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SG5015 Enterprise Architecture Assignment

SGLines

Enterprise Architecture Blueprint

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Preliminary

Requirement Management

Statement Analysis

The requirements goals for SG lines are broad and lack of information. The EA program is kick started with initial requirements gathering and fact analysis done by the team member.

ID	Reference	Statement	Concern	EA Domain	State	Action
SA 1	S1, P1	SGLines work with international partners to cover route segments in countries where SGLines do not Operate		BA	Baseline	FYI
SA 2	S1, P2	Shipping vessel and containers are manage globally through 2 different systems, VMS and CMS	lack of information flow	AA	Baseline	REQ
SA 3	S1, P3	Usage of Prediction Engine in CMS and ability to manual override the rules		AA	Baseline	FYI
SA 4	S1, P3	CMS is used to track bulk sales of empty containers at ports that primarily used for import so as to minimise the number of empties being shipped		BA,AA	Baseline	FYI
SA 5	S1, P3	CMS also manage the transfer of containers from SGLines' vessels to vessels belonging to third party companies and track these containers while transported by third parties		BA,AA	Baseline	FYI
SA 6	S1, P4	Different regional HQ , serve as main transshipment ports		BA	Baseline	FYI

SA 7	S1, P5	Separation of task of shipping vessels between regional and international routes		BA	Baseline	FYI
SA 8	S1, P5	Vessel on regional routes usually complete round trip within 1 or 2 days, while international will take around 5 to 10 days		BA	Baseline	FYI
SA 9	S1, P5	Container may be transferred across multiple transshipment ports	Lost/miss placed of shipping item	BA	Baseline	FYI
SA 10	S1, P6	Expected decline of 40% of revenue due to the global economic recession and lost business to competitors due to price competition		BA	Baseline	Problem
SA 11	S2, P1	SGLines work with local operators of tow-heads to transport containers and empties to the designated location		BA	Baseline	FYI
SA 12	S2, P1	Little corporate guidance on how to engage local tow-head operators and local offices negotiate own deals. Little corporate knowledge of cost of engagement of local tow-head operators, except for summary cost item	non standardisation approach for procurement of services	BA	Baseline	Problem

SA 13	S2, P2	SGLines work with port operators in the countries it ships from where they are responsible for optimizing loading, unloading and re-organization of containers pertaining to a shipping vessel and cranes		BA	Baseline	FYI
SA 14	S2, P2	Each port operator run own optimization algorithm for loading, unloading and re-organisation of shipping vessels	Poor space utilisation, longer loading and unloading times	BA	Baseline	Problem
SA 15	S2.P2	Most port operators prefer to work with shipping companies through cooperative computing	To optimize operations	BA	Target	REQ
SA 16	S3, P1	SGLines IT systems are primarily standalone	Lack of information sharing between systems	AA	Baseline	Problem
SA 17	S3, PT1	Sales is done by customer through RFQ or order placement to SGLines sales team, and quotation is sent by email, fax, or phone		BA	Baseline	FYI
SA 18	S3, PT1	Customer express the interest of ability to place order through internet, while larger customer prefer a sort of better interaction between their in-house system with SGLines		BA, AA, TA	Target	Problem

		system				
SA 19	S3, PT1	Loss of business when phone call were not answered because of staff absence	loss revenue	BA	Baseline	Problem
SA 20	S3, PT1	Viruses on the email attachment that crippled the office operations	Security issue	AA , TA	Baseline	Problem
SA 21	S3, PT2	Legacy SOS system is unsupported by vendor and do not have access to source code, thus unable to further enhance the functionality of SOS	Risk of breaking down and limitation to cater for business needs	BA , AA	Baseline	Problem
SA 22	S3, PT2	Sales summary is generated every month		BA, AA	Baseline	FYI
SA 23	S3, PT2	The need to access SOS system online		AA, TA	Target	REQ
SA 24	S3, PT2	Acceptance of quotation is done by EMAIL / Phone / Fax		BA	Baseline	Problem
SA 25	S3, PT3	Sales team call Order Processing Admin and passes the details of order or RFQ, and OPA will find out how fast the order can be fulfilled		BA	Baseline	FYI
SA 26	S3, PT4	Staff doubled as order processing administrator, in the event of unplanned absent, will cause significant delays for their customer and	Loss of revenue	BA	Baseline	Problem

		missed orders				
SA 27	S3, PT5	Administrator will use VMS to check vessel availability and enquire vessel schedule		BA	Baseline	FYI
SA 28	S3, PT5	CMT will use CMS to verify vessel schedules and overall container movement chart		BA	Baseline	FYI
SA 29	S3, PT5	CMT will locate empties at the nearest regional ports and raise Container movement order to the pertinent local office, this will be done by fax, email , or phone		BA	Baseline	FYI
SA 30	S3, PT6	Transfer of empties is delayed, and cause missing scheduled departure, for some cases the delay have cost SGLines substantial amounts of money for recovery and damages	Penalties	BA	Baseline	Problem
SA 31	S3, PT6	Keeping track of container availability to meet demand is extremely critical	Reputation	BA, AA	Target	REQ
SA 32	S3, PT7	Long processes from OPA to ST and back to customer	Long process	BA	Baseline	Problem
SA 33	S3, PT7	Details of quotation are updated in the SOS		BA	Baseline	FYI
SA 34	S3, PT8	Customer need to accept quotation within 3 working		BA	Baseline	FYI

		days				
SA 35	S3, PT8	When quotation is accepted, the ST update SOS and send a copy of order to the OPA by email	Email could get lost	BA	Baseline	Problem
SA 36	S3, PT8	Once quotation is accepted, the OPA request for customer to be billed through CBS		BA, AA	Baseline	FYI
SA 37	S3, PT9	VMS and CMS is developed in-house based on old technology, and often take too long to implement simple changes		AA	Baseline	Problem
SA 38	S3, PT9	VMS and CMS as high down time (around 10 - 15%) and this cause the whole operation comes to halt during the period	Lose of sales	AA, TA, DA	Baseline	Problem
SA 39	S3, PT10	SGLines has a website hosted by local ISP for marketing purpose, and about 2k hits per day		BA	Baseline	FYI
SA 40	S3, PT10	Customer would like to have additional capability to place order and check the calculation of shipment		BA, AA, TA, DA	Target	REQ
SA 41	S3, PT10	The website is not integrated with SGLines other IT system		AA, TA	Baseline	FYI
SA 42	S3, PT11	SGLines use AFIS and HRS for internal accounts and human resource management		BA. AA	Baseline	FYI
SA 43	S3, PT11	SGLines AFIS and HRS run on		TA, AA	Baseline	FYI

