Portfolio: TOGAF® AI Digital Transformation

Master of Science

Information & Communication Technology

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Abstract

This paper extends a fictional, enterprise architecture case study, which depicts an organization, after a three-way merger. ArchiSurance used ArchiMate® Specification and TOGAF® framework to realize digital transformation. The paper analyzes ArchiSurance's use of enterprise architecture and extends the case study to drive security, compliance, globalization, Big Data, and a distributed multi-cloud infrastructure. The writing presents reference architectures that transform ArchiSurance from a fledgling post-merger organization to an AI-enabled, globalized insurance enterprise.

Background

ArchiSurance began as three merged organizations. The companies desired to fast-track Digital Transformation (DX). DX refers to an organization's adoption of fast-changing and often disruptive technologies. As of this writing, several technologies such as cloud computing, Big Data, Artificial Intelligence (AI), Internet of Things (IoT), and Agile represent example DX technologies (Ebert, Duarte 2018). DX aims to increase productivity, value, and social welfare of the organization by adopting long-term policies grounded in strategic-foresight studies (Kaidalova et al. 2018).

ArchiSurance stakeholders developed a *Digital Customer Intimacy Strategy.* This focuses on Big Data acquisition to improve customer experience. Table 1 outlines ArchiSurance's key DX strategy points.

Data Acquisition Aspirations	Key Factors
Capture increased customer data detail	● improve customer interaction ● improve customer satisfaction ● adjust insurance premiums based on risk
Leverage data from smart connected devices	● fitness trackers ● vehicle tracking systems ● home automation gateways
Leverage B2B market data	● fleet managements systems ● vehicle tracking systems ● in-store RFID devices ● smart building sensors

Table 1. Digital Customer Intimacy Strategy Information.

ArchiSurance believes the planned DX could deliver insurance products that provide real-time customer interaction. For example, while a customer runs on a treadmill, a notification could display potential insurance cost savings.

Enterprise Architecture

ArchiSurance used Enterprise Architecture (EA) to chart its vision. EA provides a coherence of principles, methods, and models. These are leveraged in the design and realization of an enterprise's organizational structure, business process, information systems, and technical infrastructure (Lankhorst et al. 2017, 3).

While EA has multiple framework options, the ArchiSurance case study outlines a TOGAF® strategy. The case study also displays visualizations, which were created via the ArchiMate® modelling specification. The Open Group created TOGAF®, ArchiMate®, and the ArchiSurance case study.

Enterprise architects strive to design EAs that supply an innovative foundation for execution. The *foundation for execution* represents a company's IT infrastructure and digitized business processes, which automate the organization's core capabilities (Ross et al. 2016, 17). While enterprise architects have no explicit ties to TOGAF® or ArchiMate®, the enterprise architect plays a central role in deciding the EA framework, design, tools, and so on (Helfert et al. 2013).

The Open Group Architecture Framework, or TOGAF®, accounts for over eighty percent of existing business framework structures. TOGAF® provides the Architectural Development

Method (ADM) which adapts the framework to accommodate for independent, architectural creativity (Architecture Center 2019).

The TOGAF® ADM includes a ten phase *Architecture Development Cycle* where the current state is constantly validated against the original expectations (The Open Group 2 n.a.). In Figure 1, the circular graphics represent the ten TOGAF® ADM phases, and overlay their correspondence on the ArchiMate® layers.

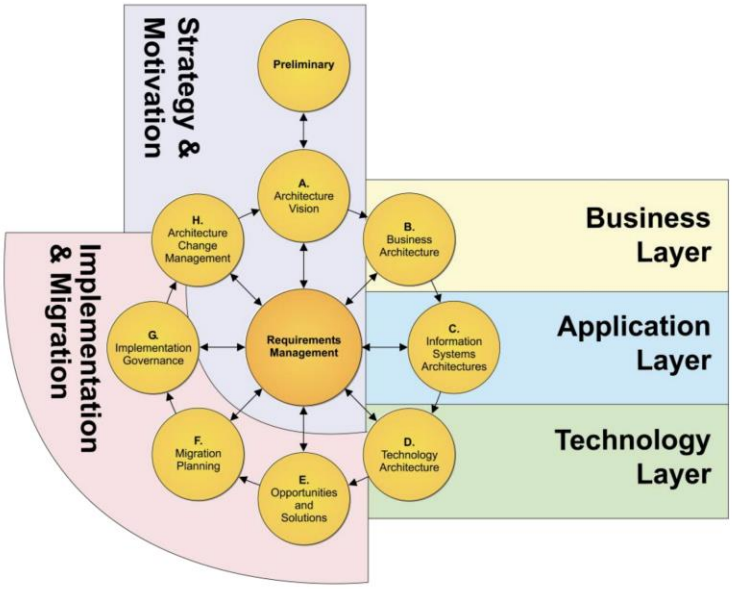


Figure 1. Rough Correspondence Between the ArchiMate® Language and TOGAF® ADM.
Source: (Jonkers et al. 2016, 7).

Viewpoints and Visualizations

Successful enterprise architects must wear several hats. The qualifications include technology genius, business strategist, accomplished manager, and expert communicator. They also design, create, and present model visualizations. The “Enterprise Architect Paradox” refers

to the seemingly endless expectations, which get projected to the enterprise architect role (Sadler 2018). EA offers work flows to help mitigate such risks.

Classification Viewpoints help enterprise architects choose the ideal viewpoints for the stakeholder audience. The classification framework is divided by *purpose* and *content* (Helfert et al. 2013, 185). Table 2 displays each dimension of the classification viewpoint framework, and provides high-level *Type* details.

Dimension	Type	Description	Key Illustrations
Purpose	Designing	support architects and designers throughout design process	Examples: diagrams like those in UML
	Deciding	provides insight to cross-domain architecture relationships	Examples: cross-reference tables, landscape maps, lists, and reports
	Informing	to achieve understanding, obtain commitment, and convince adversaries	Examples: illustrations, animations, cartoons, flyers, etc.
Content	Details	typically contains one layer and one aspect of the framework	Stakeholders: software engineer or process holder
	Coherence	spans multiple layers or multiple aspects	Stakeholders: operational managers
	Overview	addresses both multiple layers and multiple aspects	Stakeholders: enterprise architects and decisions makers such as CEOs and CIOs

Table 2. Classification Viewpoints: Dimensions & Types. Source: (Helfert et al. 2013, 185).

The following, background subsections describe high-level constraints associated with globalized DX.

Data Regulations

ArchiSurance plans to outsource all insurance claims processing to a specialist organization in Australia. Companies that desire to go global must focus on the following five areas to ensure a successful enterprise strategy (Ramesh 2018):

- Industry and Global Context
- Global IT Governance
- Global Interoperability and Reusability
- Privacy and Security Standards
- Data Access Controls

In recent years, countries (Ramesh 2018) and territories (Chrisholm 2019) trend towards increased data privacy and regulatory compliance. Figure 2 displays the EU's General Data Protection Regulation (GDPR) factors, which EU operating organizations must incorporate into their EA.

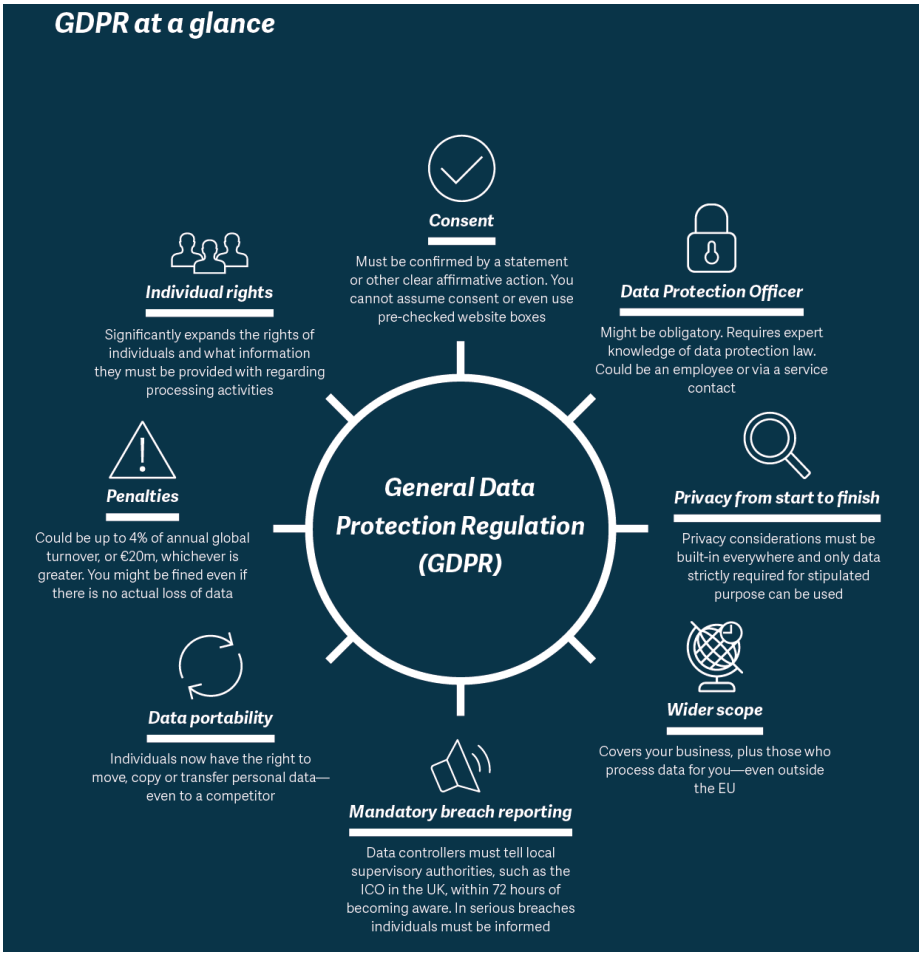


Figure 2. GDPR Quick View. Source: (Data SQL Visionary 2018).

In addition, Australian policy discourages the practice of localizing sensitive data within the country borders (Secure Drive 2019). Figure 3 shows how sensitive, customer data cannot enter Australia. The writing suggests a means to allow specialized, outsourced organizations to carry out ArchiSurance business functions, while maintaining global compliance.

Figure 3. How Can ArchiSurance Outsource Claims Processing? Source: (Secure Drive 2019).

Security and Risk

A well-designed foundation increases system resilience, security, privacy, and data integrity. Such a foundation involves simplified IT and business environments (Ross et al. 2006, 193-194). While Enterprise Architecture (EA) may inherently add protection via simplified IT, specific security principles and concepts must be applied to an enterprise architecture. Table 3 describes security concepts and principles, which an enterprise architect must build into the EA.

Concerns	Description

Authentication	Obtaining the identity of a person
Authorization	Permitted capabilities of an authenticated entity
Audit	Supplies forensic data to measure a system's security policies
Assurance	Ability to measure system's security policies with accuracy
Availability	Mitigates service interruptions and depletion under duress
Asset Protection	Protects information assets from loss and disclosure, and resources for unauthorized use
Administration	Ability to add or change security policies, policy implementation, and users of a system
Risk Management	An organization's tolerance for risk

Table 3. Enterprise Architect Security Concerns. Source: (The Open Group 1 n.a.).

Figure 4 demonstrates how Information Security Management (ISM) and Enterprise Risk Management (ERM) components can wire into the TOGAF® ADM phases. The following list shows examples for relevant phases.

- **Architecture Vision**: *Security Principles* and *Risk Appetite*
- **Business Architecture**: *Applicable Law and Regulation Register*
- **Information System Architecture**: *Security Classification* and *Data Quality*
- **Transition Architecture**: *Risk Mitigation Plan* and *Security Audit*

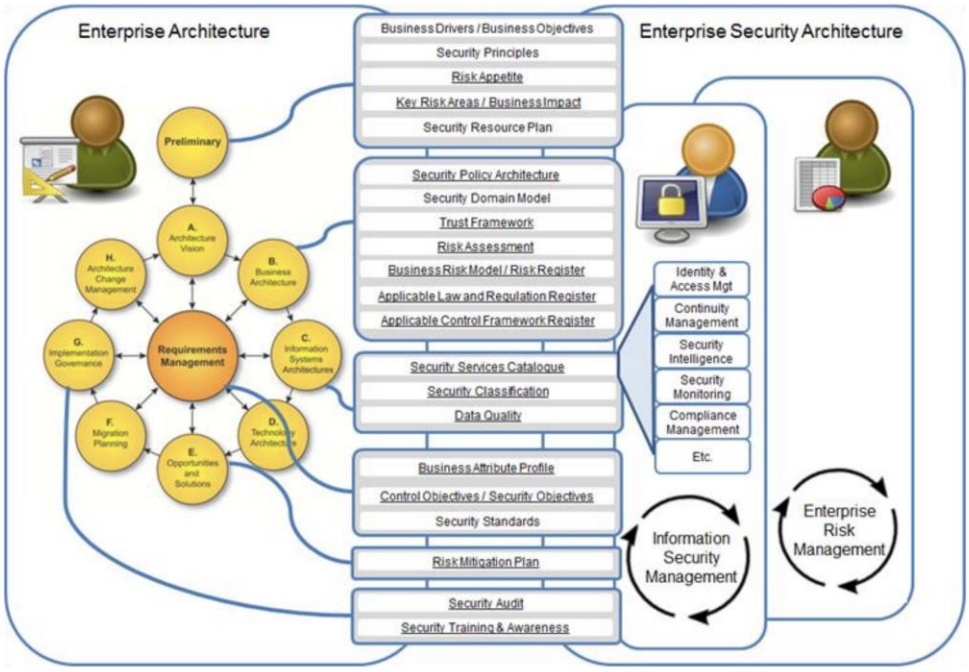


Figure 4. Essential Security and Risk Concepts and their Position in the TOGAF ADM.
Source: (Band et al. 2019).

