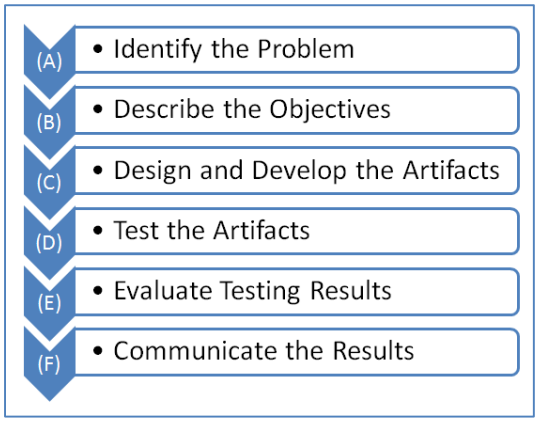


Figure 1: 6-Phase Design and Development Research Approach (Ellis & Levy, 2010)

Problem

In 2010, Compassion International's multinational leadership team worked together to develop Compassion's operating model. The result/value of this several month effort is a well-understood operating model that expresses Compassion's leadership's decisions regarding the necessary level of business process integration and standardization for delivering goods and

services to its customers, both sponsors and beneficiaries. Implementation of the selected operating model requires the development of a traceable EA framework that can guide the planning and implementation of the future processes and systems.

Developing an operating model requires that business leaders make just two decisions about the firm's ongoing operations: (1) how much to standardize business processes, and (2) how much to integrate business processes (Weill & Ross, 2009). Compassion International's operating model, demonstrated in Figure 2, reflects its decision to seek a lower degree of process standardization in parts of its business and a higher degree of process standardization in others. The operating model also clearly defines requirements for a high degree of data integration (standardized data) in respect to most of its core processes.

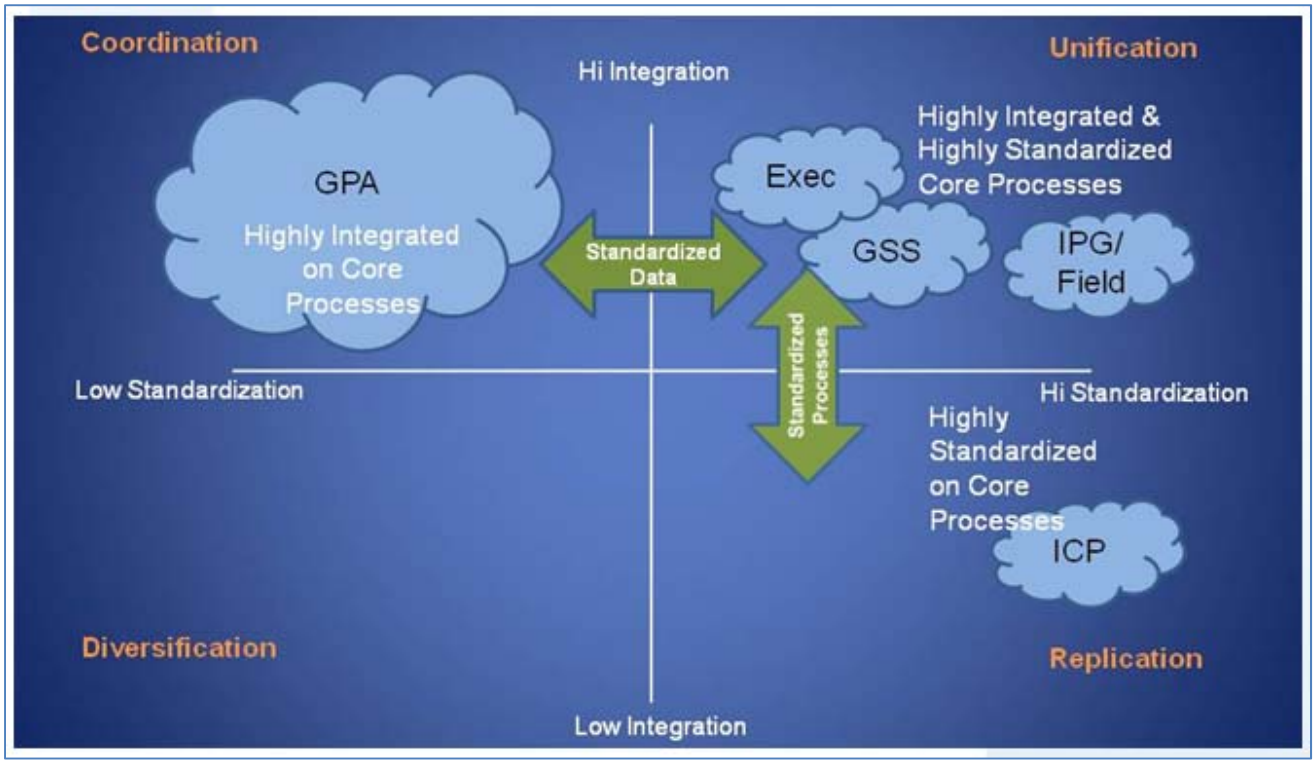


Figure 2: Compassion International's Operating Model

Compassion's operating model was reviewed, edited, and ultimately approved by Compassion's executive management. Consensus and approval of the operating model set the stage for the development of Compassion International's core diagram. As shown in Figure 3, Compassion's core diagram seeks to highlight the key components of each future digitized platform.

- Core Processes: Those processes that are "core' to the achievement of its mission.
- Core Services: Those key services that will be shared across the organization.
- Shared Data: The data that is required to be shared across the organization. The data required integrate the core processes and to document Compassion's performance and historical relationships.
- Key Customers: Those customers (supporters and beneficiaries) served by the organization and its digitized platform.

Figure 3: Compassion International Core Diagram

Objectives

The chief objective of this project is to define a set of effective and efficient traceable enterprise architecture artifacts (e.g., models, tools) that communicate an organizations processes and information in a language and a context that matters to the business. In addition, the artifacts should seek to enable stakeholders to:

1. Understand how the enterprise gets work done.
2. Easily locate descriptions for the organization's common business terms.
3. See how two or more points of data are related, where they come from, and how they are used.

4. Understand the potential impact of process changes, both within a single process and within the context of the enterprise as a whole.
5. Guide and govern future enhancements to its digitized platform.

Artifact Design

Figure 4 represents the high-level design that will be used to construct the artifacts (models) that are intended to meet the objectives of this paper. Users will be provided access via four channels; Glossary of Terms, Relationships, Events, and Performance Metrics. Each channel will provide access to an appropriate set of semantically linked wiki pages. Wiki pages and their associated hyperlinks will enable the user to explore, to increasingly levels of detail, how the enterprise works. To ensure traceability, each data element wiki page will include a UDEF Name and the associated UDEF ID.