		AS400 which has MQ Series				
SA 44	S4, PT1	To achieve greater internal business process efficiency		AV, BA	Target	REQ
SA 45	S4, PT2	To take full ads on the internet and broaden existing customer base		BA, AV	Target	REQ
SA 46	S4, PT2	To Provide customer with capability to register and directly place order online		BA, AV	Target	REQ
SA 47	S4, PT3	Improve customer service level by providing facilities such as online order submission, status checking, accelerated process for repeat orders and shipment status checking		BA, AV	Target	REQ
SA 48	S4, PT4	To use e-business to establish better network of local tow head operators and companies that supplies shipping containers more cheaply or more quickly		TA, IA, AV	Target	REQ
SA 49	S5, PT1	Consolidate SOS and CBS into 1 system called SCBS		AA	Target	REQ
SA 50	S5, PT1	App process and data management are to be hosted on the separated server, with redundancies to ensure maximum up time		TA	Target	REQ
SA 51	S5, PT1	Presentation layer for SCBS should be web based and all batch job shall be run at		AA	Target	REQ

		application tier				
SA 52	S5, PT2	Consolidate VMS and CMS into 1 system called VCMS		AA	Target	REQ
SA 53	S5, PT2	App process and data management are to be hosted on the separated server, with redundancies to ensure maximum up time		TA	Target	REQ
SA 54	S5, PT2	To ensure system response time for is fast enough to cater prediction engines and other transactional process		IA , TA	Target	REQ
SA 55	S5, PT3	Integration between SCBS and VCMS for the submission and capture of RFQ, orders, and at the same time improving the overall processing efficiency and allow quicker business turnaround times. This will include automatic submission of CM orders to the local offices, and delivery estimation for ordered empties		BA, IA, TA	Target	REQ
SA 56	S5, PT4	All staff access will be standardized on IE web browser		AA	Target	REQ
SA 57	S5, PT4	Function required encryption for secure client side processing will be implemented using signed		IA	Target	REQ

		java applets				
SA 58	S5, PT5	SCBS will be enhanced to allow customer submit order from new Web Storefront		BA, AA, TA	Target	REQ
SA 59	S5, PT5	Web content should be personalized for each customer type and country		BA, DA	Target	REQ
SA 60	S5, PT5	function required encryption for secure client side processing will be implemented using signed java applets		AA	Target	REQ
SA 61	S5, PT6	For more sophisticated customer, SCBS will provide a set of web service to allow customers' procurement systems to be integrated		IA, TA	Target	REQ
SA 62	S5, PT7	VCMS will also provide a set of web services for port operators to determine optimal container movement and placement within a vessel to support optimization for SGLines' vessels		IA , TA	Target	REQ
SA 63	S5, PT7	Future facilitation of EAI		IA, TA	Target	REQ
SA 64	S5, PT8	All transaction from staff and customer will be handled by the same set of application and database server		BA, AA	Target	REQ

SA 65	S5, PT8	However, for security purpose, separate Web Servers will be used to handle traffic from two different groups of users, reducing network latencies for the internal users		TA	Target	REQ
SA 66	S5, PT9	SCBS will access VCMS transactional data and produce management reports from consolidated data		IA, TA	Target	REQ
SA 67	S5, PT9	VCMS is mission critical, must not be impacted by the jobs that generate management reports		IA	Target	REQ
SA 68	S6, PT1	Although the business direction has been established at the exec level, there are some sections of the IT and Operations teams which are not supportive to this architecture redefinition, However , some champions are very closely aligned with the exec team priorities		Governance	Baseline	FYI
SA 69	S6, PT2	Staff who oppose the change include Solution Architects who support the legacy system, and see the new architecture as spelling their demise		Governance	Baseline	FYI