The following sections outline ArchiSurance's EA evolution via ArchiMate® layers. Each ArchiMate® Layer contains three to four subsections, which roughly outline the following.

- ArchiSurance Case Study Evolution and Analysis
- Security Components
- Risk Mitigation and Regulatory Compliance
- AI Targets to realize Digital Customer Intimacy Strategy

The writing argues for reference architectures that transform ArchiSurance from a fledgling post-merger organization to an AI-enabled, globalized insurance enterprise.

Strategy and Motivation

Architecture Vision: Case Study Analysis

The Architecture Vision Phase allows the enterprise architect to understand ArchiSurance's vision, in regards to the main stakeholders, their concerns, and assessments. The enterprise architect must gather information by communicating with stakeholders. The information serves as the basis of several Architecture Vision models and viewpoints. The enterprise architect iterates on the views with stakeholders, until they reach an agreed upon vision.

The Stakeholder viewpoint allows enterprise architects to model stakeholders and stakeholder concerns. In addition, the stakeholder assessments can be modelled with the following criteria:

- strengths
- weaknesses
- opportunities
- threats

Table 3 includes a Stakeholder View. The view identifies Board and Customer stakeholders, who share a Customer Satisfaction driver. Each stakeholder possesses drivers that can be chained together, for example, the need to fulfill a *Profitability* concern, in order to meet a *Stakeholder Satisfaction* concern.

Archisurance's EA identified several viewpoints to plan the organization's Architecture Vision, which are described as follows:

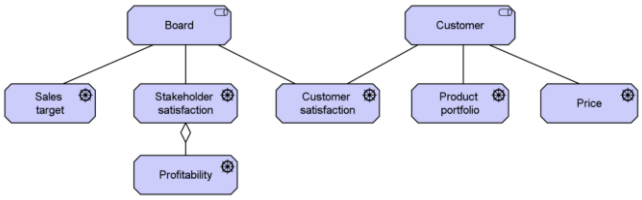
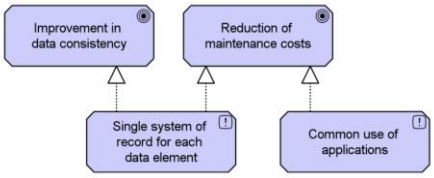
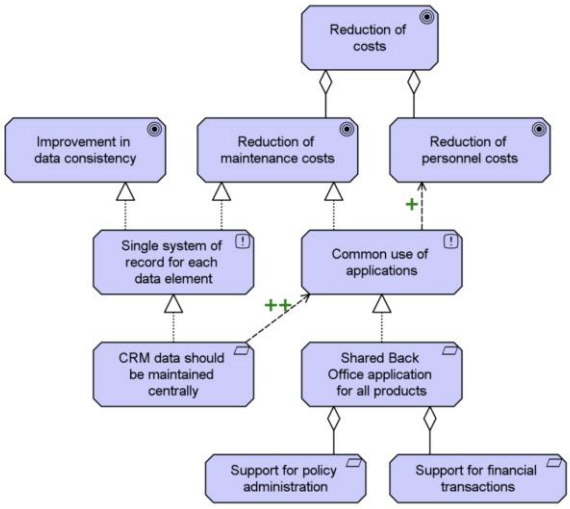
- **Principles Viewpoint**: Displays principles that serve to meet business goals, and how those principles can be achieved.
- **Goal Refinement Viewpoint**: identifies specific steps required to achieve high-level goals.
- **Strategy Viewpoint**: identifies how the long-term goals, for example DX, fit into the overall strategy.
- **Solution Concept View**: explains added value and reasoning behind the architecture proposal.

(Jonkers et al. 2016)

Table 4 provides key factors that the enterprise architect discovered, designed, and executed in collaboration with ArchiSurance's main stakeholders. These include goals, an example driver, new capabilities required for the Digital Customer Intimacy Strategy, solutions, and model views created via ArchiMate®.

Architecture Vision: Key Factors

Architecture Vision Goals	● Identify main stakeholders ● Gather stakeholder concerns and assessments
Example Driver	Profitability ● Customers leave for competitors with superior digital experience and/or lower costs ● Reduce maintenance and personnel costs
Digital Customer Intimacy Strategy	New Capabilities and Resources: ● digital customer management ● data acquisition ● data analysis

Solutions	● integrated back-office automation replaces separate back-office applications ● As part of DX strategy, acquire customer behavior data and feed into Business Intelligence (BI) system ● Analyze social media data to measure success
Stakeholder View (Fragment)	
Principles View (Fragment)	
Goal Refinement View for Rationalization Strategy	

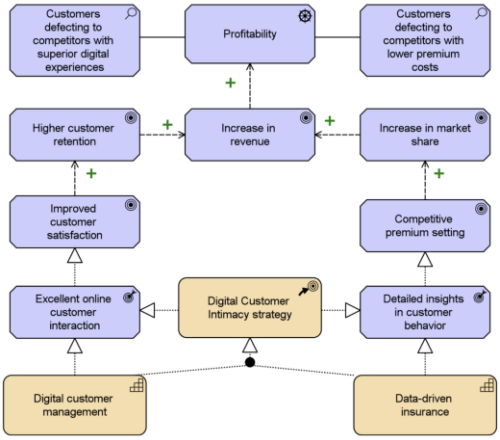
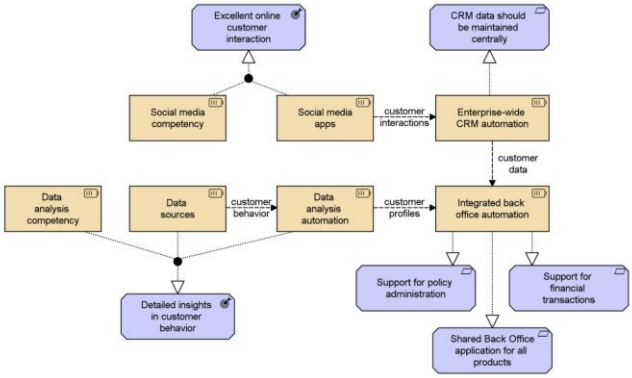
Strategy View for Digital Customer Intimacy Strategy	
Solution Concept View	

Table 4. Phase A: Architecture Vision Key Factors. Source: (Jonkers et al. 2016).

Architecture Vision: Security

While developing Security Principles, an enterprise architect must satisfy the security and business stakeholder's value concerns. These include risks and cost benefit analysis (The Open Group 2 2019, 19).

Figures 5-9 provide suggestions based on a *Risk Mitigation and Security* driver. These models aim to mitigate business, operational, and cyber-security risks, and extend the original case study views.

Figure 5. Stakeholder View (Fragment) with Risk Mitigation and Security.

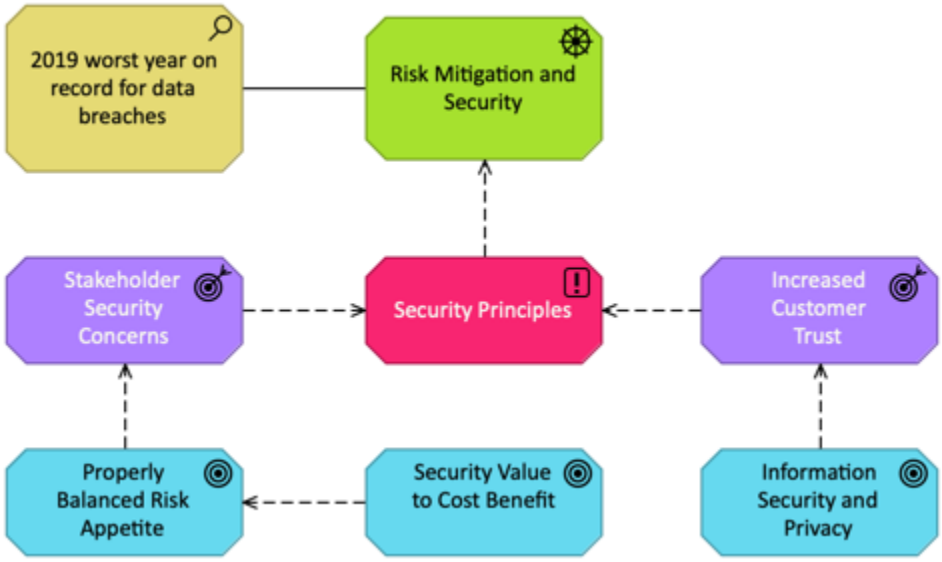


Figure 6. Goal Refinement View for Risk Mitigation and Security. Source: (Hodge 2019).

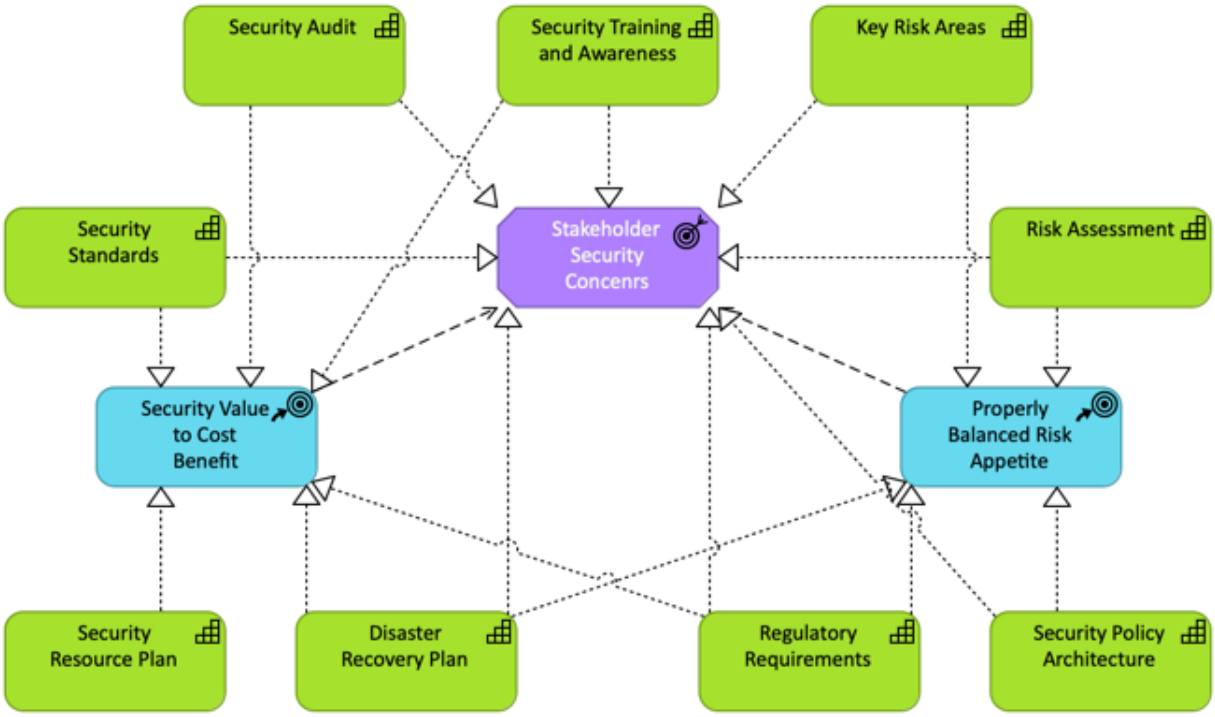


Figure 7. Strategy View: Stakeholder Security Concerns.

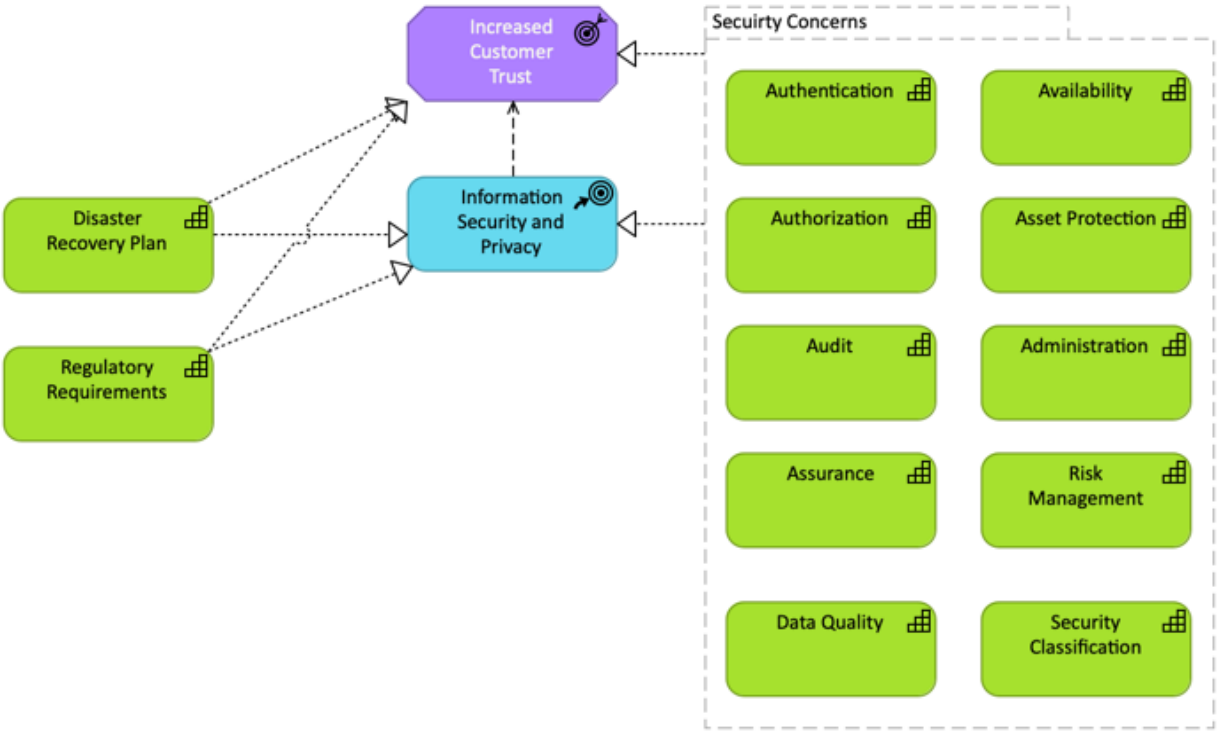


Figure 8. Strategy View: Increased Customer Trust.