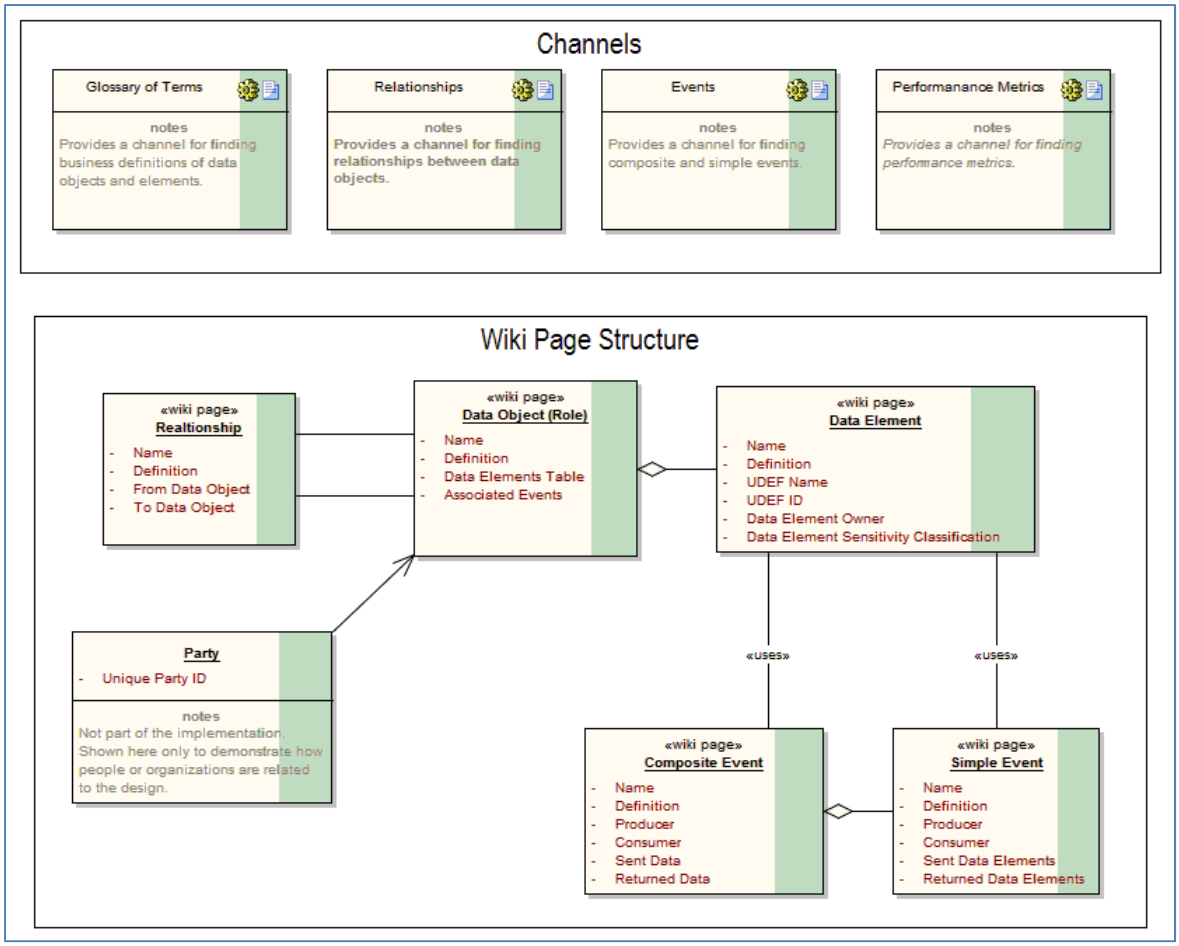


Figure 4: High-Level Artifact Design

Artifact Development

Artifact development will be accomplished using cost effective wiki tools and architecture modeling tools (Sparx Enterprise Architect). The majority of the artifacts will consist of wiki pages that are semantically linked via hyperlinks. Process models will be developed using Business Process Management Notation (BPMN). The process models will contain hotspots that will enable the user to navigate from key areas on the process models to appropriate wiki pages. Additional web pages will provide the user with navigation capabilities via the four channels.

Artifact Testing and Evaluation

The artifacts will be assessed using a largely qualitative approach. Consideration was given to the type of artifacts being evaluated (i.e., models as represented by wiki pages and process diagrams). A qualitative approach is consistent with models as outlined by *Design Alternatives for Evaluation of Design Science Research Artifacts* (Cleven, Gubler, & Huner, 2009). The evaluation methods seek to determine the utility and efficiency of the design, from the perspectives of users and stakeholders. Utility and efficiency are equally important, as it matters little that the design is easy to use, if it does not provide what the user needs. It is also no good if the design can hypothetically do what the user wants, but the user cannot find it because the user interface is too difficult.

Usability is a quality attribute that assesses how easy it is for the intended audience to use the models (user interfaces). The artifacts will be tested for usability by conducting usability interviews with five potential users. Using a script, each interviewee will be asked questions and be expected to attempt to complete a list of tasks. During the interviews, answers, observations, and comments will be recorded. Evaluation of the results will help determine the degree to which the artifacts satisfy the following criteria:

Learnability:

- How easy is it for users to accomplish basic tasks the first time they encounter the artifact?
- Does the design enable the user to determine what the artifacts are for and what value they provide from the users perspective?
- Does the design provide sufficient guidance so that the user can quickly understand how they can find what they are looking for?

Efficiency:

- Once users have learned the artifacts design, how quickly can they perform tasks?

Satisfaction:

- How pleasant is it to use the design site?
- Does the user see the “so what” of the site?

Chapter 4 – Results

An initial version Compassion International's enterprise architecture framework has been created. The initial version is populated with enough content to provide value to Compassion stakeholders and provide a sufficient body of work by which evaluation and conclusions can be drawn. Figure 5 shows the home page of the design of Compassion International's initial traceable EA framework. Event processing and universal data model constructs are used to set the foundation for this design and to incorporate Compassion's core processes and standardized information. "Compassion's Information Architecture" was selected as the title for this design because this title provided a level of cultural congruency to a body of work that was created in 1996 to guide the creation of one of Compassion's main legacy systems – the legacy system that will be replaced by Compassion's future digitized platform.

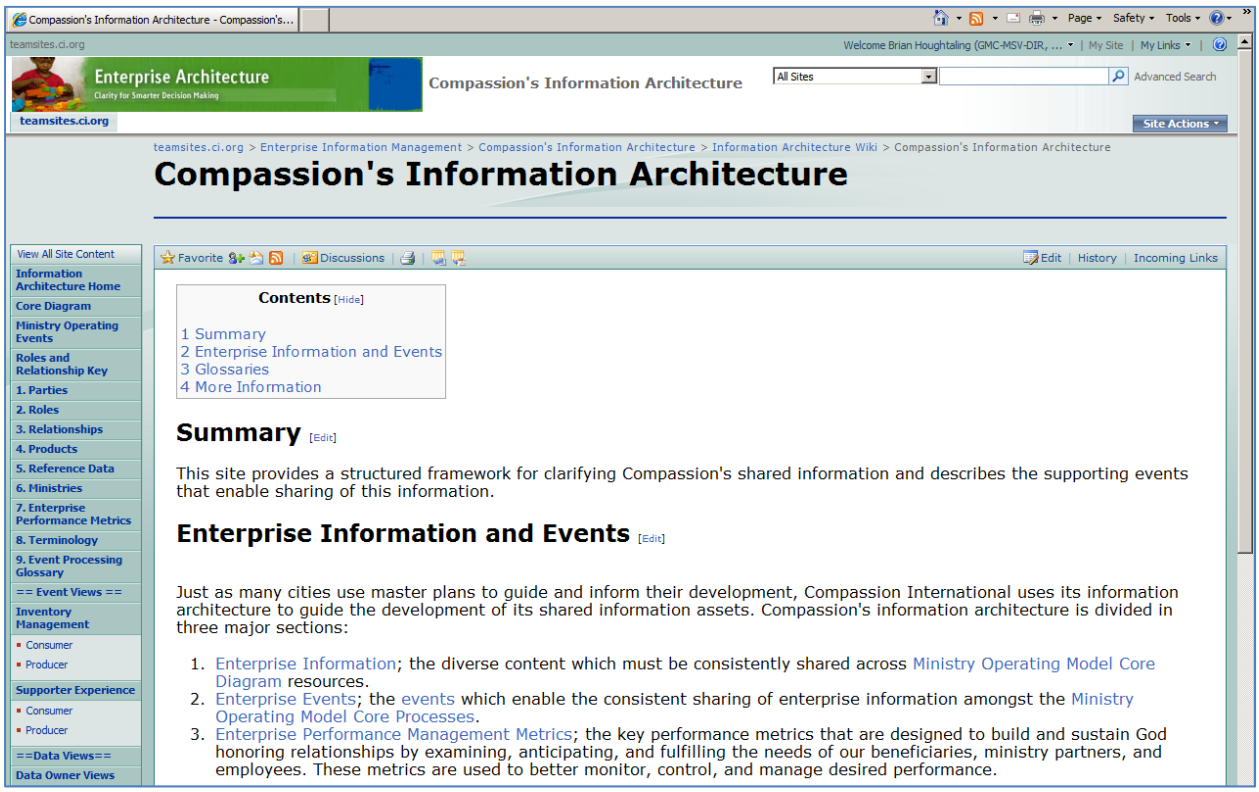


Figure 5: Compassion's EA Framework Home Page

Compassion's Information Architecture provides a structured framework for clarifying Compassion's shared information and describes the supporting events that enable sharing of this information. The framework is explicitly designed to overtly call out high-level data modeling constructs and to associate the data with the events (processes) that create or change the data. This feature supports both business process management and data governance programs by providing stakeholders (users) with the ability to explore how business processes enable data provisioning and consumption. Traceability of business processes to their associated data and vice versa, can potentially increase the effectiveness of Compassion's business processes by providing a means for determining what processes could improve data quality.