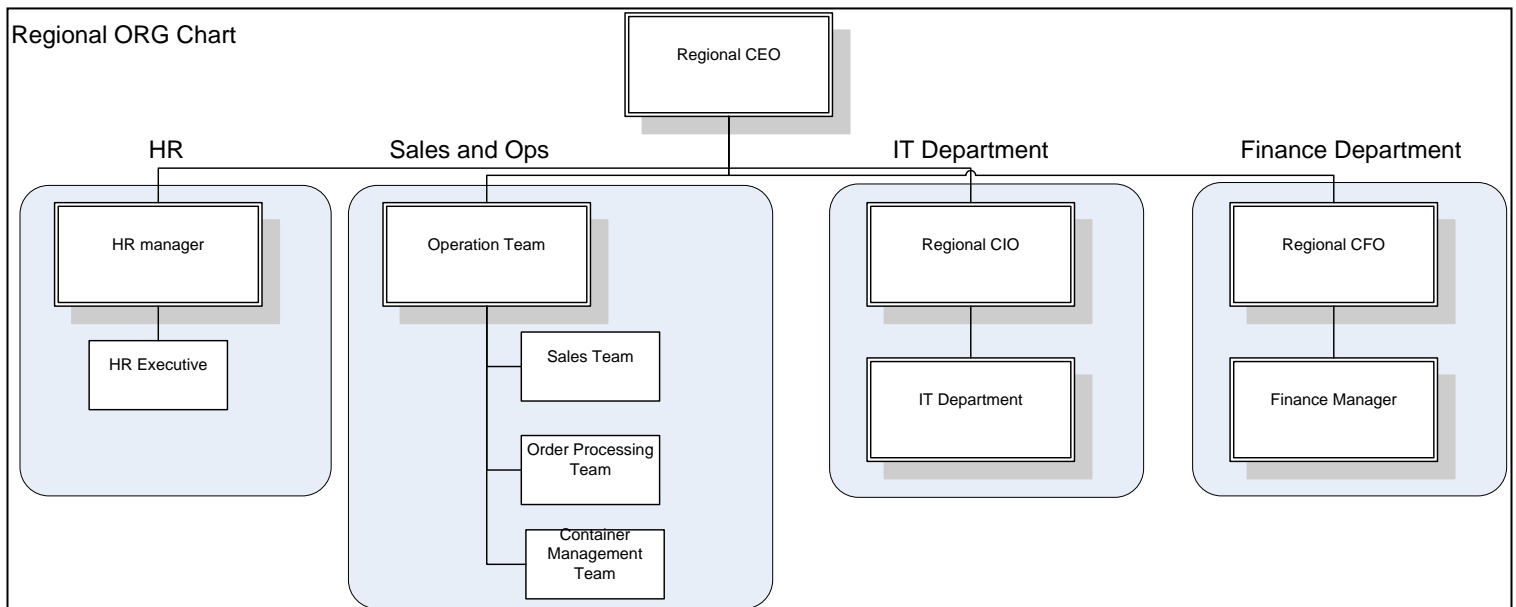
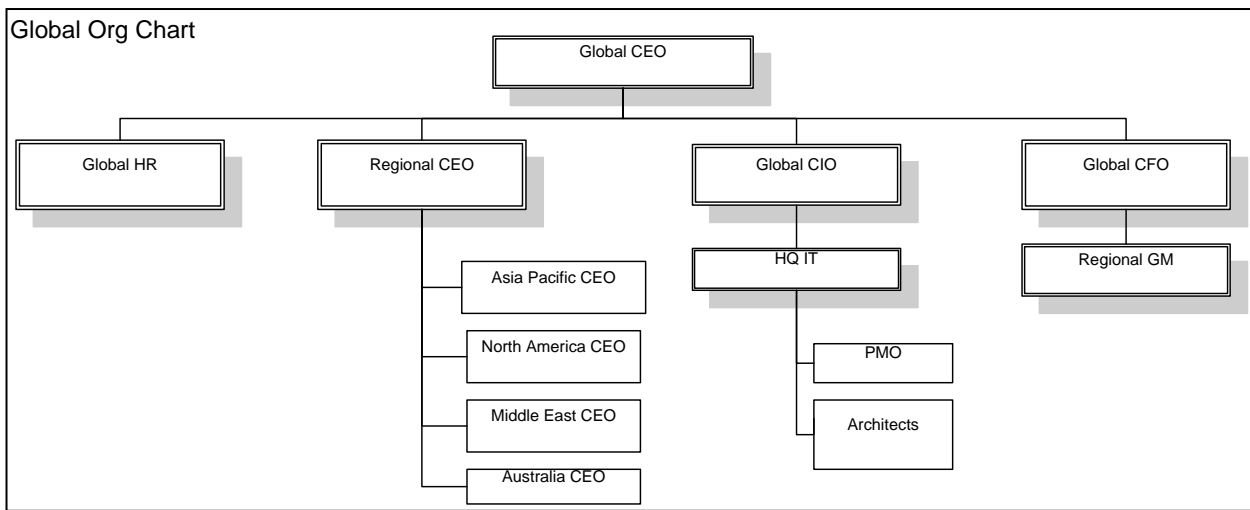
SA 70	S6, PT3	There are some broad cynics among the architects who do not believe in the principles of EA		Governance	Baseline	FYI
SA 71	S6, PT4	There are also those sceptics who see this as history repeating itself, in the sense that IT is investing in new system, technologies and infra as a way to justify their existence		Governance	Baseline	FYI

Assumption

After initial analysis of the statements above, the team come out with the below points are the assumption on SGLines current processes.

ID	Assumption	Remark
AS 1	"SGLines consist of hierarchical structure of ORG chart CEO"	Required by Architecture Vision
AS 2	Each region HQ will have GM	Required by Architecture Vision and Governance
AS 3	Each region will have different Org chart	Required by governance
AS 4	Global ORG chart is different from Regional Org chart	Required by Architecture Vision
AS 5	Profit centre and cost centre	Required by Business Architecture
A6	Huge losses of revenue from un-entertained customer	Required by Business and Information Architecture
A7	Lack of boundariless information flow	Required by Business and Data Architecture
A8	Lack of security control	Required by Data and Technology architecture
A9	Lack of infrastructure, System, and Storage space redundancies	Required by Technology architecture
A10	"Silo style" system to support enterprise wide business process	Required by Application Architecture
A11	Out-dated skill set from IT personnel	Required by Business and Governance
A12	High management wish to implement in stages	Required by migration and planning

Organisation Chart



Initiating EA Program – Architecture Vision

Problem Description

Stakeholders and Their Concerns

SGLines as a shipping company has huge diversity throughout the organisation that span across the globe. Their businesses run at the global scale that covers from States throughout the Asia regions. Although with huge coverage of businesses, SGLines doesn't possess good flow information from one department to another, not to mention a traditional way of process sales, which prone to human errors.

Further elaboration of the stakeholders and their concern is mapped through below table:

Stakeholder	Key Concern
Customer	Ability to place order with higher turn around date
CxO	Losing sales? Prevent delay of shipment errors, Higher SLA, Cutting cost
Sales Team	Real time sales order generation, and faster feedback from RFQ, Improve Up time for VMS and CMS, at the same time improve customer service level through usage of technology
Order Processing Team	To have real time checking on vessel availability and container availability
IT and Operations	Sceptical on the investment of the new IT business goals, as they have no confident on the new system and technologies
Container Management Team	To have better recorded network with tow head operator, and hope could improve the efficiency of the local tow head operators. Current operation take too long to query a certain information from local tow head operator

List of Issues/Scenarios to Be Addressed

Through the initial study of SGLines business flow, the team manage to identify issues and scenarios to be addressed as per below:

- Reduce the operation cost of SGLines
- Losing of sales due to unanswered call from customer
- Consolidation of multiple systems based on the business domain to improve real time access
- Accurate Real time information throughout multiple departments
- Improve UP TIME for system that classified as critical
- Improve response time to customer

Vision Statement

With the planned improvement by restructuring and reorganising the processes and work flow of the organisation, SGLines shall have significant improvement in terms of revenue and operating profit. Not to mention, with the help of modularity within department and better process work flow to achieve instant shared services / Information across multiple department within in bound and out bound of the organisation that will move to better customer care services .