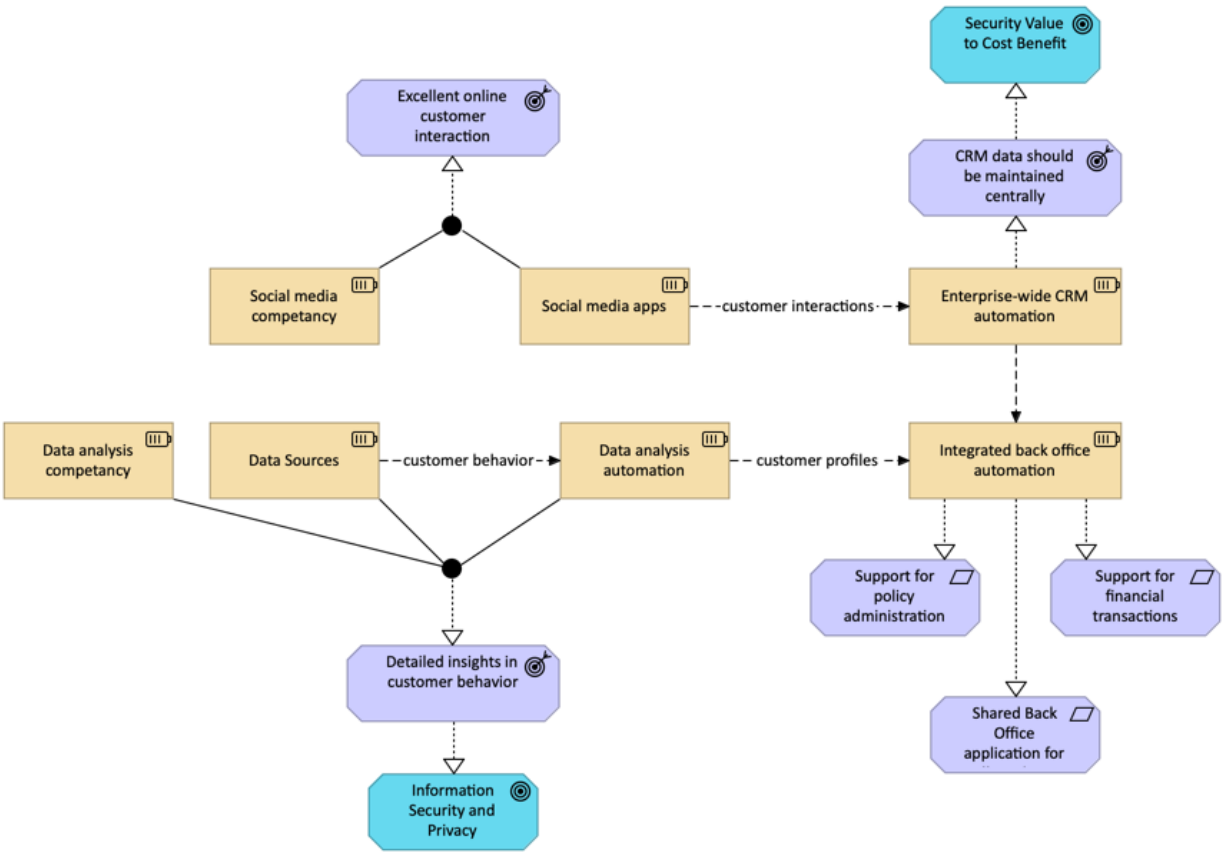


Figure 9. Solution Concept View with Security Suggestions.

Adaptable Regulatory Compliance

Rather than accept the tradeoffs associated with different Infrastructure as a Services (IaaSs), an enterprise architect possesses the option to incorporate a multi-cloud strategy. Figure 10 demonstrates a Goal Refinement View that aims to meet an *Adaptable Regulatory Compliance* driver. This is achieved by a *Multi-cloud Strategy* principle. The ability to choose any cloud provider offers several benefits.

- **Avoids vendor lock-in**: best of breed service selection
- **Disaster recovery**: resilience to cloud-specific cyber attacks
- **Standardized data management**: virtual hardware, compliance, regulations, security, reporting, and so on

- **Cloud cost optimization**: meet performance requirements for the lowest cost
- **Low Latency**: distributed applications provide servers in proximity.

  (Solanki 2018)

- **Kubernetes**: provides a standardized platform of infrastructure automation, and simplifies multi-cloud management (Platform9 2019).

  .

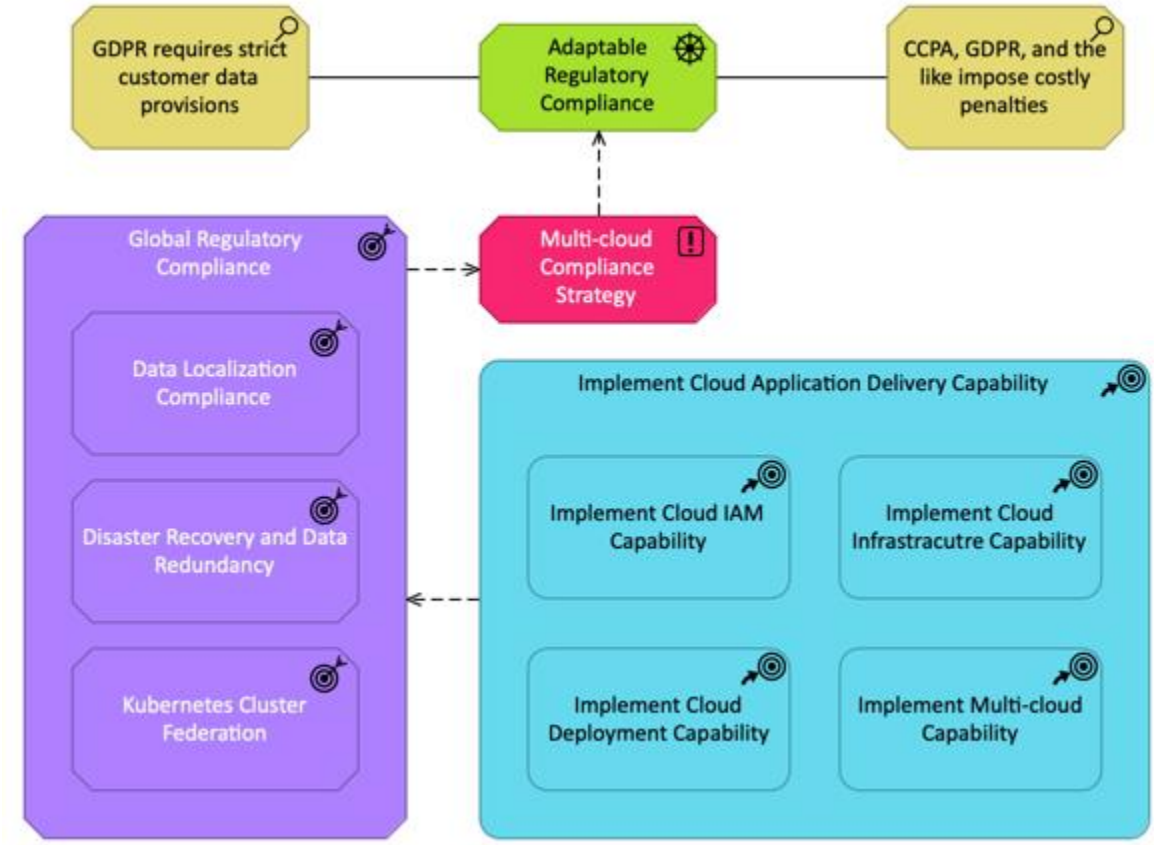


Figure 10. Goal Refinement View: Adaptable Regulatory Compliance. Source: (Band and Kennedy 2017, 18).

Figure 11 shows a Strategy View that drives toward a *Global Regulatory Compliance* outcome and displays required capabilities and resources.

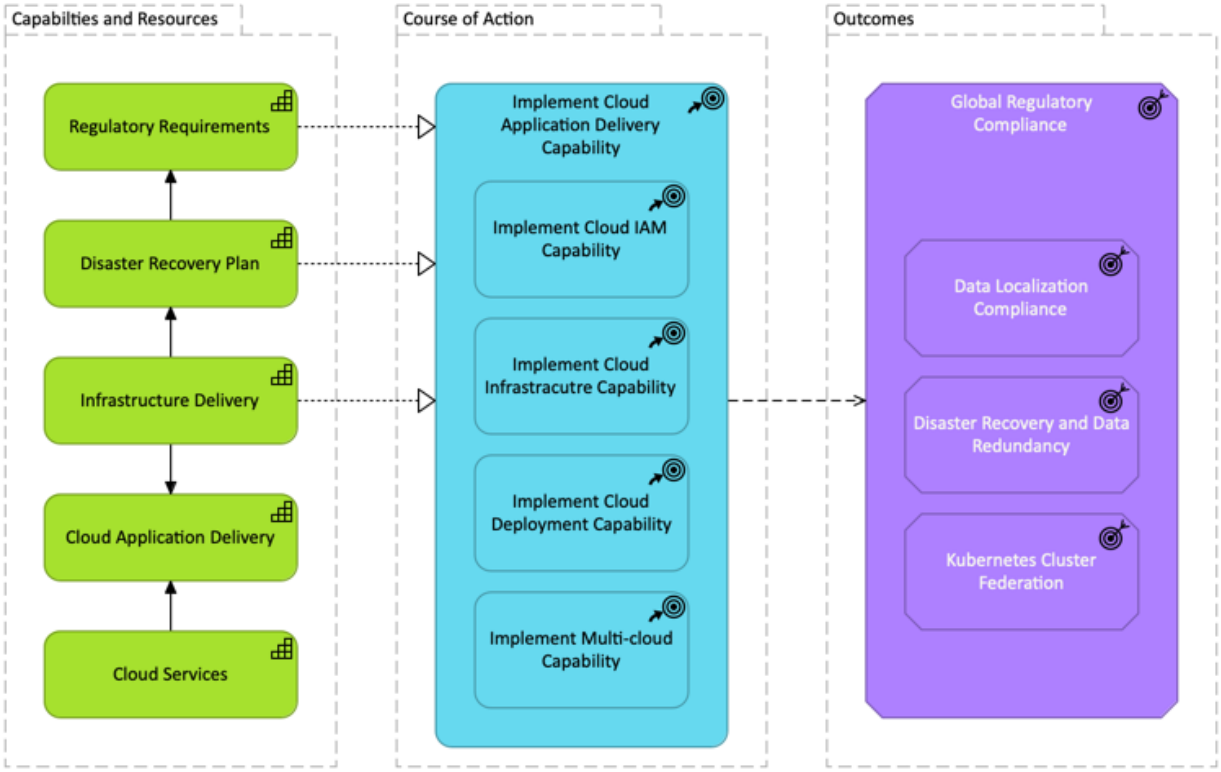


Figure 11. Strategy View: Global Regulatory Compliance. Source: (Band and Kennedy 2017, 18).

While *Increased Customer Trust* requires the *Information Security and Privacy* goal, the target does not, in and of itself, **Increase** Customer Trust. As ArchiSurance must focus attention on data sovereignty (Cole 2019), the enterprise architect may suggest a principled, outward-facing stance to “localize all customer data everywhere.”

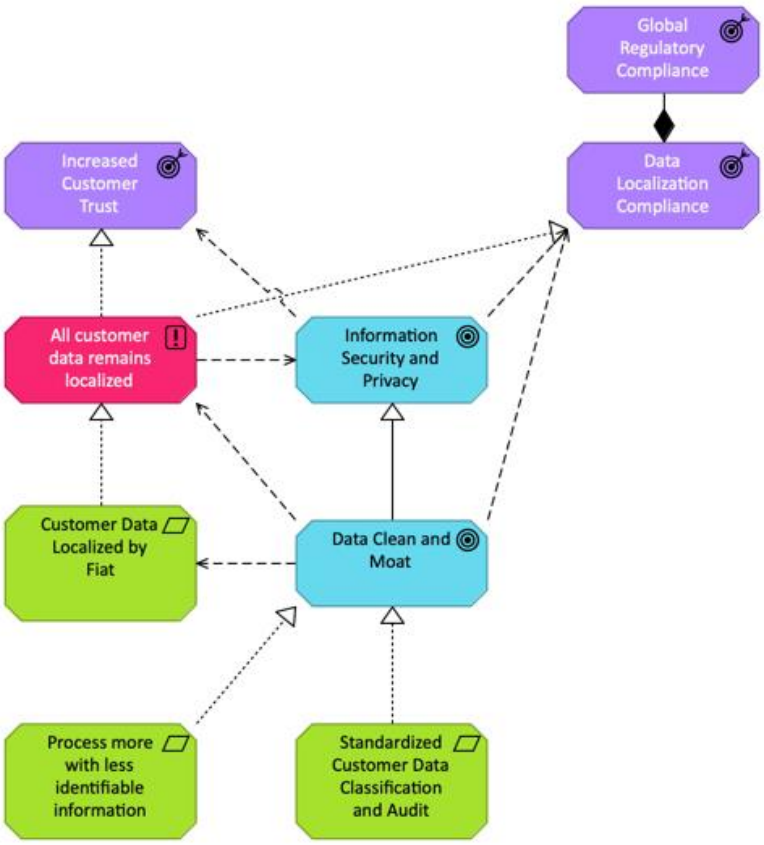


Figure 12. Strategy View: Global Regulatory Compliance. Source: (Band and Kennedy 2017, 18).