Compassion International's internal collaboration platform utilizes Microsoft SharePoint 2007, so the EA framework was designed to incorporate this platform. The capabilities of SharePoint 2007 wiki tools were evaluated; however, they offer only very basic functionality and a third-party wiki tool (KWizCom SharePoint Wiki Plus) was selected to provide required functionality.

Navigation

As a user of Compassion's Information Architecture (CIA) your main entry point is through the navigation features provided on the left column (frame) of each page. Figure 6 shows the basic navigation of CIA. This navigation frame can be used to quickly access Compassion's key events, data definitions, metrics, terminology, and EA centric diagrams. This information can also be accessed via links provided on the main body of the home page; however, these links are not immediately accessible once you begin your exploration.

Figure 6: Key Navigation Frame

Party Model Construct

Your ability to find information on CIA is enhanced when you have a basic understanding of the "party model" data construct. One of the key decisions for structuring the data that supports Compassion's digitized platform was to embrace the party model - a Universal Data Model that can be used as a starting point for many relationship based business entities. The name "party model" comes from the notion that the model does not worry about the specifics of who your business will interact with; instead the model focuses on the idea that your business will interact with parties, which are simply other entities that will have an interest in interacting with your business (Reynolds, 2010). Figure 7 provides a high-level view of the main party model components that are used to construct Compassion's party model.

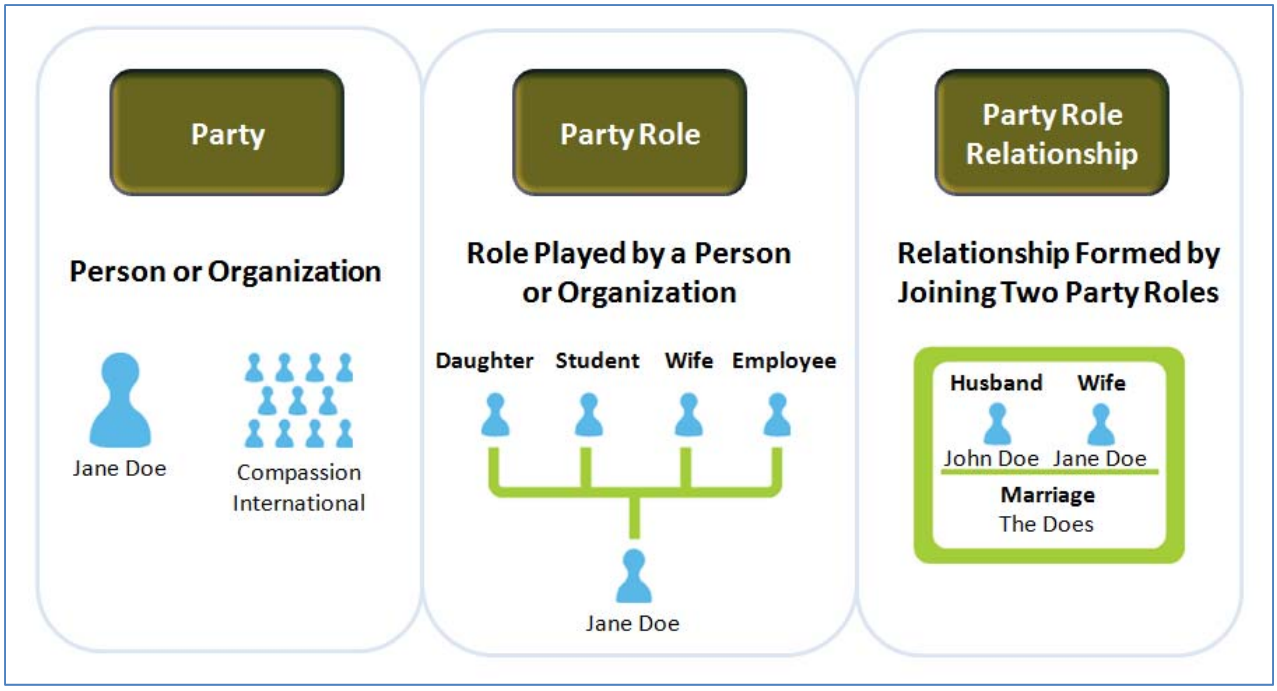


Figure 7: Main Party Model Components

Compassion uses the party model construct to list all of its common business entities and their relationships. The resulting data model describes all the important attributes of each business entity and all the key business entities that its core processes might provision or consume.

Party Roles

A party role is a function or position assumed by a party. Each party (a person or an organization) can play one or more roles (e.g., employee, employer, child, parent, sponsor, etc.) By following the "roles" link in the navigation frame, a user is provided with a canonical taxonomy of Compassion specific party roles. As shown in Figure 8, the user is then able to select any party role and retrieve the information needed to understand the definition/detail of the selected role.