The target architecture must be able to support and improve current SGLines business operation.

Value Proposition

After years of operation, SGLines is in need to revamp the current flow of the processes that often considered as un-competitive to serve the day to day operation needs. After further analysis of current workflow of SGLines, it is obvious that the company suffer from losses from time to time due to human error and dependencies. There is a huge gap of communication within department that cause such issue and in turn drive them to lose of sales and revenue, not to mention mistakes done could lead to liquidated damages the company has to suffer. The value proposition for SGLines is "Increase Operational Profits and reduce sales losses":

- **Increase Operation Profit**, SGLines predicted decline of sales up to 40% for years ahead due to global economic recession. Declining of sales must be compensated with better operation cost to minimises the losses and help the company to be more efficient in managing their internal workflow
- **Traceability of cost, network, and shipping movement** is another main event that SGLines must be able to trace the cost of engagement for each local tow head operators. At corporate level, this is an important factor, rather than depending on the bulk cost summary, an itemised billing based on the distance of travel would have better impact on setting up the routes they should take
- **Usage of ecommerce** portal as point of sales is another factor to retain the customer
- **Streamline the business processes** and automate certain task to speed up the fulfilment times
- **Create infrastructure environment** that enable service innovation by promoting flexibility in features implementation

Scope

The scope of the architecture is enablement of enterprise wide architecture and governance through common principles of interoperability, migration and conformance. Motivation of the scope is derived from the lack of streamlined business processes and automation between departments as such each region has their own processes that do not adhere to the organisation standards.

The program aims to use the ADM phases that promote incremental development of the artefacts within the EA frameworks. The scope will focus on businesses and IT segments as per below:

- Define overall architecture description for regional level adherence
- Develop guidelines, rules and regulations that must be followed by other business segments
- Building architecture components based on the guidelines with certain flexibility in implementation and extension
- Define standard means of communication between different systems to assist better flow of information across the systems

General Principles

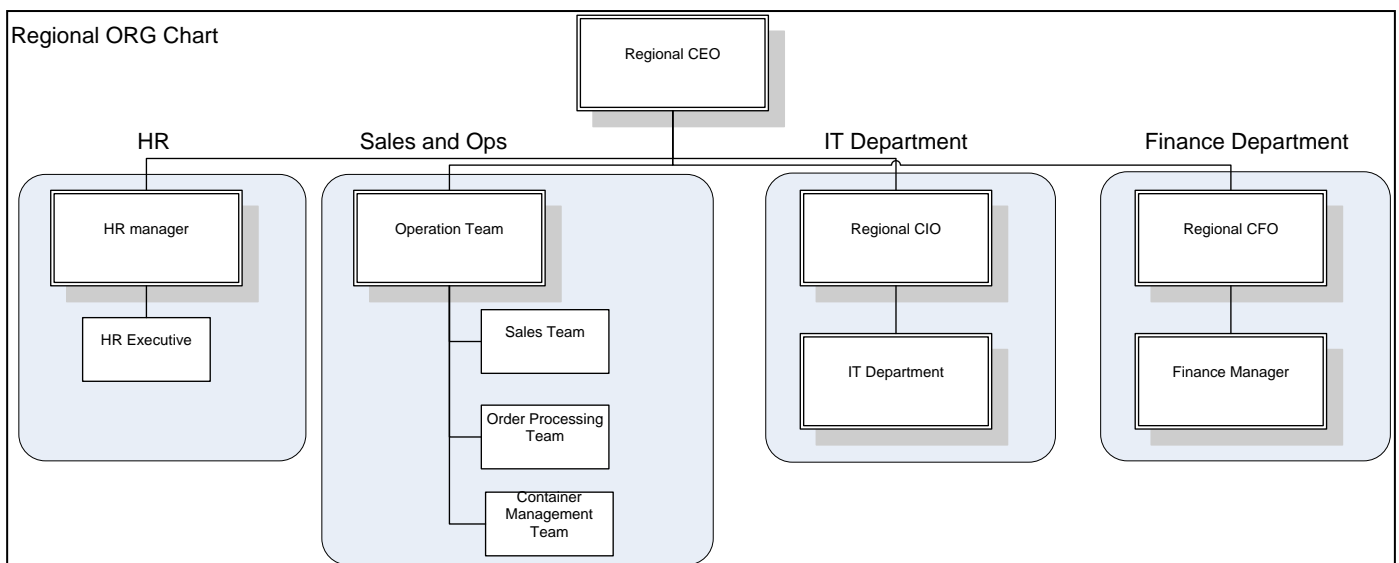
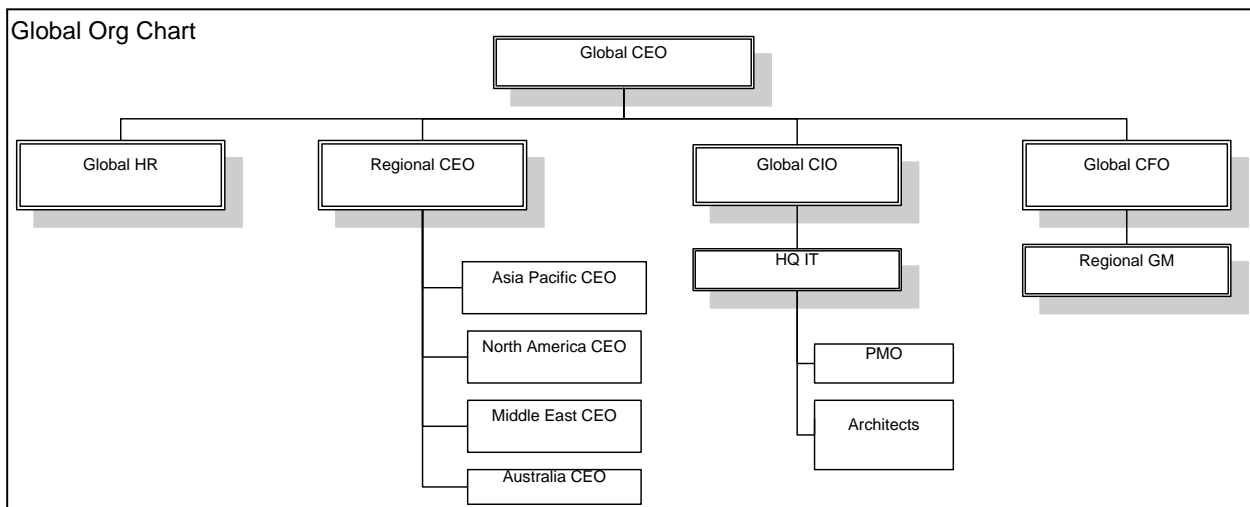
The principles applied to EA wide implementation where:

- Business driver
 - No IT implementation should be made without business approved architecture
 - Processes must closely aligned with SG Lines missions

- Requirements should closely aligned with the SG Lines vision
- Collaborative and Information flow
 - Every business unit of SGLines should show proactive response on the evolution of the proposed architecture
 - Architecture shall improve the information flow between business units to improve the processing and fulfilment times
- Leverage on existing infrastructure , implementation, and workflow where possible

Organisation Structure

The diagram depicted from the preliminary phase, where SGLines has Global and Regional organisation structure.



Entity	Roles & Responsibility	Report to
Global		
Global CEO	Responsible for oversee overall company direction	
Global HR	<ul style="list-style-type: none"> Responsible for employee and head count management for global scale, at the same time approving hiring of new employee Allocate staff transfer between regionals 	Global CEO
Regional CEO	<ul style="list-style-type: none"> Work with regional branch for business collaboration Manage their own regional business direction 	Global CEO
Global CIO	<ul style="list-style-type: none"> Deciding guidelines and rules for company IT direction Oversee IT implementation direction on global scale 	Global CEO
HQ IT	<ul style="list-style-type: none"> Define guidelines and manage approval of regional IT request 	Global CIO
Global CFO	<ul style="list-style-type: none"> Manage company Finance direction 	Global CEO
Regional GM	<ul style="list-style-type: none"> Define company business vision and work closely to ensure the vision is fulfilled 	Global CFO , Global CEO
Regional		
HR Manager	<ul style="list-style-type: none"> Manage head counts internally 	Regional CEO, Global HR
Operation Team	<ul style="list-style-type: none"> Manage daily business operation Look for new sales Support customer queries Perform checking on shipment and vessels 	Regional CEO
Regional CIO	<ul style="list-style-type: none"> Oversee regional IT alignment 	Global CIO
IT Department	<ul style="list-style-type: none"> Manage day to day IT task 	Regional CIO
Regional CFO	<ul style="list-style-type: none"> Oversee regional company finance direction 	Global CFO
Finance Manager	<ul style="list-style-type: none"> Ensure goals set by regional GM is achieved 	Global CFO

Environment and Process Models

Further on the planning of SGLines EA blue print, the company direction is to scrutinise the cluttered process model where there are too many unnecessary steps that cause delay in timing, role duplication and inaccurate information. This has cause a lot of losses in term of monetary to SGLines, not to mention lead to poor customer satisfaction on the service provided by SGLines.

The Ideal processes flow for SGLines would be to minimise the effort of each staff , improve the response time and information readiness thus will lead to better efficiency in resource utilisation (be it human or non-human resources). The new process flow will consist of:

- **Global Sales** , where it handle all the sales from internal staff or external customer
- **Space Tracing** , for vessel and container availability with the predefined routes and calculation of the most effective cost
- **Global Payment**, that handles the payment from customer and billing from third party vendors. The process will handle in multiple currency
- **Shipment Tracking** to ensure the success and prevent losses of every delivery, every customer item will be tagged with specialised identification, where it can be used to track the location of the item, which container and scheduled departure from and arrival to date



Figure 1 Value Chain Diagram

Most of the business process in SGLines needs to have accompanying technology and business environment to support the activity.

Business Process	Environment		User Group
	Business	Technology	
Global Sales	<ul style="list-style-type: none"> • Customer • Client • Sales Personnel • Competitor 	<ul style="list-style-type: none"> • Sales ordering system • Sales portal 	<ul style="list-style-type: none"> • Sales Process Team • Order Process team
Space Tracing	<ul style="list-style-type: none"> • Customer • Client • Local tow head • Country rules and regulation 	<ul style="list-style-type: none"> • Vessel and Container management • Prediction engine 	<ul style="list-style-type: none"> • Container management Team
Global Payment	<ul style="list-style-type: none"> • Customer • Client • Bank Merchant • Rules and regulation • Currency Exchange rate 	<ul style="list-style-type: none"> • Global payment portal • Account management 	<ul style="list-style-type: none"> • Bank Merchant • Order Processing Team
Shipment Tracking	<ul style="list-style-type: none"> • Port Rules and regulation • Customer / client • Local tow head operator 	<ul style="list-style-type: none"> • ShipTrack system 	<ul style="list-style-type: none"> • Container management Team
Reporting	<ul style="list-style-type: none"> • All other business processes 	<ul style="list-style-type: none"> • Reporting Tools 	<ul style="list-style-type: none"> • Senior / top level management

Information Flow

With the above explanation, SG lines is divided into 5 different processes, each process will trigger the next processes sequentially through the successive chain of information transfer from 1 process to another.

The steady flow of information is critical and need to be identified early to ensure there are no hiccup along the while process flow. Below is the further explanation of the steady flow of information in detail:

- **The initial state** is the information from customer or client that requested to ship and item based on the weight, size, and custom declaration of the items. Every information will go through Global Sales process before it is escalated further for **space tracing**
- **Space tracing** is when user have submitted required information and need to have arrangement on the vessel and shipping confirmation. This process should took less than a day
- Once everything is completed and user is agree with the routes, they will proceed with the payment through the Sales order generated by Global Sales process. The order will indicate the detail of the items and the total purchase prices in multiple currency
- Last Flow of the information would be the tracking of the shipment. Through payment SGLines will trigger tow head operator on the incoming request. The request will be handled by the tow head operator and processed accordingly. The information on current status of the item will be updated regularly by tow head operators