Figure 12 describes the *Increased Customer Trust* target as it relates to *Information Privacy* and *Global Regulatory Compliance*. The *Information Security and Privacy* goal is achievable, however the *Data Clean and Moat* goal is a specialized form of *Information Security and Privacy*.

The vision communicates that before realizing *Increased Customer Trust* and *Data Localization Compliance,* the following requirements must be met.

- **Process more with less identifiable information**: explore potentiality to process data—for example, AI—outside country borders, as it relates to non-identifiable data.

- **Standardized Classification and Audit**: an interface to migrate data between clouds with assurance.
- **Customer Data Localized by Fiat**: to possess confidence in the ability that all customer data is known, accessible, and delete-able.

Thus, ArchiSurance must complete the *Data Clean and Moat* goal to achieve an *Outsourced Claims Processing* capability in Australia.

Business Layer

Business Architecture: Case Study Analysis

The Business Architecture provides context for the Data, Applications, and Technology Architectures. The enterprise architect modelled the following viewpoints and diagrams to realize ArchiSurance's Business Architecture.

- **Organization View**: describes the organization of an enterprise, department, network of companies, and the like.
- **Capability Map**: displays existing organizational capabilities.
- **Business Functions Viewpoint**: describes relationships, information flow, redundancies, and so on between required business resources and competencies.
- **Business Process Viewpoint**: breaks down the steps taken to achieve particular business processes.
- **Requirements Realization Viewpoint**: visualizes the core elements required to realize the Architecture vision, such as business actors, business services, business processes, applications services, and so on.
- **Capabilities Gap Analysis**: identifies the missing pieces between the baseline and target viewpoints.
- **Resource Map Viewpoint**: displays a structured view of resources to achieve the Rationalization and Digital Customer Intimacy Strategy

- **Resource Realization Viewpoint**: describes how the elements in the *Resource Map Viewpoint* are realized in the Business, Information System, and Technology Architectures.

  (Jonkers et al. 2016)

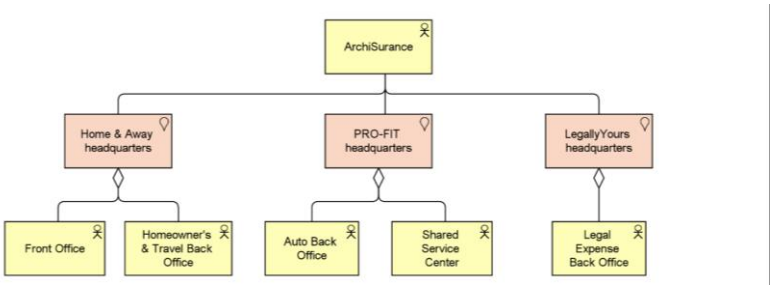
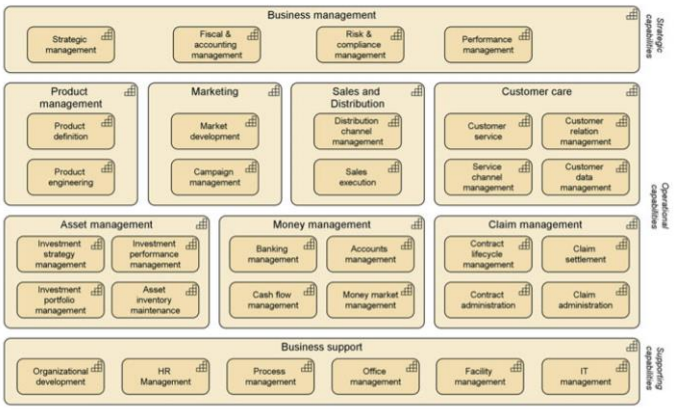
As part of the Architecture Vision, the *Digital Customer Intimacy Strategy* requires business architecture changes. In this case, the enterprise architect must suggest a capability investment in:

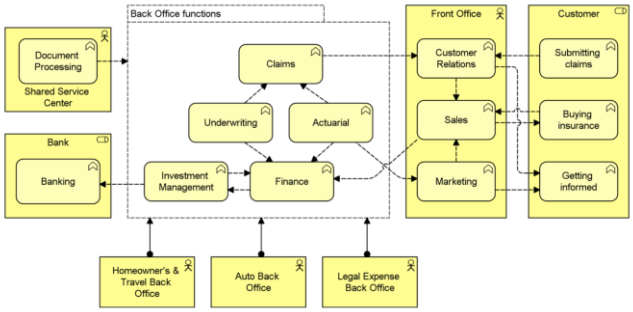
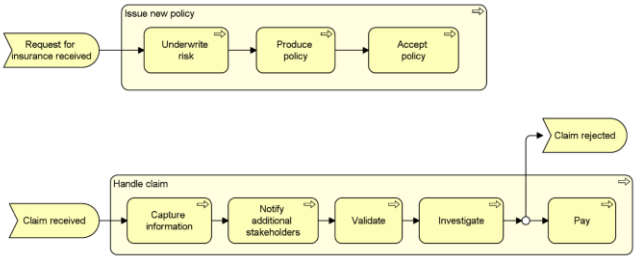
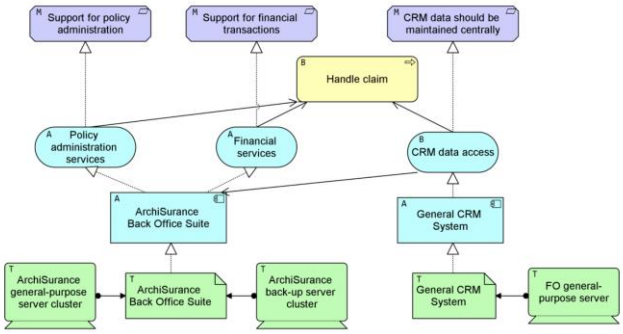
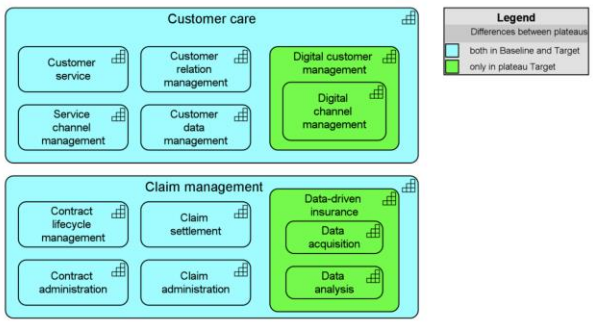
- personnel who possess DX experience & knowledge
- smart devices & sensors
- improved customer data acquisition

Table 5 includes a Capability Gap Analysis, which affects ArchiSurance's *Customer Care* and *Claim Management* strategies. In order to meet ArchiSurance's strategic ends, the enterprise architect must recommend a capability investment in *Digital channel management*, *Data acquisition*, and *Data analysis*. In addition, Table 5 presents details about the organization's structure, the shared service center, capability changes, and relevant model view examples.

Business Architecture: Key Factors

Organization Structure	● shared front-office leveraged as multi-channel contact center for sales and customer service ● three separate back-offices remain siloed ● Shared Service Center (SSC) established for document processing

Shared Service Center	• central document repository • automated document workflows • performs all scanning, printing, and archiving for legally binding documents • hosts trained personnel and equipment to perform front-office functions
Capability Changes	• Digital channel management • Data acquisition • Data analysis
Organization View	
Capability Map	

Business Functions View (Baseline)	
Business Process View (Baseline)	
Requirements Realization View	
Capabilities Gap Analysis	

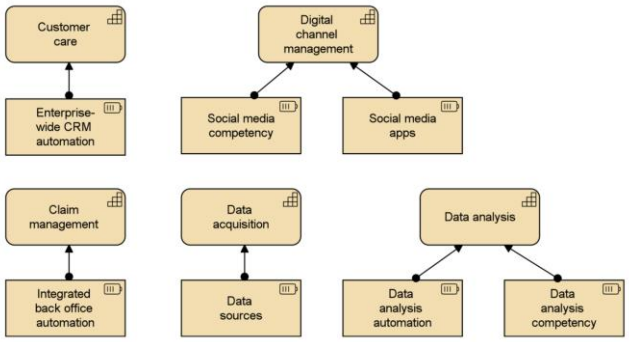
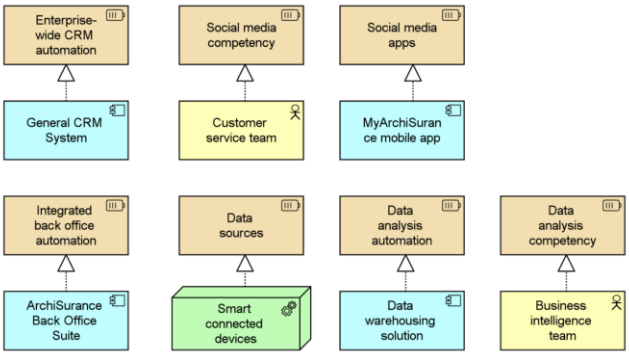
Resource Map View (Target)	
Resource Realization View (Target)	

Table 5. Phase B: Business Architecture Key Factors. Source: (Jonkers et al. 2016).

Business Architecture: Security

The enterprise architect's Business layer goals include business-level trust, risk, and controls. These do not include IT systems (The Open Group 2 2019, 20). The following list displays Business Architecture artifacts, which an enterprise architect may leverage.

- Security Policy Architecture
- Security Domain Model
- Trust Framework
- Risk Assessment
- Business Risk Model/Risk Register
- Applicable Law and Regulation Register
- Applicable Control Framework Register

Figure 13 displays a nested Capability Map view, which drills into ArchiSurance's initial model (Table 5). This displays suggested target security capabilities (Davis 2013).

Figure 13. Capability Map: Security (Target). Source: (Davis 2013).

Figure 14 displays a Risk Analysis of the ArchiSurance *Back office suite* and the *General CRM System*. The model analyzes business processes associated with updating customer information. The view displays how a hacker can exploit weak authentication as a means to make private information public and thwart the *Information Security and Privacy* goal.

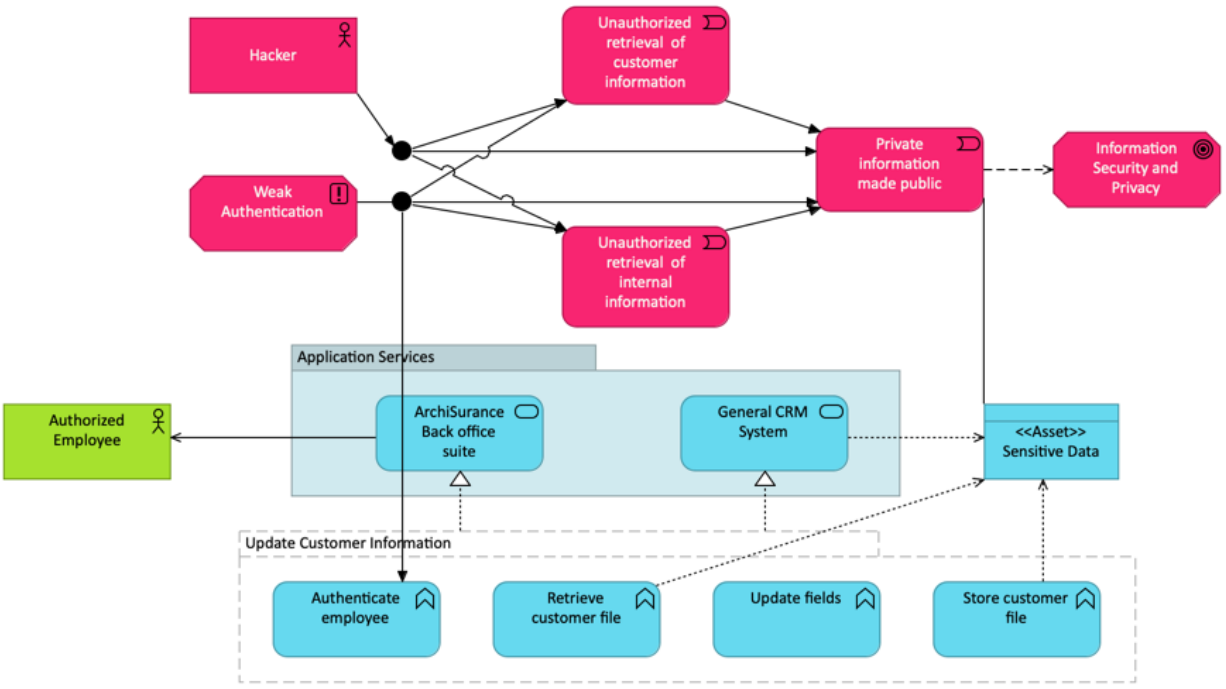


Figure 14. Risk Analysis View: Back Office Suite and General CRM System. Source: (Lankhorst 2018).

Data Clean and Moat

Figure 15 displays a Business Functions View with the *Data Clean and Moat* application service entry points. The model aims to identify the types of data that can leave regulatory territories. This paper does not intend to research claims processing, and does not argue the reference architecture's validity as it relates to claims processing. The model contends that data from particular business functions may still find a processing home outside regulatory compliance zones.