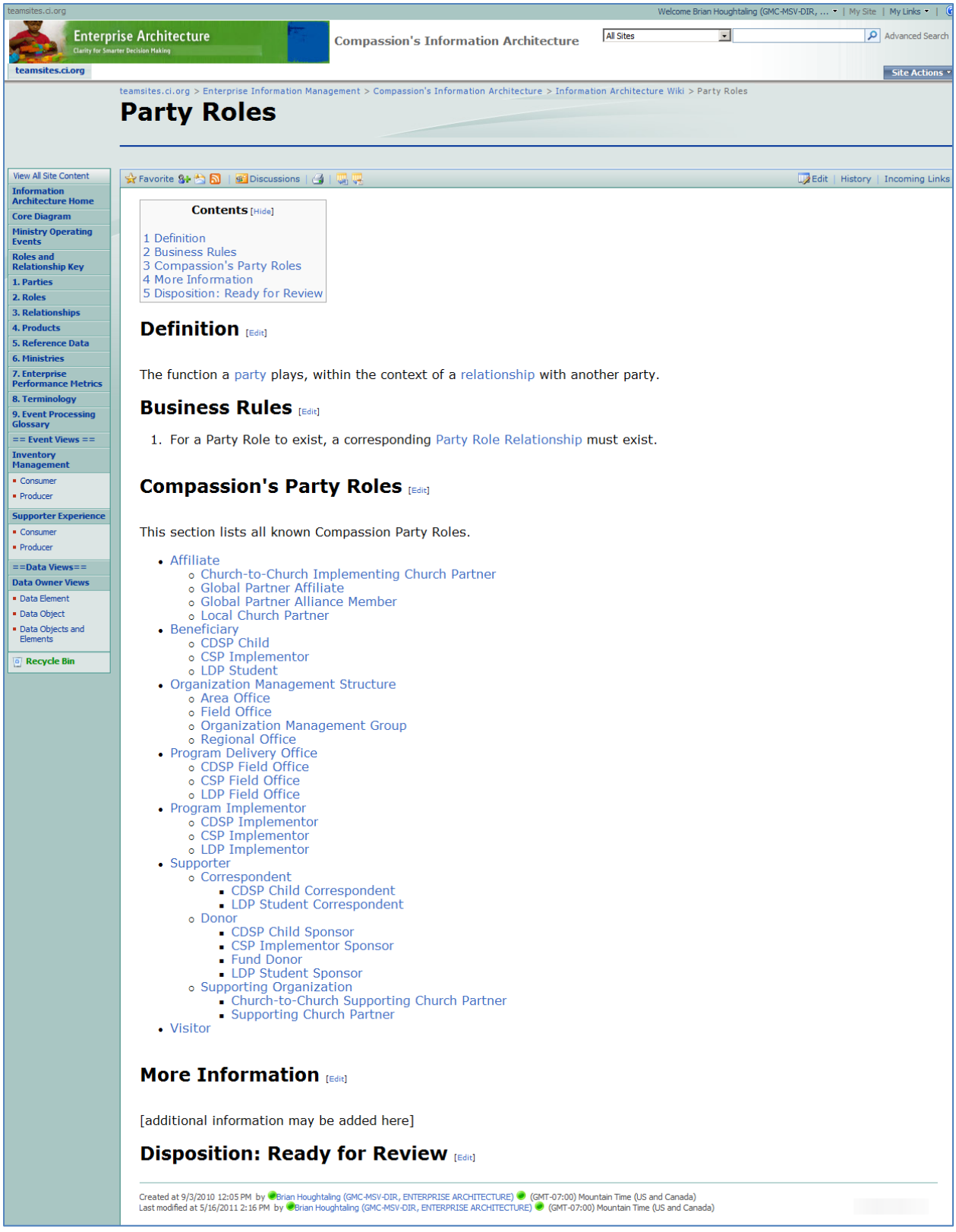


Figure 8: Party Roles Wiki Page

Party Role Relationships

Each party role is connected to another party role by a clearly defined relationship. By following the "relationship" link in the navigation frame, a user is provided with a canonical taxonomy of Compassion specific relationships. CIA provides a way, that user should now recognize as a routine pattern, to select and view any Compassion specific party role as is depicted in Figure 9.

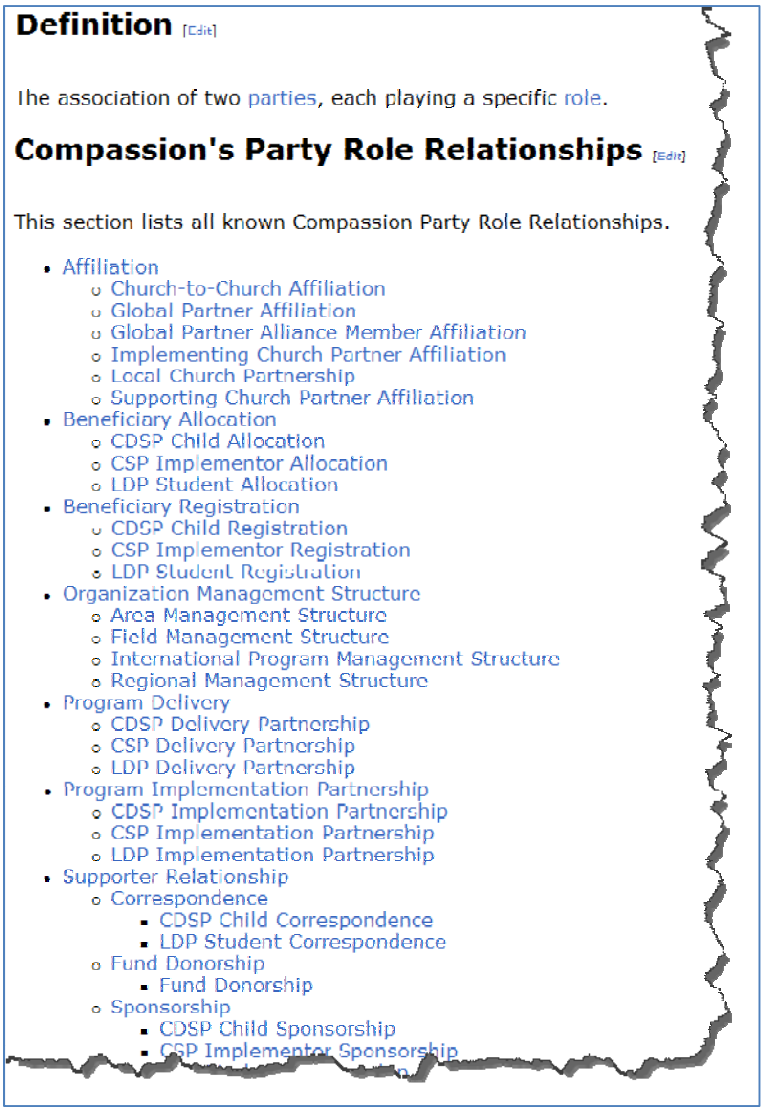


Figure 9: Partial Relationship Wiki Page

Common Wiki Page Templates

The EA framework relies heavily on a set of wiki based page templates. As the user explore CIA they will find that all of the templates are designed with a similar look and feel; there are templates for events, data objects, data elements, and metrics. Figure 10 provides an example of a typical data object wiki page, several features, common to all CIA wiki pages are highlighted and additional details are provided below.

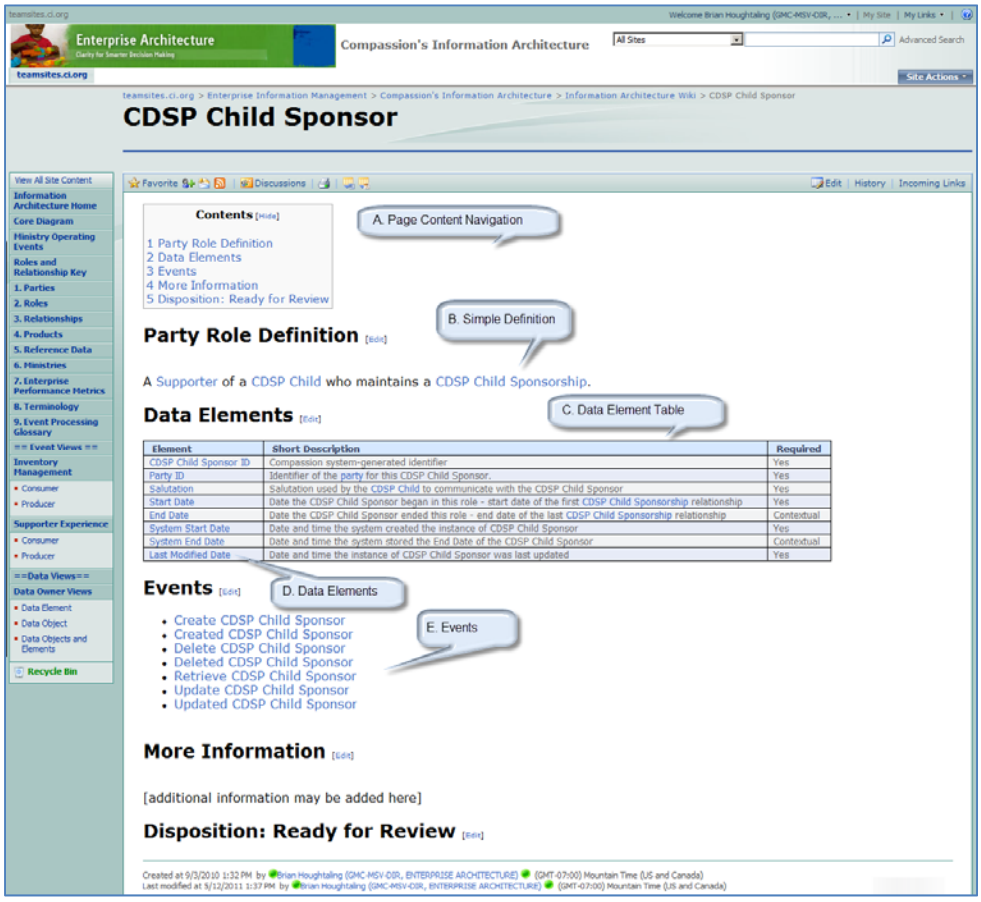


Figure 10: Typical Data Object Wiki Page

A. Page Content Navigation – provides an easy way for users to navigate directly to a specific area of interest.

B. Simple Definition – a clear definition of the data object with links to associated terms.

C. Data Element Table – a listing of all data elements required to instantiate the data object.

D. Data Elements – each data element has a simple definition and is linked to an associated data element page.

E. Events – lists and links to all events that could affect the data object.

Wiki Page Meta-Data

Each wiki page contains a meta-data section that is highlighted in Figure 11. This section has been purposefully placed on the very bottom of each page. If you were a general user, you would most likely not be interested in the meta-data section. Placing the meta-data at the bottom of the page, allows a general user to concentrate on the top part of the wiki pages without being exposed to the details that may be useful only to a smaller set of detail oriented users.