Actors, Roles and Responsibilities

Human Actors and Roles

Actor	Role
Sales Team	<ul style="list-style-type: none"> • Process the incoming sales • Help with order realisation between customer and SGLines
Order Process team	<ul style="list-style-type: none"> • Carry forward the task of sales team • Generate purchase order and bill the customer
Container Management Team	<ul style="list-style-type: none"> • Maintain close relation with local horizon office • Manage Vessel and container scheduler and space
Web User	<ul style="list-style-type: none"> • Ad hoc User that purchase shipping service
CxO	<ul style="list-style-type: none"> • Manage overall SGLines direction
IT Support	<ul style="list-style-type: none"> • Provide 8/5 IT support to the system • Maintain report batch timing to be generated by the system
Local tow head operators	<ul style="list-style-type: none"> • Transport loaded containers and empties to the locations where they needed
Dock Operators	<ul style="list-style-type: none"> • Optimizing and loading, unloading, reorganization of containers
Partner	<ul style="list-style-type: none"> • Company partners in a business or firm with shared risks and profits
Customer	<ul style="list-style-type: none"> • Experience services from SGLines

Computer Actors and Roles

Actor	Role
SCBS	<ul style="list-style-type: none"> • Manage Vessel schedule • Manage Container Schedule

	<ul style="list-style-type: none"> • Advance analytics and prediction engine • Maintain local tow head operators with the cost • Process sales • Process payment • Process PO generation
VCMS	<ul style="list-style-type: none"> • Track client shipment process
Shipment Tracking	<ul style="list-style-type: none"> • Serve as static FAQ of the company • Allow purchasing of SGLines service • Allow preview of shipment tracking
SGLines Website	<ul style="list-style-type: none"> • Act as separate entity that publish web service Interfaces to other company
Interface Engine	<ul style="list-style-type: none"> • Act as SGLines internal account and financial system
AFIS	<ul style="list-style-type: none"> • Act as internal Human Resource System
HRS	<ul style="list-style-type: none"> • Business intelligent reporting tools that extract data form Data Warehouse
Report	<ul style="list-style-type: none"> • Store and process the data from different system. Act as Single source of truth among system communication • Only track pertaining report and Interface Engine

Business Architecture

Business Systems Model

Key Factors

1. To achieve greater internal business process efficiency, through process integration and better use of its IT systems:
 - Consolidation of system:
 - Sales Order System (SOS) and Customer Billing System (CBS) will be combined as Sales and Customer Billing System (SCBS)
 - Vessel Movement System(VMS) and Container Movement System(CMS) will be combined as Vessel and Container Movement System (VCMS)
 - Integration between Vessel and Container Movement System (VCMS) and Sales and Customer Billing System (SCBS) to improve overall order efficiency
 - Sales and Customer Billing System (SCBS) allow web store front order
 - Service Oriented Architecture for Vessel and Container Movement System (VCMS) and Sales and Customer Billing System (SCBS) to allow third party Web Service call
2. To take full advantage of the Internet and broaden the existing customer base:
 - Online Order Submission & Order Status Checking
 - Accepting orders when and where the customer wants to place them
 - Making it easy to check the order status
 - Sales and Customer Billing System (SCBS) will provide a set of Web Services to allow customers' procurement systems to be integrated
3. To improve the overall customer experience and customer service:
 - Online Order Submission & Order Status Checking
 - Accepting orders when and where the customer wants to place them
 - Making it easy to check the order status
4. To use e-business to establish a more effective manner for the business processes to integrate with company's suppliers' IT systems:
 - Vessel and Container Movement System (VCMS) will provide a set of Web Services for Port Operators to determine optimal container movement and placement within a vessel to support optimization decisions for SGLines' vessels

SWOT Analysis

Current SWOT Analysis

The below table shows SGLines' current business architecture strengths, weaknesses, opportunities and threats.

Strengths	Weaknesses
<ul style="list-style-type: none"> Worldwide Shipping Vast knowledge on shipping network and local destination "Reachability" event at the most remote geographical area "Human Touch", deal directly with operators for order placement 	<ul style="list-style-type: none"> Un-clear job description Un-automated processes Sales order placement only available during working hour or staff availability Error prone and high processing time Missing clear view of local tow head operators from upper management level(lack of visibility or transparency) Non standardization on space utilization Business dependant on un-robust system Delayed or miss shipment schedule
Opportunities	Threats
<ul style="list-style-type: none"> Automated processes to reduce manual intervention Allow order placement 24/7/365 Shorten the business processes (Activity) to increase efficiency Paperless integration Integration with port operators for optimization operation 	<ul style="list-style-type: none"> Resistance from key user Time taken to re-train the staff Losses of revenue due to the un-entertained customer Forecasted slower revenue due to global economic recession Penalties on delayed shipment System down time often halts the business operation

Target SWOT Analysis

The below table shows SGLines' target business architecture strengths, weaknesses, opportunities and threats.

Strengths	Weaknesses
<ul style="list-style-type: none"> Worldwide Shipping Vast knowledge on shipping network and local destination "Reachability" event at the most remote geographical area "Human Touch", deal directly with operators for order placement Lower operating cost Fast Turnaround time Good customer service 24/7/365 Order placement Information Readiness throughout whole organisation Information transparency and visibility 	<ul style="list-style-type: none"> On the fly report readiness Customer experience on online order placement High Transformation cost Concerns on internet security Precise tracking on the shipping item
Opportunities	Threats
<ul style="list-style-type: none"> Integration with business intelligent reports Secured channel for payment integration Boarder payment gateway 	<ul style="list-style-type: none"> Staff knowledge to interpret analytical reports Leak of customer sensitive information Proactive and Collaboration from staff to the new process redefinition New Processes and supporting system Critical System Migration

We can address "Proactive and Collaboration from staff to the new process" weakness:

- Management team should have briefing to all staff for the purpose and benefits of new architecture
- Learning and Organization team should organize learning and communication session with all staff
- Establish formal feedback exercise for employees to raise voice concerns

To address "Leak of customer sensitive information" threat :

- Good governance on security guidelines
- Staff training on security and sensitive information awareness

To address "Staff knowledge to interpret analytical reports" threat:

- Training and certification on analysis reporting

To address "Critical system migration" threat:

- Proper control and procedure in application team, infrastructure team and system operations team
- Establish formal policies and procedures for mitigating risk such as resource turnover.
- Establish internal reporting/approval process, e.g.:
 - System migration and deployment
 - Change management
 - Incident resolution
- Plan and schedule disaster recovery exercise
- Establish detailed Service Level Agreements (SLA) for all running applications
- To conduct regular training exercise for all IT and Operations team

To address "New Processes and supporting system" threat:

- Proper User Acceptance Testing (UAT) must be done before applications release, staff will have fewer difficulties to use and understand the system
- To conduct thorough orientation and training program for all staff to be familiar with the new process and applications
- To gather feedback from staff on how to optimize the process and applications
- Continuously internal support from management team
- Continuously internal support from IT and Operations team
- Provide "Hands On" Training and educate the staff for establishing the new system

Strategy Map

The Strategy Map describes how SGLines can achieve its vision, mission and customer value proposition. The Ace Manufacturing Strategy is decomposed into four important perspectives to create sustained long term shareholder value:

- Learning and Growth
- Internal Process
- Customer
- Financial

The graphical representation of Strategy Map for SGLines is shown below:

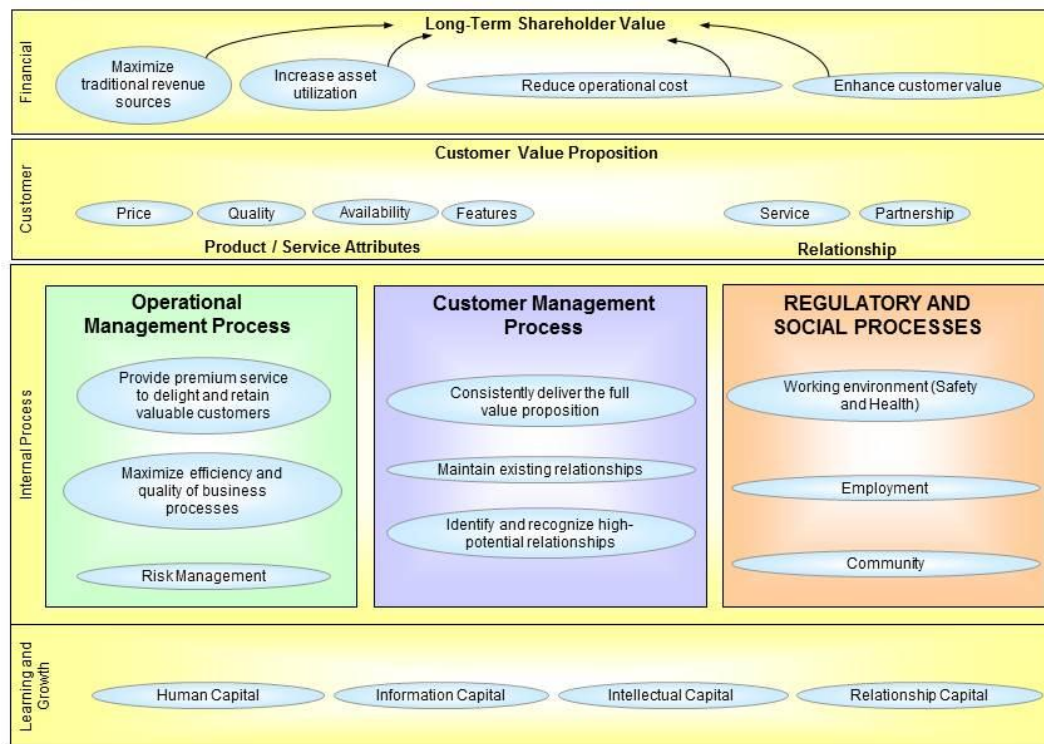


Figure 2 Strategy Map

With the main vision of improvement in **operational profit** and **enhance customer experience**, SGLines business strategies shall fall within the below categories:

- **Financial**
 - **Improve Cost Structure** through elimination of unnecessary processes and transparency of company expenditure
 - **Increase Asset Utilisation** through the mean of order automation and estimates delivery for empty vessels, which can improve overall order process efficiency
 - **Enhance Customer value** by providing accurate and timely information such as tracking and tracing of orders, fast and accurate quotation generation, shorten waiting time for queries
- **Customer**
 - **Availability and Service** in sales order processing, query by customer, through the mean of self-service or with the help of hot lines.
 - **Strategic Partnership** with existing partner to build a stronger relationship at the same time to establish effective communication that promote transparency and traceability
- **Internal Process**
 - **Operational Management Process**

- Provide premium service to delight and retain valuable customers
 - Maximize efficiency and quality of business processes
 - Mitigate the risk that could arise from integrating different systems
 - Regularly assess the effectiveness of SGLines' business processes for continual improvement
- **Customer Management Processes**
 - Consistently deliver the full value proposition
 - Maintain existing relationships
 - Identify and recognize high-potential relationships in different regions
- **Learning and Growth**
 - **Human Capital**
 - Conduct internal training session to understand the new EA for all staff
 - Consult with external EA expertise during the transition exercise
 - Conduct training session for IT and Operations team to follow the new process and operation procedure
 - **Information Capital**, It includes various systems, databases and networks.
 - **Intellectual Capital**, Collective knowledge (whether or not documented) of the individuals in the company. This knowledge can be used to produce wealth, multiply output of physical assets, gain competitive advantage, and to enhance value
 - **Relationship Capital**, Improve relationship with existing customers and partners to build a relationship

Business Reference Model

The Business Reference Model describes the functions provided by SGLines to its customers and partners. SGLines' BRM is structured into a hierarchy of business functions with services (vertical) offered to the external customers and partners, services (horizontal) offered to the staffs and the internal services required to support the organizations operations.