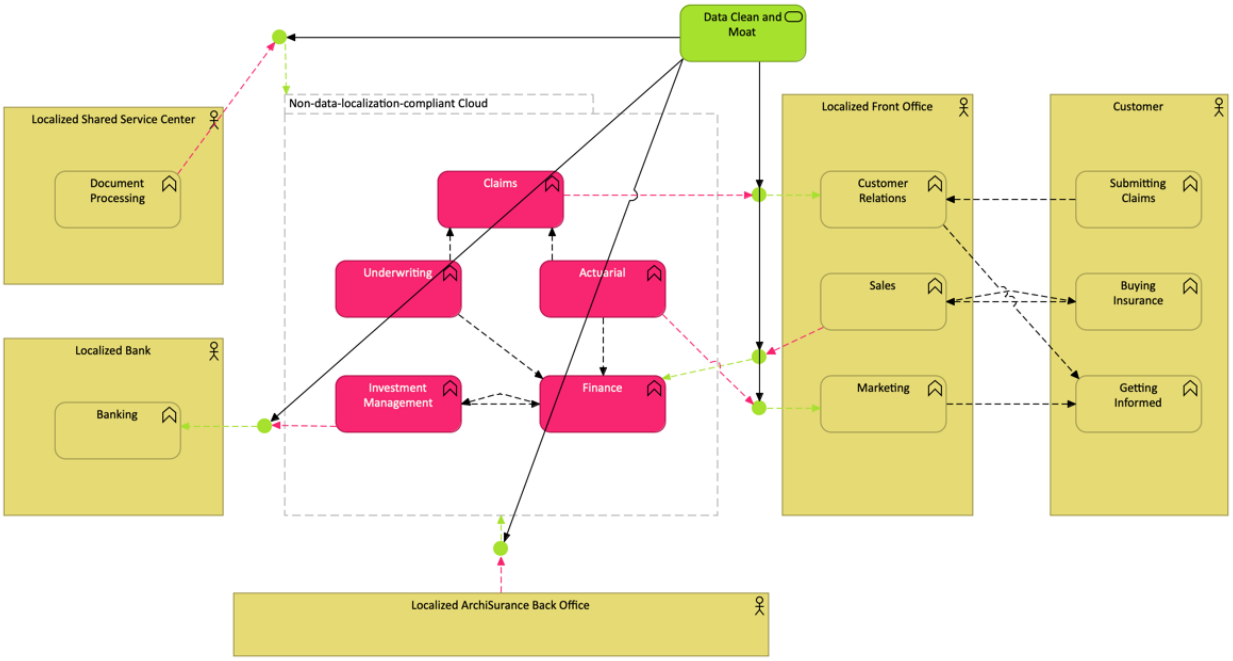


Figure 15. Business Functions View: Data Clean and Application Service. Source: (Jonkers et al. 2016).

Machine Learning Capabilities

Figure 16 displays Machine Learning (ML) pipeline capabilities. ML is a subset of AI, and the writing may leverage these identifiers interchangeably. Cloud providers offer resources that can fill AI capabilities (Amazon Web Services 1 2020). The initial plan assumes that standardized ArchiSurance applications handle both *Logging/Monitoring* and *Computer Environment Specifications*.

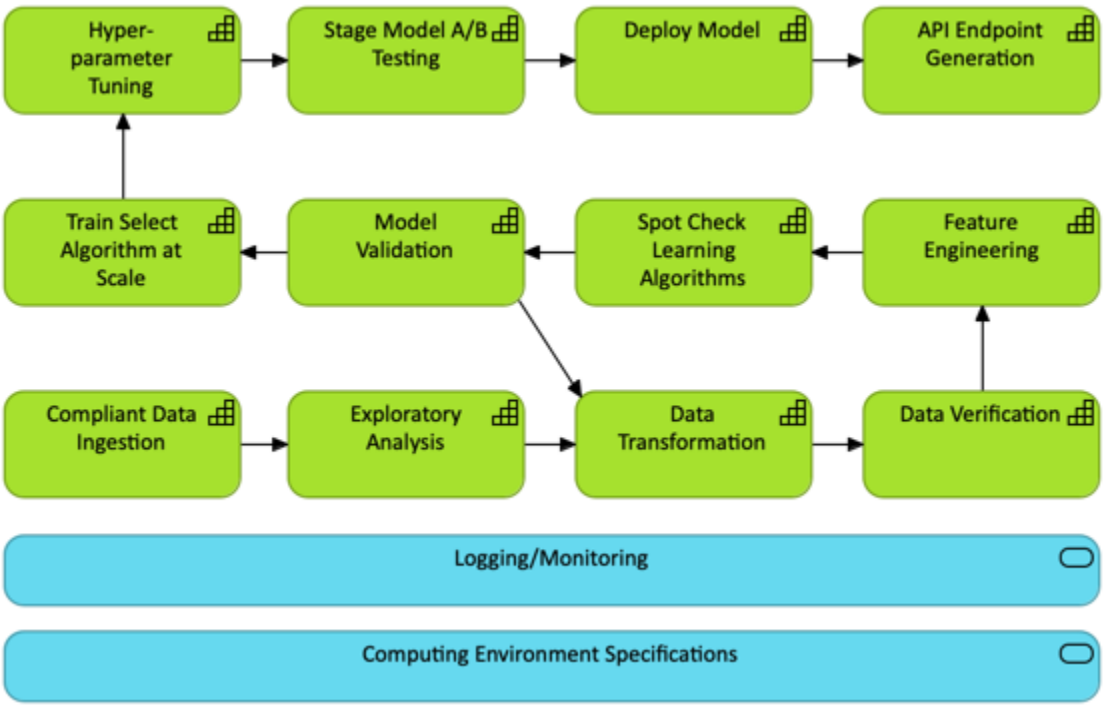


Figure 16. ML Pipeline Capability View. Source: (Bisong 8.46).

Figure 17-19 displays resources that trigger the target ML Pipeline capabilities. The diagrams provide cloud ML services from Google Cloud, AWS, and Azure respectively. The listings are not exhaustive. The images demonstrate how each cloud provider offers multiple services and platforms that meet resource needs for each ML pipeline capability. In addition, each IaaS offers an ML platform, which may provide enough usability for specific AI functionalities. Given this observation, the remaining reference architectures may leverage services from Google Cloud, AWS, or Azure, and the writing assumes similar architectures achievable across IaaSs.

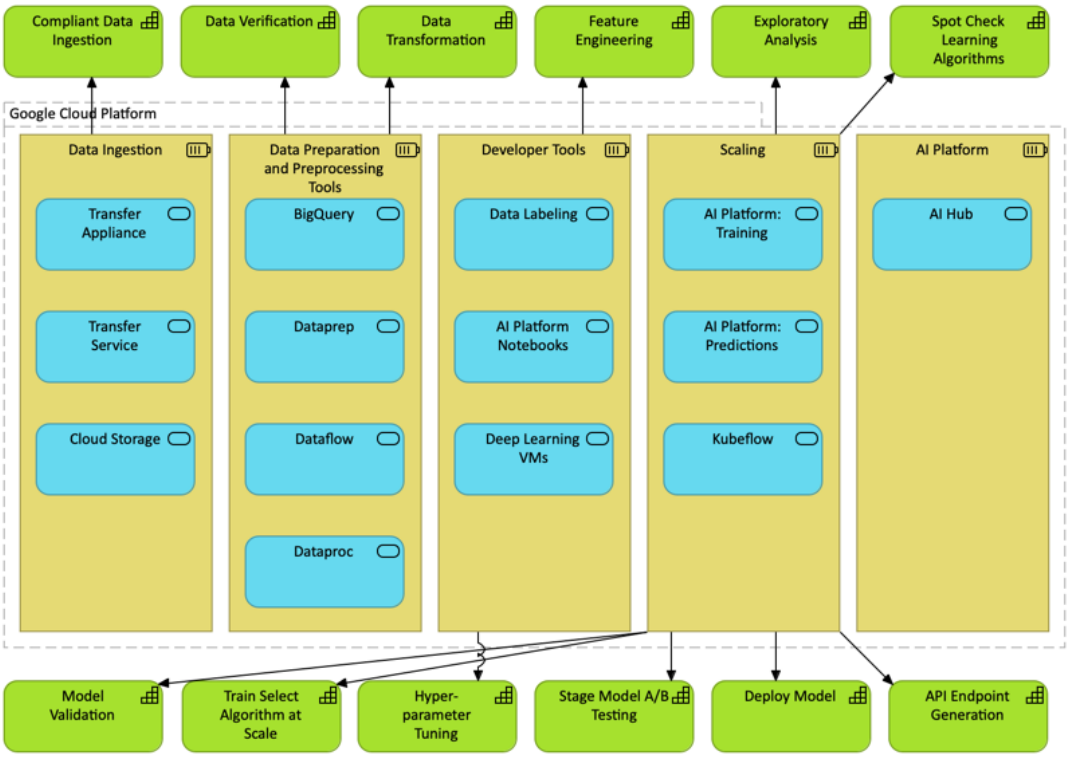


Figure 17. Resource Realization View: Google Cloud Platform. Source: (Vergadia 2020).

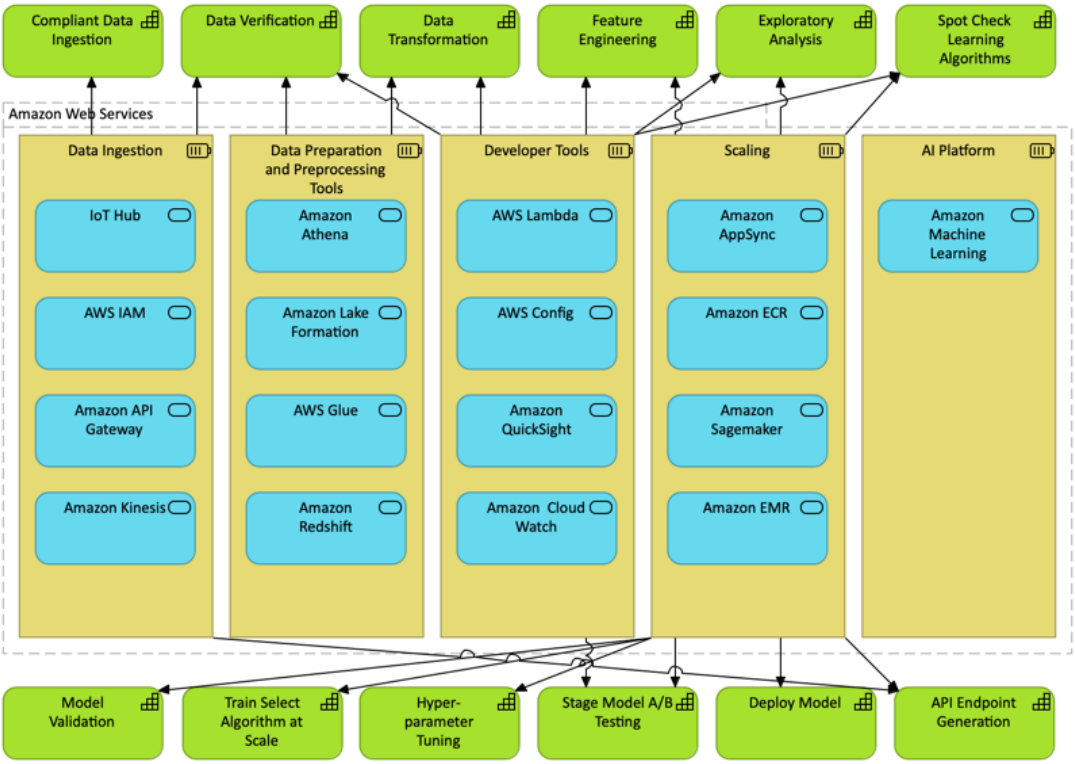


Figure 18. Resource Realization View: AWS. Sources: (Amazon Web Services 3 2020).

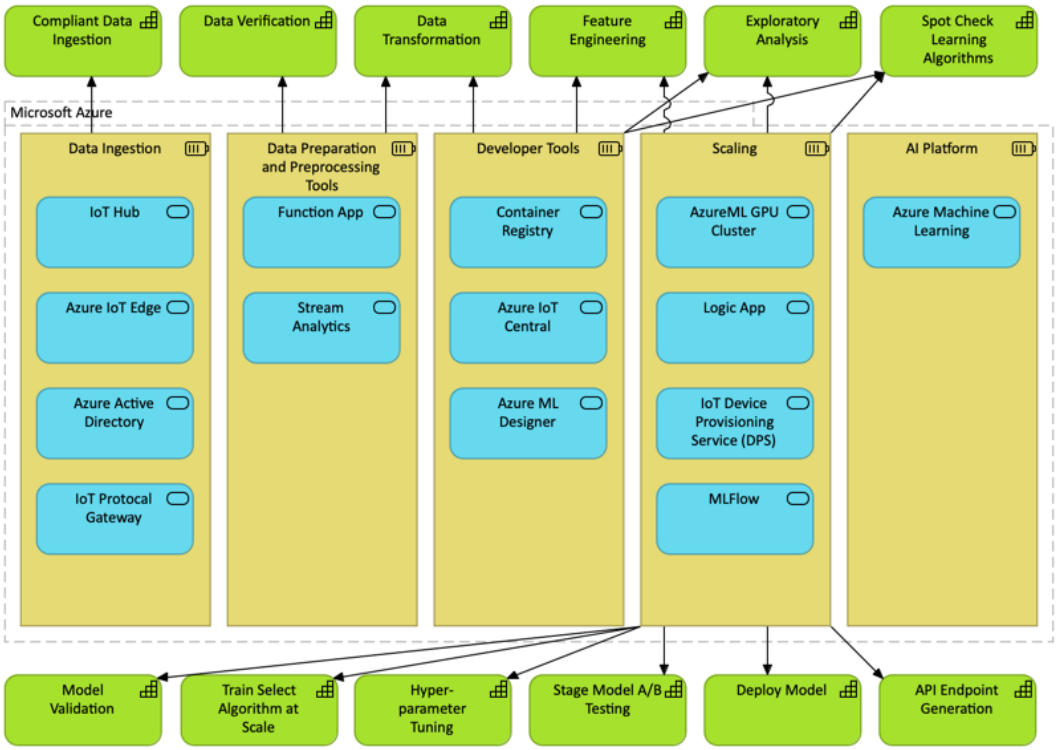


Figure 19. Resource Realization View: Azure. Source: (Microsoft 2019).