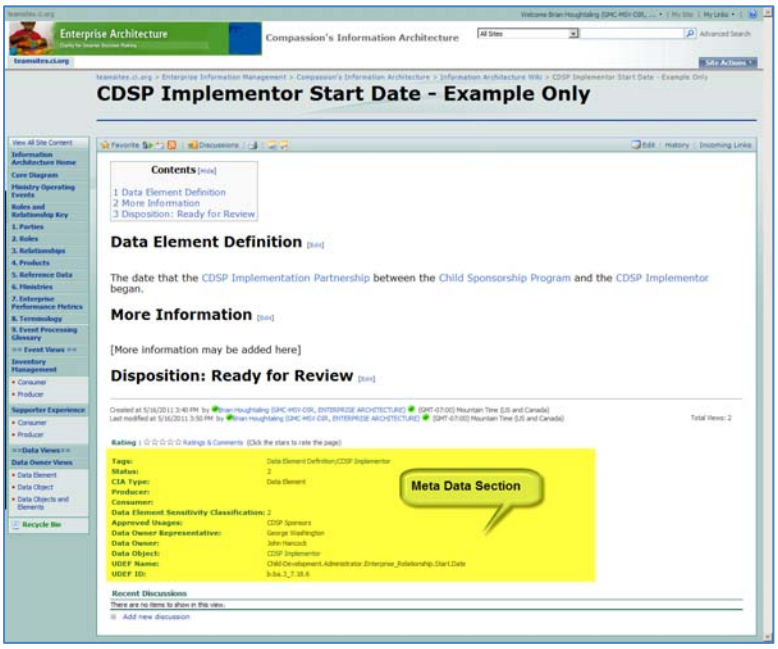


Figure 11: Meta-Data Section

Those users with a need to understand and/or trace more detailed implementation concerns will be interested in the meta-data section. Meta-data is important because it is one of the key mechanisms that CIA uses to ensure traceability and semantic interoperability of Compassion's processes and data. CIA meta-data details are shown in Figure 12 and the key meta-data fields are further explored below.

Figure 12: CIA Meta-Data Section Details

- Tags, Status, CIA Type: these meta-data fields are used for navigation and review purposes only – users would not usually be interested in these meta-data fields.
- Producer, Consumer: these meta-data fields list which core processes produce or consume an event.
- Data Element Sensitivity Classification: this meta-data field defines the level of security required for managing data. The data owner representative determines/completes this classification and the data owner has accountability for the classification.
- Approved Usages: this meta-data field lists external roles that are explicitly allowed to view class two - restricted data. The data owner representative determines/completes this classification and the data owner has accountability for the classification.

- Data Owner Representative: defines the specific people who have been authorized to represent a data owner.
- Data Owner: lists a Compassion executive who is accountable for overseeing data security classifications and approved usages of restricted data.
- Data Object: this meta-data field is populated in most data element pages. It provides traceability to the data object where the respective data element is used
- UDEF Name: this meta-data field provides a highly structured data concept name that complies with UDEF standards.
- UDEF ID: this meta-data field provides a highly structured and controlled ID that can be used to tag data in distributed systems and identify the data as it moves across the enterprise.

In addition to the providing CIA with traceability and semantic interoperability capabilities, meta-data also provides simple mechanisms for creating views/lists that enable the creation of domain specific views. This capability is informed by and supports the ArchiMate philosophy of focusing EA so that it covers the whole organization, while providing users with the capabilities to visualize different architecture domains and their underlying relationships and dependencies.

Core Diagram Navigation and Traceability

The primary foundational model that encapsulates Compassion International's enterprise architecture is its "core diagram." This simple one-page picture is a high-level view of the processes, data, and technologies constituting the desired foundation for execution (Ross et al., 2006). Compassion's core diagram, annotated to highlight seven core processes, is shown in Figure 13.

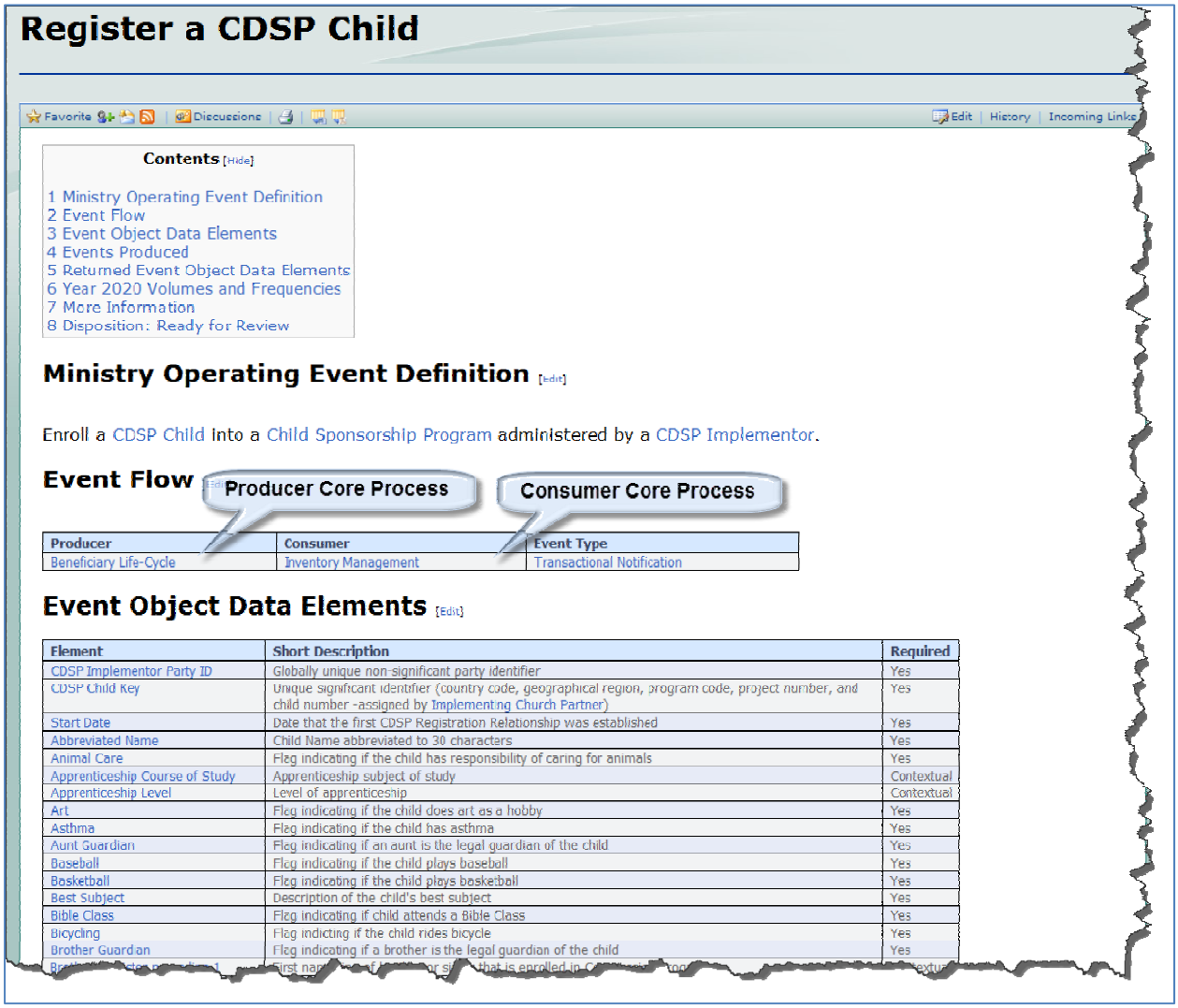
Figure 13: Compassion's Core Diagram (Process Annotated)

While Compassion executes many important processes to accomplish its mission, only its seven core processes are depicted on its core diagram. Our enterprise architecture practices and CIA focuses attention only on this smaller set of enterprise processes. These "core processes" are those that define the stable set of company-wide capabilities that Compassion must perform with excellence in order to fulfill its mission and vision. Compassion's core diagram assists EA to provide the organization a key tool for improving its value chains; refocusing the organization efforts from "small and local" to "large and system-wide." The core processes also provide the basis for describing, tracing, and navigating the "event pages" within CIA.