Application Layer

Information Systems Architecture: Case Study Analysis

The first part of the Information Systems Architecture Phase involves Applications. Archisurance's EA outlines the following ArchiMate® viewpoints and diagrams.

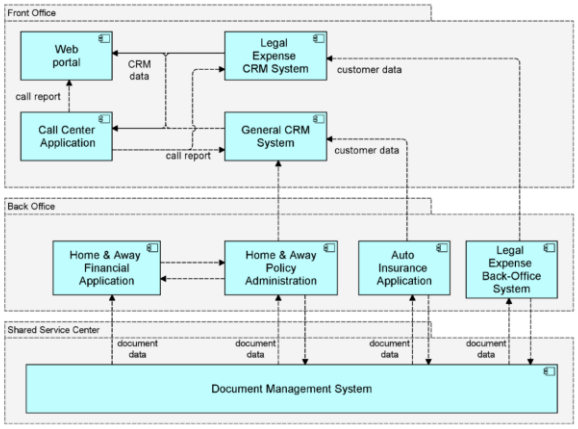
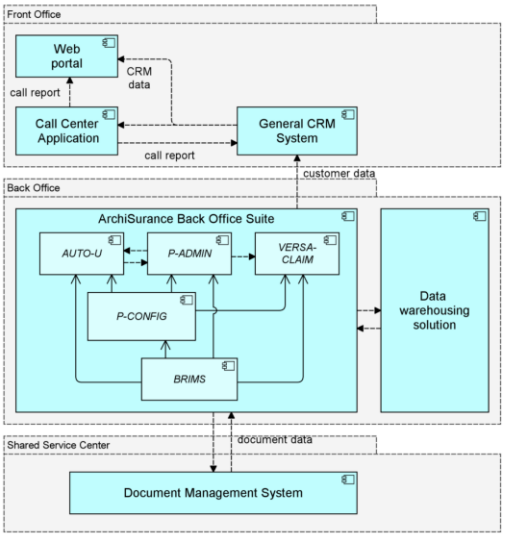
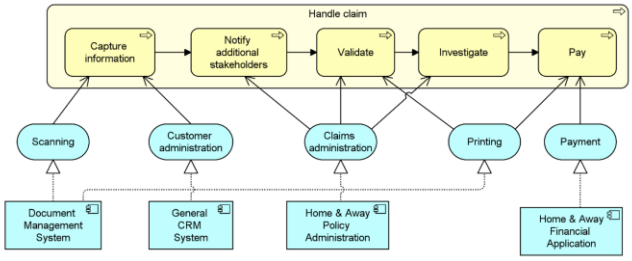
- **Application Cooperation Viewpoint**: displays the relationships between application information flow or relationships between services they offer and use.
- **Application Usage Viewpoint**: describes how applications support other business processes and their relationship to other applications.
- **Application Behavior Viewpoint**: displays behavior such as acquisition of data, to the business processes, to the functions, and so on.
- **Gap Analysis**: displays difference between baseline and target viewpoints

(Jonkers et al. 2016)

Table 6 outlines the Application rationalizations, changes to the Application Architecture, gap analysis, and several Application Architecture viewpoints created by the enterprise architect.

Application - Information Systems Architecture: Key Factors

Rationalization	● Board desires a common set of products and customer-focused applications to reduce costs ● Home & Away has not upgraded policy administration and financial application packages ● PRO-FIT and Legally Yours still uses pre-merger monolithic applications
Application Changes	● *AUTO-U*: automated underwriting system that generates proposals and policies ● *P-ADMIN*: replaces policy administration functionality of the Home & Away, Auto, and Legal Expense legacy systems ● *VERSA-CLAIM*: replaces claims processing functionality of the Home & Away, Auto, and Legal Expense legacy systems ● *P-CONFIG*: product configurator management system ● *BRIMS*: a Business Rule Management System (BRMS) ● General CRM used by the entire organization
Gap Analysis	Application End of Life (EOL): ● separate back-office applications ● separate Legal Expense insurance CRM system Additions: ● back-office application suite ● data warehousing solution

Application Cooperation View (Baseline)	
Application Cooperation View (Target)	
Application Usage View	

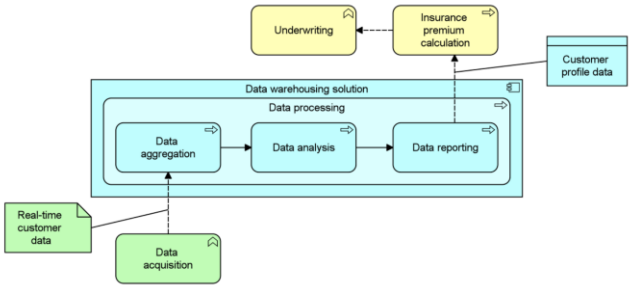
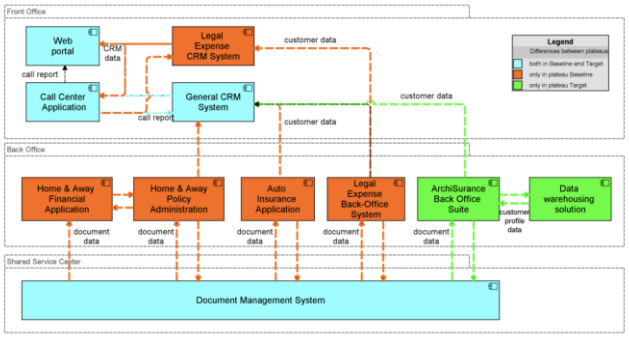
Application Behavior View	
Gap Analysis	

Table 6. Phase C: Application - Information Systems Architecture Key Factors. Source: (Jonkers et al. 2016).

Data represents the second part of the Information Systems Architecture Phase. The enterprise architect created the following views to communicate ArchiSurance's data architecture.

- **Information Structure Viewpoint**: shows structure of information used in the organization, business process, application, data types, class structures, and the like.
- **Data Dissemination Diagram**: displays relationship between data, business service, and application components.

(Jonkers et al. 2016)

Table 7 defines *Data Architecture* and illustrates the *Phase C: Data* views.

Data - Information Systems Architecture: Key Factors

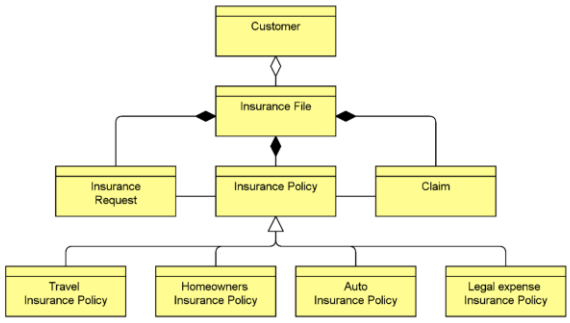
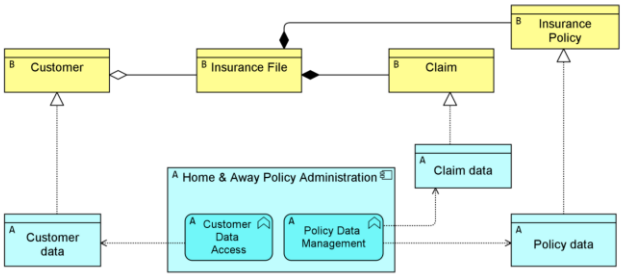
Data Architecture	describes relationships between conceptual business objects and logical data objects
Information Structure View	
Data Dissemination Diagram	

Table 7. Phase C: Data - Information Architecture Key Factors. Source: (Jonkers et al. 2016).

Information Systems Architecture: Security

In the Information Systems Architectures Phases, the enterprise architect must identify functional security services and their classifications (The Open Group 2 2019, 20). Information Systems Architecture-specific artifacts include *Security Services Catalog*, *Security Classification*, and *Data Quality*.

Figure 20 displays the ArchiSurance Application Architecture with incorporated target security architecture.

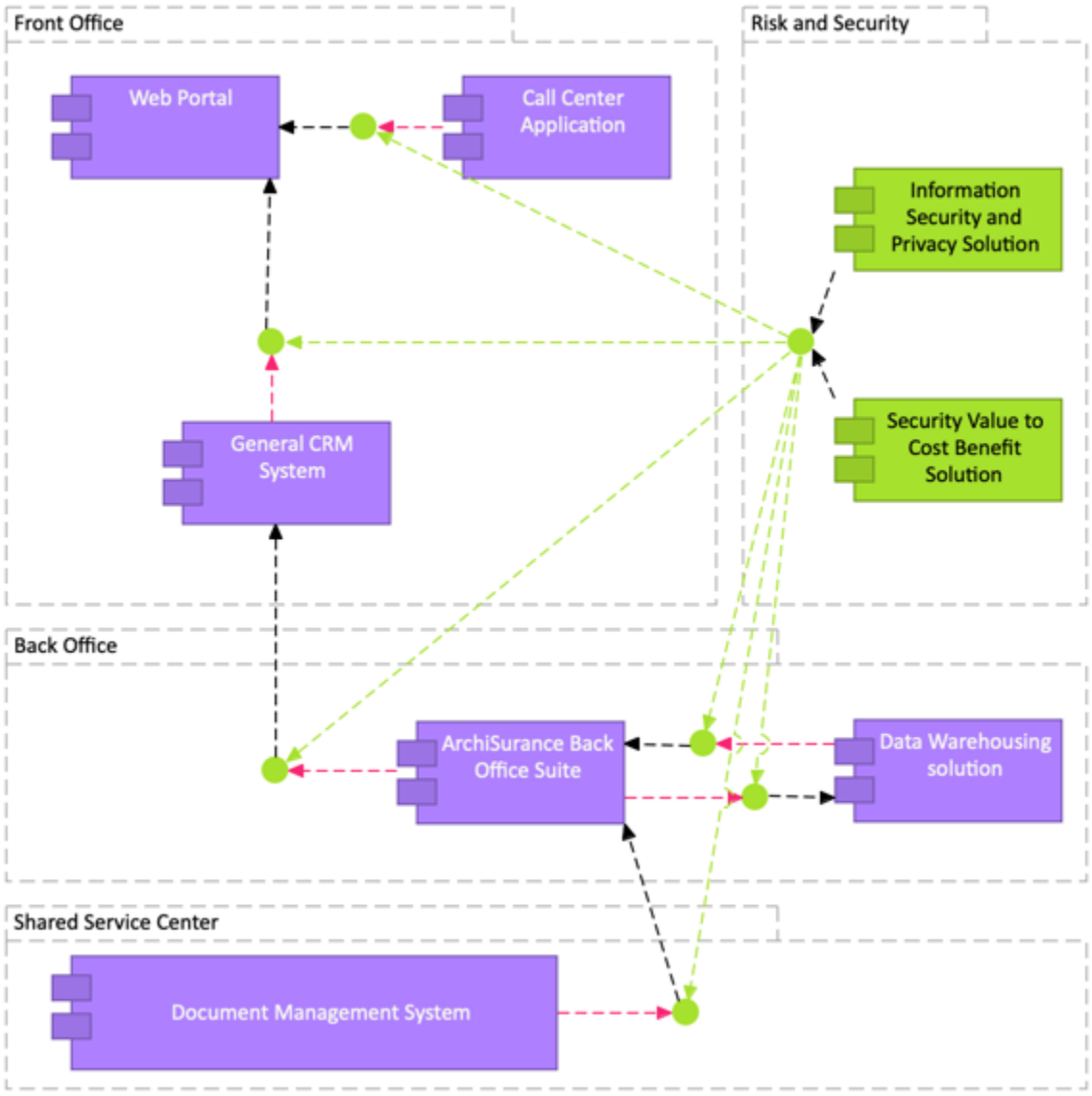


Figure 20. Application Architecture View: Risk Mitigation and Security Target.

Standardized Cloud Architecture

In order for outsourced, specialized organizations to access/process ArchiSurance data across the globe, an enterprise architect may decide that data migration must abide by a standardized cloud architecture. Figure 21 describes a Capability Maturation View, which shows the *Target Cloud Architecture* necessary to realize an *Outsourced Claims Processing* Capability

(Band and Kennedy 2017, 19). These include Identity and Access Management (IAM), Infrastructure as Code (IaC), and Continuous Delivery Continuous Deployment (CI/CD).

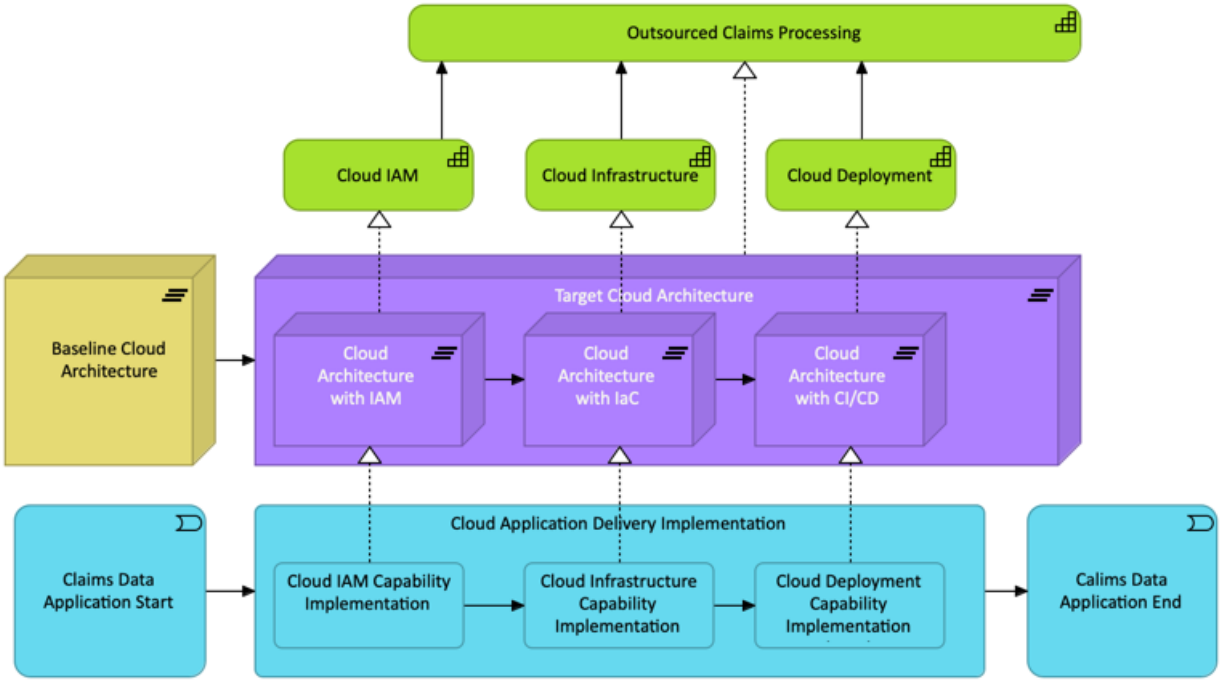


Figure 21. Capability Maturation View: Outsourced Claims Processing. Source: (Band and Kennedy 2017, 19).

IoT Application Cooperation

The *Digital Customer Intimacy Strategy* requires the collection and analysis of IoT data. Figure 22 shows how a licensed PRO-FIT partner may leverage AWS to send ArchiSurance data and connect IoT services. The IoT Application Cooperation view displays magenta colored *service* nodes that represent standardized components. These can be leveraged as part of the *Global Regulatory Compliance* Target.

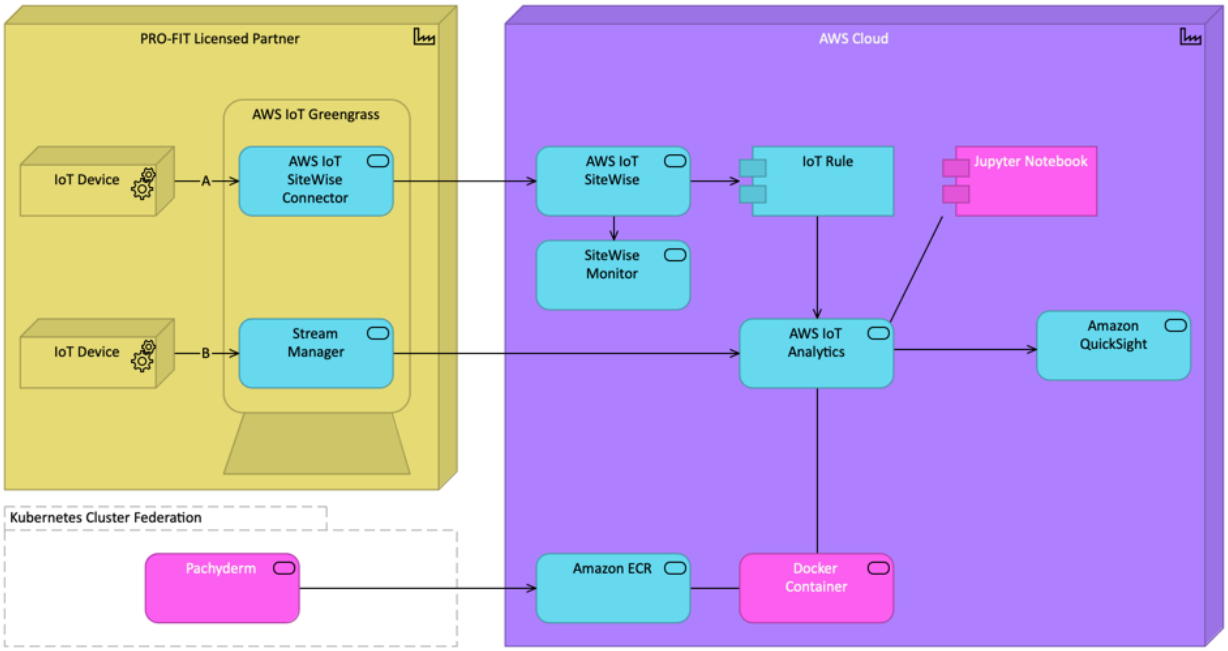


Figure 22. IoT Application Cooperation View: AWS. Source: (Amazon Web Services 1 2020).

Pachyderm

Pachyderm is a data science platform that touts an ability to version control AI datasets, models, and so on. This data lineage can provide an AI audit.

> "Data provenance creates a complete audit trail that enables data scientists to track the data from its origin to the final decision and make appropriate changes that address issues. With the adoption of GDPR compliance requirements, monitoring data lineage is becoming a necessity for many organizations that work with sensitive data" (Pachyderm 1 2020).

Data lineage alteration is becoming an investment (Chan 2020) and should help prepare ArchiSurance for current and future regulatory constraints.

In addition, Pachyderm runs on containers, Kubernetes, and promises an ability to connect multi-cloud ML pipelines. Some believe that Pachyderm may replace Hadoop (Naik 2017). Pachyderm is not the only AI platform that can connect multiple IaaS ML pipelines (Kubeflow n.a.), but the data provenance aspect aims to serve ArchiSurance's foundation for execution—by attempting to mitigate future regulatory constraints.

Technology Layer

Technology Architecture: Case Study Analysis

The "Enterprise Architect Paradox" involves common issues that an organization's EA may face. These include multiple expectations and problems, which generally align with Gartner's ten EA pitfalls (Gartner 2009). For example, an enterprise architect may fail to communicate how an infrastructure built on microservices and Kubernetes could trigger digital transformation. I argue the following viewpoint types can provide DX teams a valuable service, which may help avoid paradoxical misconceptions.

The technology architecture components of an Architecture Roadmap can be classified as follows:

- Environments and Location
- Expected Processing Load and Distribution
- Physical Network Communications
- Hardware and Network Specifications

(Behrens 2020)

In order to plan and communicate the Technology Architecture, the enterprise architect modelled the following ArchiMate® views.

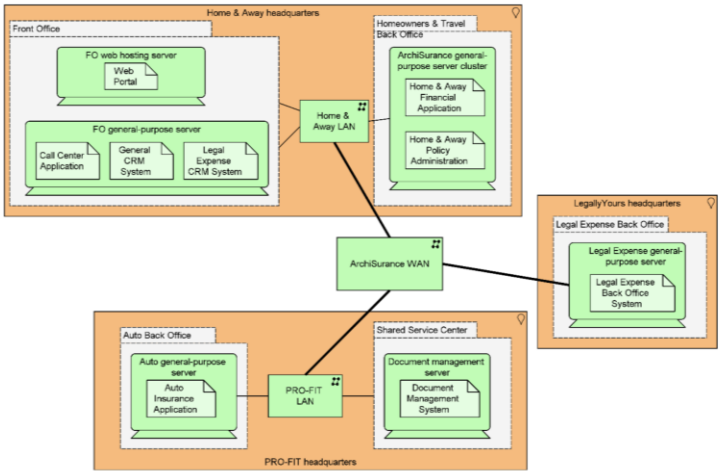
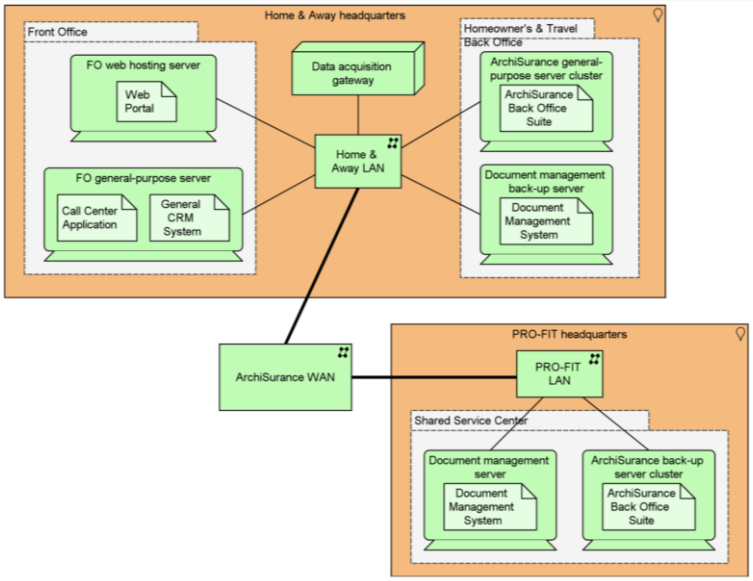
- **Infrastructure Viewpoint**: shows the software and hardware infrastructure elements, which support the Application Layer.
- **Physical Viewpoint**: displays data acquisition from physical hardware to the application entity contained in the Application Layer.
- **IoT Device Service**: demonstrates information flow in a microservices architecture to realize entities in the Application Layer.
- **Technology Architecture: Gap Analysis**: shows differences between the baseline and target infrastructures.

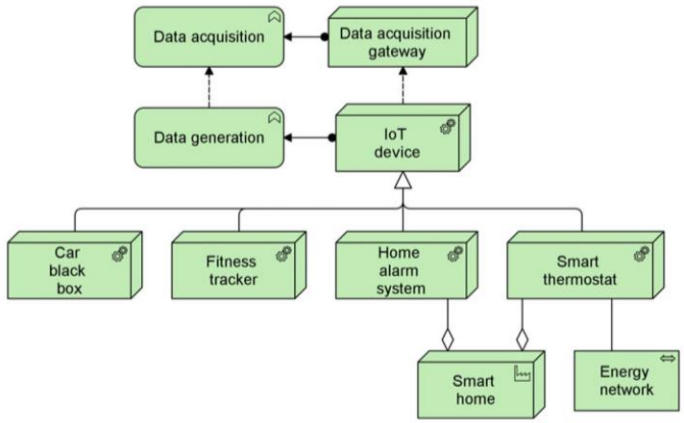
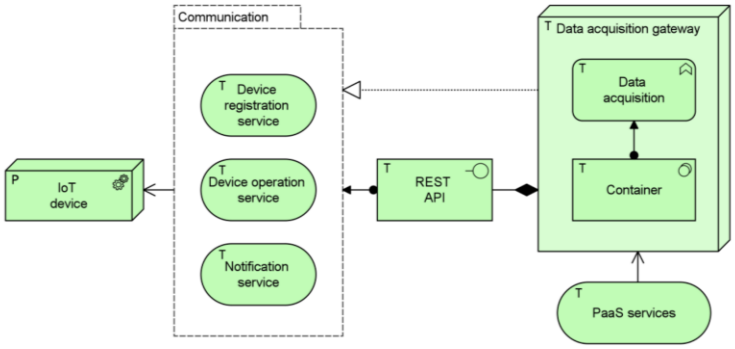
(Jonkers et al. 2016)

Table 8 contains a *Physical Viewpoint*, which shows IoT objects that were included in the *Digital Customer Intimacy Strategy* (also displayed in Table 1). In addition, Table 8 describes the Technology Architecture gap analysis and displays ArchiMate® model views.

Technology Architecture: Key Factors

Gap Analysis	Infrastructure EOL: ● separate general-purpose back-office servers Additions: ● Home & Away server cluster to become central ArchiSurance back-office service cluster ● SSC back-up server cluster ● In Home & Away back-office, back-up document management server ● back-office suite and document management system replicated on their respective main servers and back-up servers

Infrastructure Viewpoint (Baseline)	
Infrastructure Viewpoint (Target)	

Physical Viewpoint	
IoT Device Service (Target)	

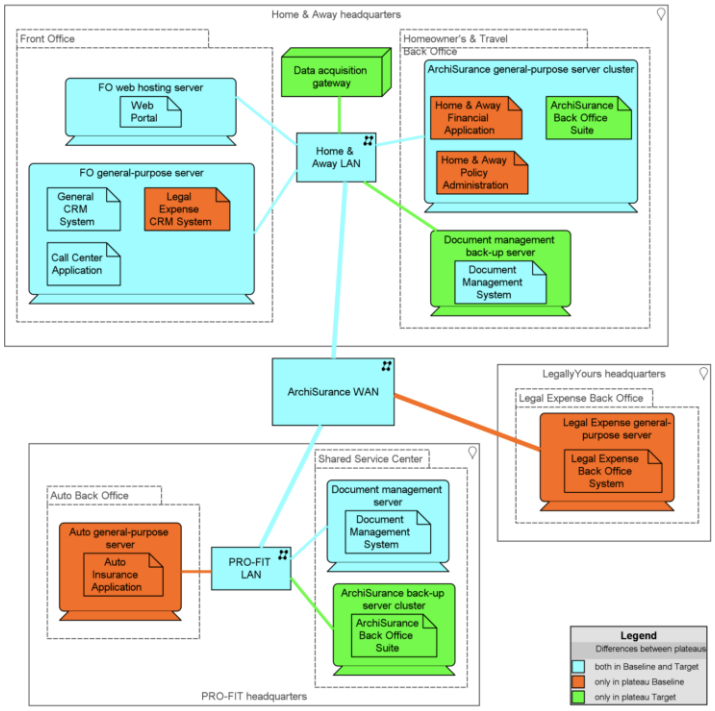
Gap Analysis	

Table 8. Phase D: Technology Architecture Key Factors. Source: (Jonkers et al. 2016).