Event Pages

CIA event pages provide detailed descriptions of how transactions flow across Compassion's core processes. They provide the organization with a horizontal view of how

work gets done. As shown in Figure 14, a typical event page lists the producers (source of the event and the consumers (recipient of the event).



Register a CDSP Child

Favorite | Discussions | Edit | History | Incoming Links

Contents [Hide]

Ministry Operating Event Definition [Edit]

Enroll a CDSP Child into a Child Sponsorship Program administered by a CDSP Implementor.

Event Flow

Producer Core Process

Consumer Core Process

Producer	Consumer	Event Type
Beneficiary Life-Cycle	Inventory Management	Transactional Notification

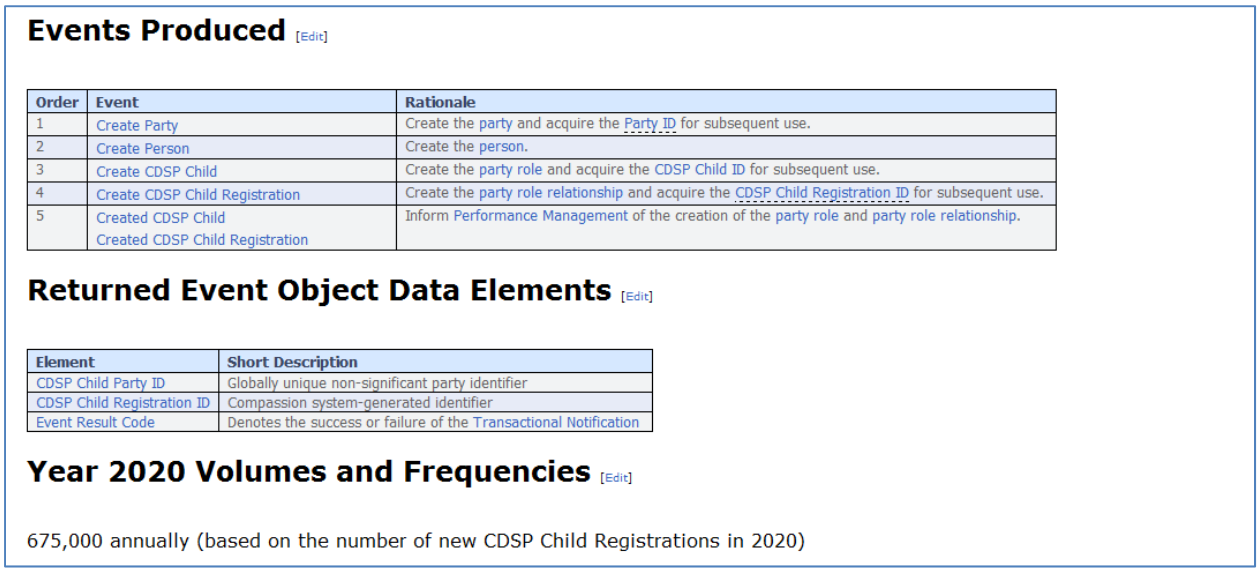
Event Object Data Elements [Edit]

Element	Short Description	Required
CDSP Implementor Party ID	Globally unique non-significant party identifier	Yes
CDSP Child Key	Unique significant identifier (country code, geographical region, program code, project number, and child number -assigned by Implementing Church Partner)	Yes
Start Date	Date that the first CDSP Registration Relationship was established	Yes
Abbreviated Name	Child Name abbreviated to 30 characters	Yes
Animal Care	Flag indicating if the child has responsibility of caring for animals	Yes
Apprenticeship Course of Study	Apprenticeship subject of study	Contextual
Apprenticeship Level	Level of apprenticeship	Contextual
Art	Flag indicating if the child does art as a hobby	Yes
Asthma	Flag indicating if the child has asthma	Yes
Aunt Guardian	Flag indicating if an aunt is the legal guardian of the child	Yes
Baseball	Flag indicating if the child plays baseball	Yes
Basketball	Flag indicating if the child plays basketball	Yes
Best Subject	Description of the child's best subject	Yes
Bible Class	Flag indicating if child attends a Bible Class	Yes
Bicycling	Flag indicting if the child rides bicycle	Yes
Brother Guardian	Flag indicating if a brother is the legal guardian of the child	Yes

Figure 14: Event Page Snap Shot

A user can explore the details of any event that traverses the core diagram – events that are required to accomplish an end-to-end value chain. Event pages provide all the detail that is required to understand the purpose of the event and the canonical data that is required to accomplish its purpose. From a technical user's perspective, events can be thought of as system

level messages and they are often directly traceable to the services that implement the event. Traceability to implemented services is contained in the event page meta-data and. Some events represent composite events – showing how a particular series of events is synthesized by combining member events using a specific order. As shown in Figure 15, a composite event contains a listing of its member events (events produced).



Events Produced [Edit]

Order	Event	Rationale
1	Create Party	Create the party and acquire the Party ID for subsequent use.
2	Create Person	Create the person.
3	Create CDSP Child	Create the party role and acquire the CDSP Child ID for subsequent use.
4	Create CDSP Child Registration	Create the party role relationship and acquire the CDSP Child Registration ID for subsequent use.
5	Created CDSP Child Created CDSP Child Registration	Inform Performance Management of the creation of the party role and party role relationship.

Returned Event Object Data Elements [Edit]

Element	Short Description
CDSP Child Party ID	Globally unique non-significant party identifier
CDSP Child Registration ID	Compassion system-generated identifier
Event Result Code	Denotes the success or failure of the Transactional Notification

Year 2020 Volumes and Frequencies [Edit]

675,000 annually (based on the number of new CDSP Child Registrations in 2020)

Figure 15: Event Page Details

Users are provided with other important information such as; the data that should be returned once the event is executed and a high-level estimation of the events future volumes and frequencies. As shown in Figure 12, event meta-data provides the ability to create views/lists domain specific views. An example of a domain specific view, that lists events produced by the “supporter experience” core process are shown in Figure 16.

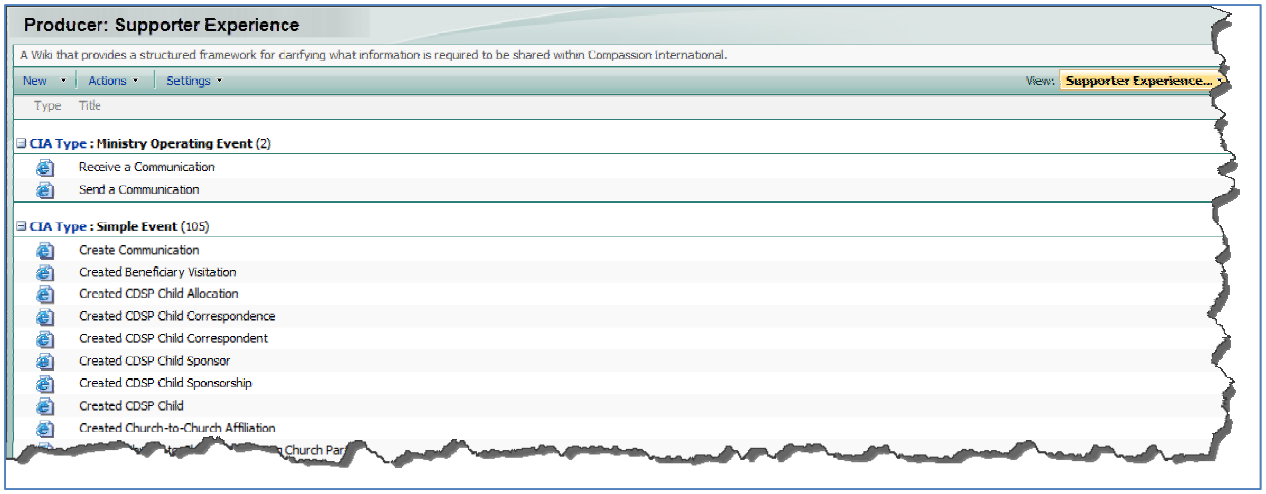


Figure 16: Event View Snapshot

Additional Content and Views

At the time of assessment, CIA contained several hundred content pages – enough material to conduct an evaluation of the results. It should be noted that CIA contains a number of additional pages and views that provide user navigation and provide tools to assist content creators. This additional information is not shown because it is specific to Compassion's environment and it would of little interest to the reader of this paper.