Technology Architecture: Security

If the Technology Architecture incorporates earlier security phases, specific Technology Layer viewpoints may not be necessary. However, a stakeholder may request a view, which describes all security technology components and how they interconnect (The Open Group 3 2019, 20).

Figure 23 displays an Information System Security Risk Management (ISSR) Domain Model (Mayer n.a.), which an enterprise architect can leverage in such a case.

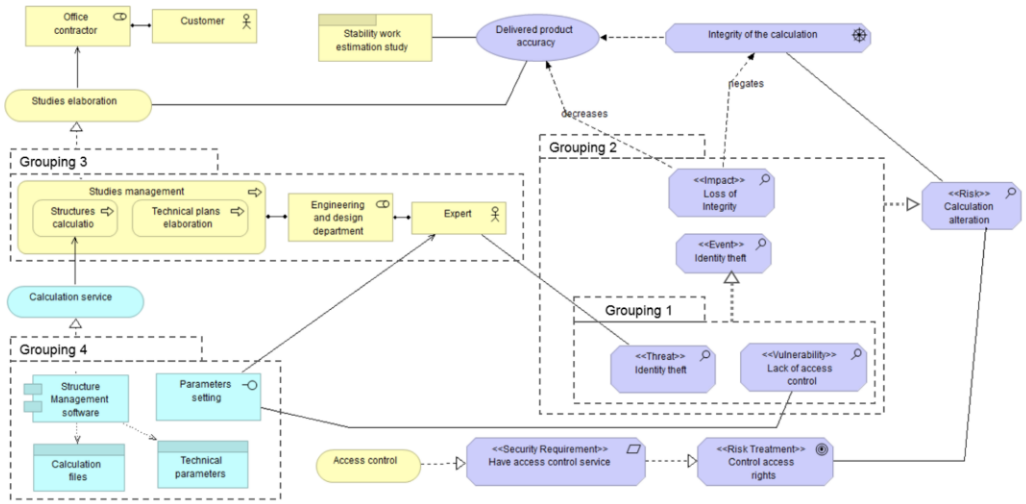


Figure 23. Example ISSRM Domain Model Represented with the ArchiMate® Language. Source: (Band et al. 2019, 37).

Multi-Cloud Regulatory Strategy

Figure 24 displays a Physical View, which shows the *Multi-cloud Regulatory Strategy*. The view displays three examples of IaaS providers that can comply with specific regulatory territories. In addition, the view demonstrates how *Outsourced Claims Processing* data/processes can connect with the Australia organization. Finally, as ArchiSurance heads towards a cloud-first strategy, it shows how the Shared Service Center at *PRO-FIT Headquarters* is scheduled for end of life.

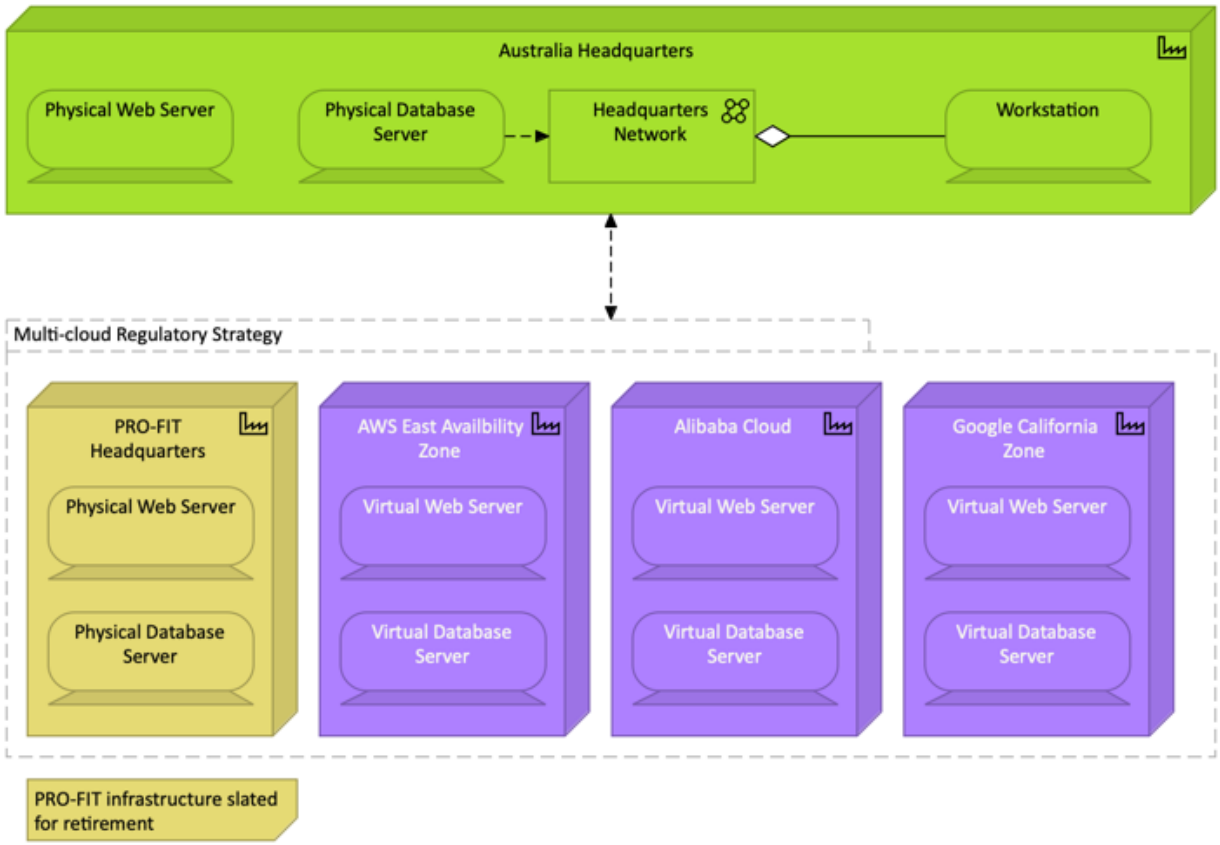


Figure 24. Physical View: Multi-cloud Regulatory Strategy. Source: (Band and Kennedy 2017, 20).

Implementation & Migration

Transition Architecture: Case Study Analysis

The Transition Architecture extends TOGAF® with *Opportunities & Solutions* and *Migration Planning* phases. From the jump, ArchiSurance did not possess adequate resources to execute the *Digital Customer Intimacy Strategy*. The Transition Architecture creates a strategy to achieve longer-term goals.

The enterprise architect leveraged the following ArchiMate® views and diagrams to plan a roadmap, which achieves ArchiSurance's post-merger EA.

- **Migration Viewpoint**: specifies the transition from an existing architecture to a desired architecture.
- **TOGAF® Project Context Diagram**: displays the migration target in relation to the project context.

(Jonkers et al. 2016)

Table 9 describes the roadblocks that caused ArchiSurance to postpone projects, the transition plan to migrate from baseline to target, and views created by the enterprise architect.

Transition Architecture: Key Factors

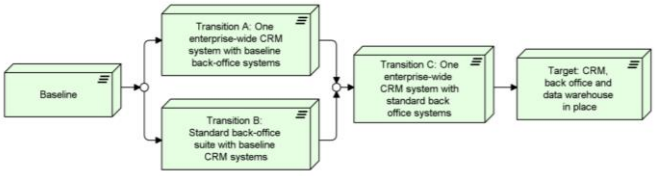
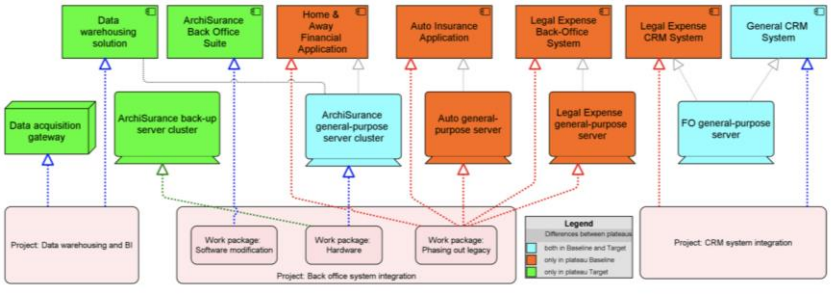
Roadblocks	Not enough resources for: ● back-office system standardization ● CRM System Integration
Transition Sequence	● **Transition A**: One CRM system with baseline back-office systems ● **Transition B**: Standard back-office suite with baseline CRM systems ● **Transition C**: One CRM system with standard back-office suite ● **Target**: CRM, back-office, and data warehouse in place
Migration Viewpoint	
TOGAF® Project Context Diagram	

Table 9. Phase E & F: Transition Architecture Key Factors. Source: (Jonkers et al. 2016).

Opportunities and Solutions: Security

An enterprise architect must leverage the Opportunities and Solutions Phase to ensure the following (The Open Group 2 2019, 20).

- Stakeholder risk and security concerns are addressed
- Security and risk value addresses business goals and drivers
- Reusable security services are identified and verified

Assurance Migration

The migration process itself needs to be secured and its risks mitigated. For example, an enterprise architect should always include regression planning to pull out of a failed migration (The Open Group 2 2019, 20).

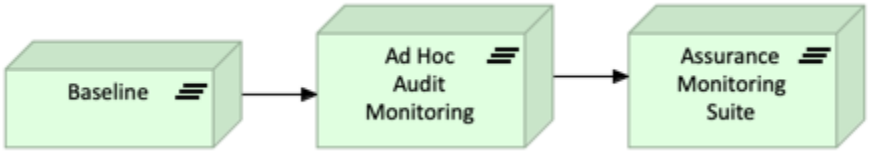


Figure 25. Migration View: Assurance.

Figure 25 displays a Migration view that transitions from the baseline security assurance capabilities to the ultimate *Assurance Monitoring Suite*. As more auditing functionality comes online, a transition solution fills the gap.

Global Expansion and Further Research

The research did not include India and China data regulations and compliance analysis. It is not clear if ArchiSurance can expand into India or China, and there may be good reasons not

to (Gallagher 2020). However, the enterprise architect may communicate a roadmap, which displays feasibility and sets expectations by visualizing a chronological migration plan.

Figure 26 demonstrates a Migration View, which shows key milestones and recommends where those milestones land in flow/chronological relation.

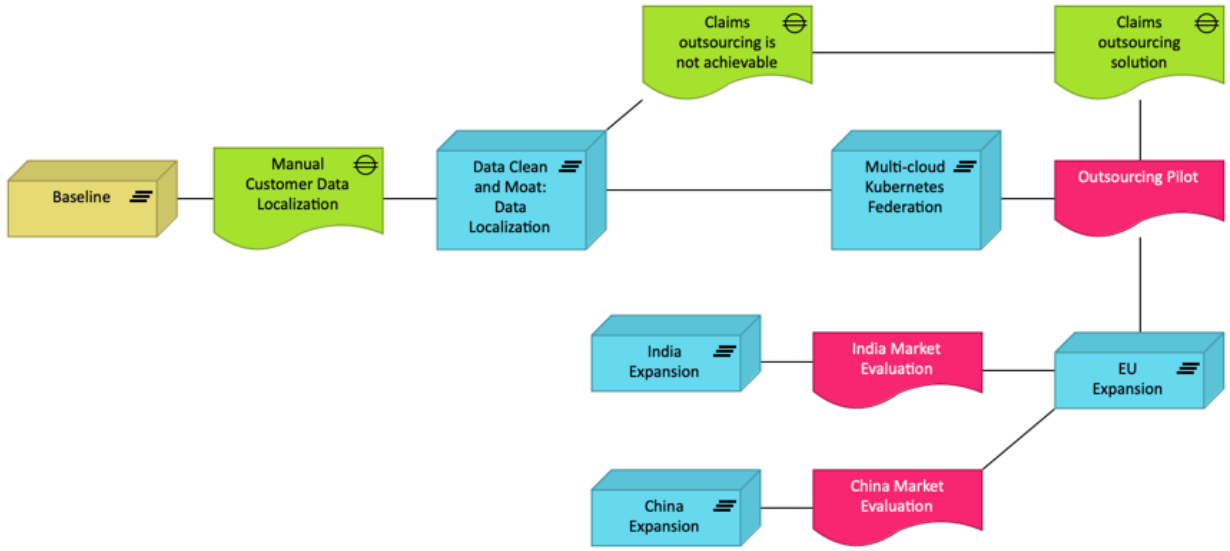


Figure 26. Migration View: Global Expansion.

Conclusion

The writing analyzed the ArchiSurance case study, and further evolved the EA to realize a global and AI-driven enterprise. The paper demonstrated the ArchiMate® Specification and TOGAF® framework. It provided reference architectures and outlined how ArchiSurance continued digital transformation by basing its vision on principles, such as *Security*, *Multi-cloud compliance adaptability*, and *All customer data remains localized*. These principles served the *Customer Satisfaction*, *Stakeholder Satisfaction*, and *Risk Mitigation and Security* drivers. The

writing provided a comprehensive analysis and extension to the ArchiSurance case study contexts.

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