Chapter 5 – Evaluation

I evaluated Compassion's Information Architecture (CIA) both informally and formally – using a qualitative approach. Using CIA within Compassion International's business process provided some informal evaluation and feedback. The informal evaluation consisted of providing access and training to a subset of users and capturing their feedback. Formal evaluation was conducted as a part of Compassion International's business process (software development life-cycle methodology). The formal evaluation consisted of five individual one-hour usability interviews with potential users. Each potential user attended the interview in a small conference room, using a computer with access to CIA. Following a script provided in Appendix A: Compassion's Information Architecture Interview Questions and Tasks, the interviewer asked each interviewee a series of questions and the interviewee attempted to complete a list of tasks. A third-party interviewer conducted each of the interviews. The author was not present during the interviews, in an effort to help ensure confidentially and lower results bias. The interviewer recorded answers, observations, and comments.

Table 1 provides a summary of the findings derived from the formal interviews. Assigning numeric values to convert qualitative interview answers to quantitative measures facilitates scoring and statistical calculations. A lower score denotes a poor evaluation and higher scores indicate an exceptionally strong evaluation (1 Poor, 2 Fair, 3 Acceptable, 4 Good, and 5 Very Good).

Table 1: Usability Interview Results

	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Mean**
Learnability						
First Impressions	3	1	4	2	1	2.2
Understands Overall Intent	4	3	2	3	3	3.0
Understands Value to Their Role	3	4	4	4	2	3.4
Efficiency						
Ease of Initial Exploration – Ability to find something of interest.	4	2	3	3	2	2.8
Finding General Definitions – What is a role?	4	4	3	5	3	3.8
Understanding Relationships – What is a relationship ?	4	2	2	3	2	2.6
Finding Lists of Associated Terms – What are Compassion's products ?	4	2	4	4	4	3.6
Finding Relevant Definitions – What parties a relevant to your role?	2	4	2	2	1	2.2
Finding Metrics/Measures – Where would you find a measure for success?	1	2	2	3	3	2.2
Describing Specific Relationships – How does a donor connect to a child?	4	2	3	3	3	3.0
Joining a Discussion – How would you join a discussion?	5	4	4	3	4	4.0
Finding Events – Give an example of three events.	1	2	2	4	2	2.2
Details of a Relationship – What are the CDSP Sponsorship parties?	1	2	2	3	2	2.0

	Test 1	Test 2	Test 3	Test 4	Test 5	Mean
Core Process Traceability – Name four of the seven core processes?	5	4	5	5	3	4.4
Process Understanding – Describe the Child Registration process?	1	1	1	1	1	1.0
Satisfaction						
Overall Impressions	2	1	3	3	2	2.2
Clarity – How well did the site help you find things?	2	1	2	2	2	1.8
Usage – Would you or your team use the site?	5	4	5	4	2	4.0
Summary Results						
Tester Total Score	55	45	53	57	42	
Tester Mean Score	3.1	2.5	2.9	3.2	2.3	2.8

Learnability

When most of the testers first encountered the CIA, they evaluated the design as marginally acceptable. First impressions of CIA were fair. Most testers stated that the design looks like a "typical SharePoint site." This means that a site is confusing and not designed for ease of learning. As each tester spent time performing tasks, familiarity increased and their understanding of intent and value increased to an acceptable level. The key obstacle to CIA's learnability is the "party model" construct. Testers, who were not familiar with the party model, lacked familiar paths/ channels (i.e., glossary, processes, relationships, and metrics).

Efficiency

Navigation efficiency increased as tester experience increased, however, an acceptable level of competence was only achieved on basic tasks. Achieving an acceptable level of

efficiency required each tester to discover or ascertain the taxonomy of the party model. Low efficiency continued, unless or until the tester discovered the taxonomy of terms listed under each of the principal party model constructs (i.e., parties, roles, relationships).

The efficiency of locating events and processes was poor and did not increase with familiarity. Testers were not familiar with the concept of "events" and all of the testers failed to identify events with the processes that produce them. The testers were able to locate core processes with reasonable efficiency; however, no tester was able to describe a process in detail.

Satisfaction

Scores for overall impressions and clarity were fair. While four out of five testers shared their appreciation for what CIA is trying to accomplish, usability obstacles prevented the testers from scoring the initial site as clearly acceptable. General feedback indicates that CIA is useful for clarifying Compassion's shared information and describing the supporting events that enable sharing of this information. As one of the testers stated, "CIA provides a lot of useful information, but it requires improvements so that general users can find this information without having to learn how the designer thinks."

Chapter 6 – Conclusions

Most definitions of enterprise architecture express its stated purpose as leading the process of translating business vision and strategy into effective enterprise change. While EA can be useful for helping define business vision and strategy, its value lies in its ability to translate vision and strategy into effective enterprise change. Vision and strategy are useless followed with traceable implementation and execution.

In this paper, I have attempted to establish a traceable enterprise architecture that effectively enables Compassion International (a medium-sized enterprise) to manage the ongoing development and transformation of its digitized platform. Translating Compassion's business strategy and vision was largely accomplished by developing the organizations operating model and core diagram. Successfully translating this strategy and vision into effective enterprise change remains an elusive goal. Accomplishing effective enterprise change requires that a diverse group of stakeholders, some speaking the language of business and some speaking various technical languages, be able to communicate clearly.

By designing, developing, and evaluating Compassion's Information Architecture, we have created many of the strands needed to help close the gap between strategy and execution. We have also discovered that these many strands do not constitute a bridge. Completing a bridge will require additional effort to increase the effectiveness and usability of CIA. The evaluation of CIA clearly demonstrates that the content and basic design provide a particularly useful foundation. The next step is to improve CIA's navigation, with the help of usability experts, to allow a larger group of stakeholders to locate and use its rich content. New design wire frame artifacts articulate usability improvements and overall utility.

As shown in Figure 17, the wire frame of the proposed CIA home page provides clearer channels for typical users. By using common "business language" channels, CIA can provide users with an on-ramp that avoids the need to understand the underlying structure of the party model construct.

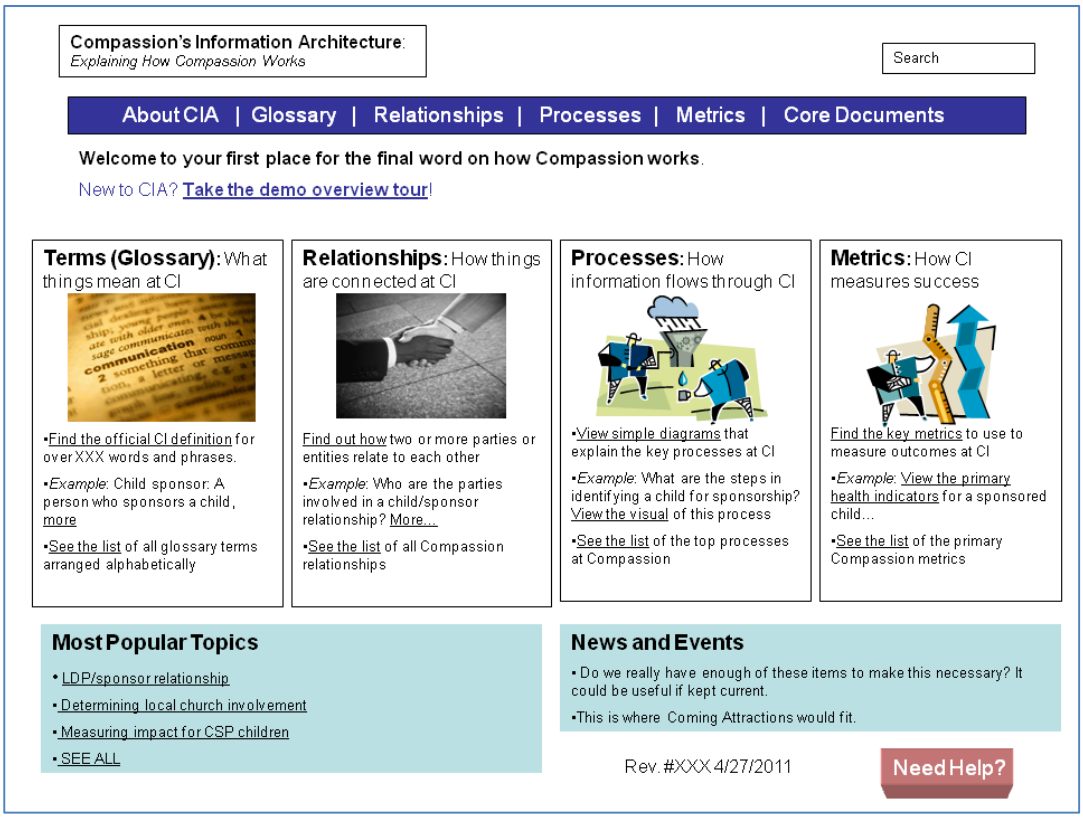


Figure 17: Proposed Home Page Wire Frame

Incorporation of business process models can improve the ability of users to understand the Compassion core processes. Figure 18, demonstrates how business process models will enable the user to see an overview of a process. The business process models also enable the user to explore the details of message flows and link directly to detailed event descriptions.

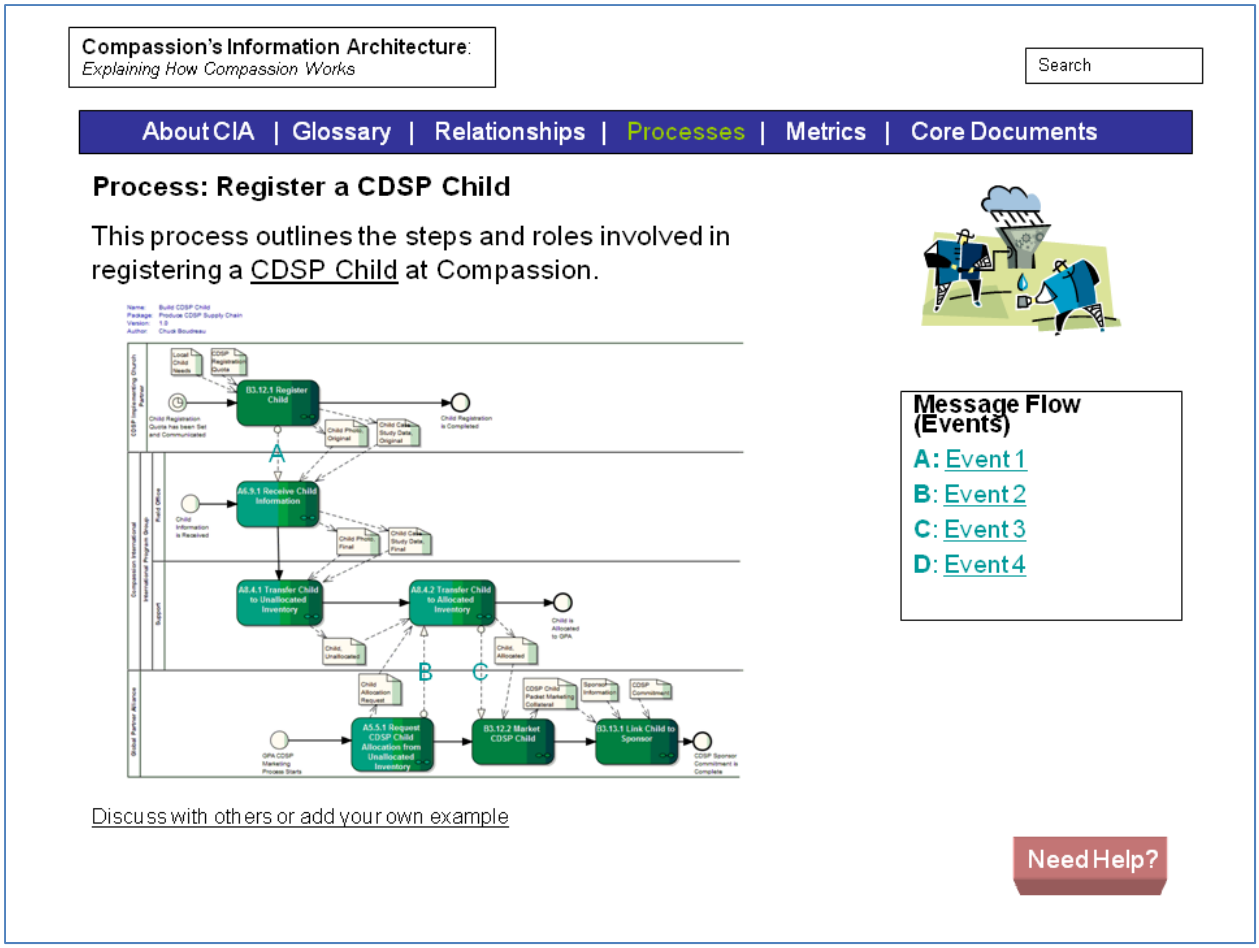


Figure 18: Proposed Business Process Model Wire Frame

The value of the CIA is already evident and users have begun to refer to the rich set of content presently available. Proposed improvements are underway and Compassion International is well on its way to use its enterprise architecture to guide the development and transformation of its digitized platform.

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Appendix A: Compassion's Information Architecture Interview Questions and Tasks

Name:

Department:

Introduction

We are here to get a better understanding of one of Compassion's Web sites, actually part of its intranet. We are going to ask a few questions about your role and usage of Compassion sites, then we will get into some specific "tests" where we will ask some questions and get have you perform some tasks on this site. The tests are about the site, not you, so we are going to ask you to be completely candid and talk aloud once we get into the testing. There are no wrong answers and if you cannot complete a task or answer a question, that is the site's issue, not yours. Once we start, I can answer general questions, but not ones that pertain to the tasks.

Background Questions:

1. Tell me about your job. What do you do?
2. How many hours per week do you use The Source (Compassion's Intranet)?
3. Have you ever heard of Compassion's Information Architecture Web site?
4. If yes, have you ever used it?
5. If yes, what has been your experience with it? (Take time to probe for general impressions, obstacles, or benefits).

Usability Questions:

Let's take a look at the site. (Show home page)

1. What are your first impressions?
2. What do you think this site is intended to do?
3. Why would someone come here?

4. How might you use this area/site?
    a. What would be some benefits to you of this?
5. Where would you go to first from here? Why?

NOTE: Allow user to define his/her own scenario and monitor progress. Within that user-defined task, ask the following:

1. What are you attempting to find?
2. How successful are you at finding that?
3. Do the explanations make sense? (Probe for any lack of clarity)
4. How would this help you in your job?

General Tasks:

1. Explain what a role is.
2. What is the difference between a role event and a relationship event?
3. Name three different types of products found on the site.
4. Which Parties are most relevant to your job?
5. Where would you find a description of how to measure the success of a particular activity at Compassion?
6. If I wanted to find out how a donor connects to his or her sponsored child, how would I do that using this site?
7. Give an example of an Event Processing Pattern.
8. What types of gifts does Compassion offer?
9. How would you join a discussion on one of the pages?
10. Give three examples of events.
11. What parties are involved in CDSP Child Sponsorship?

12. Name four of the seven core processes at Compassion.

Summary Questions:

1. What are your overall impressions of the site? Be specific.
2. What worked best?
3. What was the most challenging?
4. On a one to five scale with one being not clear at all and five being very clear, how clear was the language to you on the site?
5. On a one to five scale with five being found everything and one being found nothing, how well do you think you were able to find the requested information?
6. How often do you think you would use this site? Why?
7. What are your final thoughts? (Probe for images, what kinds of graphics would be helpful, how they see this fitting into their routine, etc.)