The figure below provides the overview of SGLines' BRM:

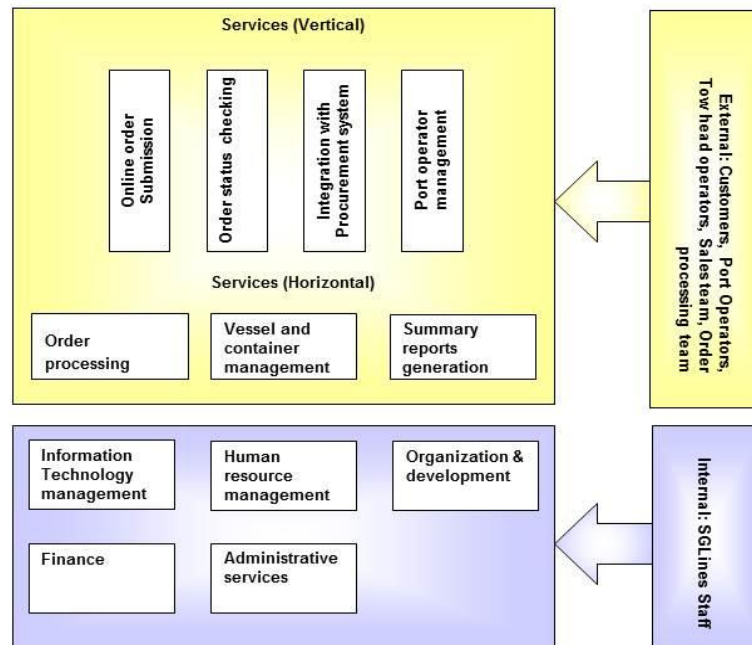


Figure 3 Business Reference Model

Performance Reference Model

The PRM was designed to serve three main purposes:

- Help produce enhanced IT performance information to improve strategic and daily decision making
- Improve the alignment, and better articulate the contribution of IT to business outputs and outcomes
- Identify performance improvement opportunities that span traditional organizational structures and boundaries.

As shown in below, the PRM includes four Measurement Areas: Mission and Business Results, Customer Results, Processes and Activities, Human Capital, Other Fixed Assets and Technology. In each area, there are Measurement Categories.

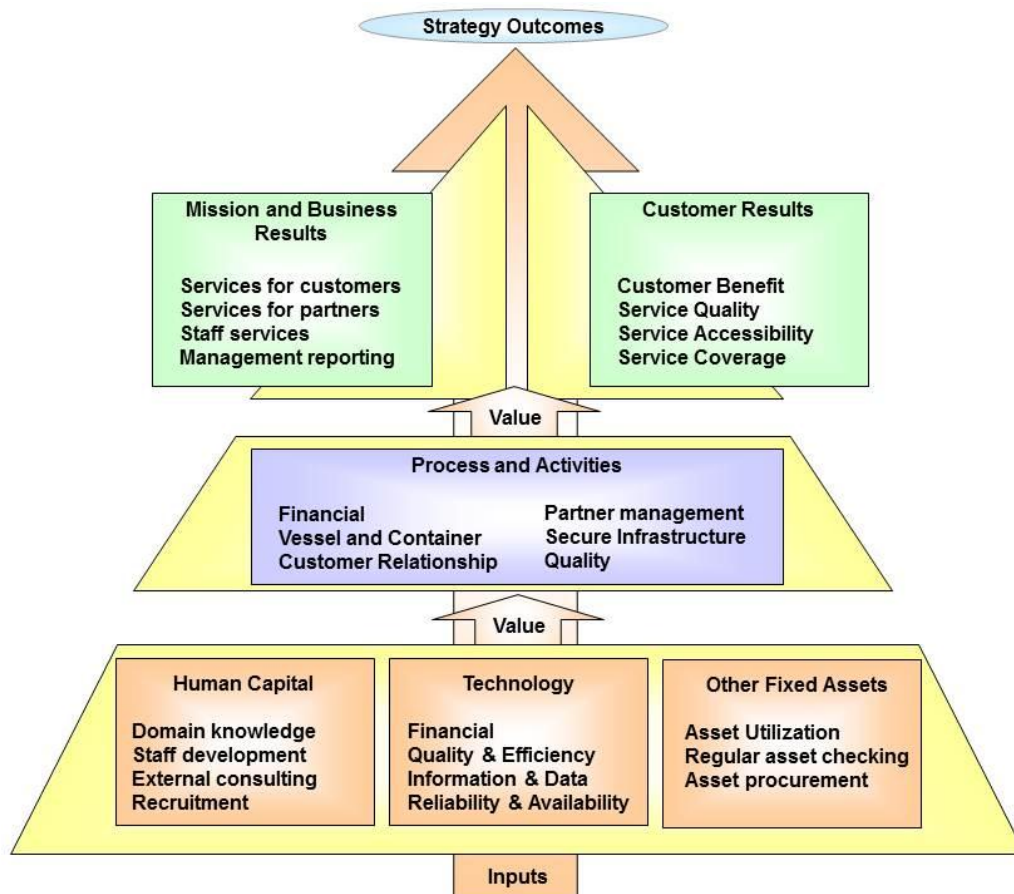


Figure 4 Performance Reference Model

Operating Model

Operating Model represents the required level of process integration and standardization to deliver services to the customers, focusing on core business process. It enables the implementation of strategic initiatives.

"The Coordination model provides integrated service to each key customer group. The integration results from sharing key data across the business units to present a common fact to the customer." (Enterprise Architecture As Strategy, by Ross, Weill, and Robertson). The operational model of the SGLines is Coordination operational model based on CISR. It's because of the following reasons:

- Shared customers worldwide
- All data are shared across different systems and units
- Operationally similar business units, however regulations and rules may change from region.
- Each department manages their own IT systems which are not integrated with each other and not integrate with HQ
- Web site is not integrated with SGLines' other IT systems although it gets 2000 hits per days
- Long time to implement even simple changes due to lack of internal resources

- Even Business-critical systems in individual factories have unscheduled downtime of average 10% to 15%
- Existing systems do not scale according to the business growth
- Main target is to provide efficient and quality process with competitive price

Business Principles

Name	Enhance customer value
Statement	Enhance existing customer satisfaction and expand potential customers
Rationale	The customer's total experience directly affects perceptions of value. By providing more efficient services (e.g. online ordering and status checking) which can sustain existing customer's relationship and expand potential customers
Implications	Application should be more efficiency and easy to use (e.g. clear user interface)

Name	Business Integration
Statement	Architectures target to streamline interoperability between business functions
Rationale	Business processes are best improved by streamlining the flow and use of data and information
Implications	Share information (e.g. Data) between different business unit

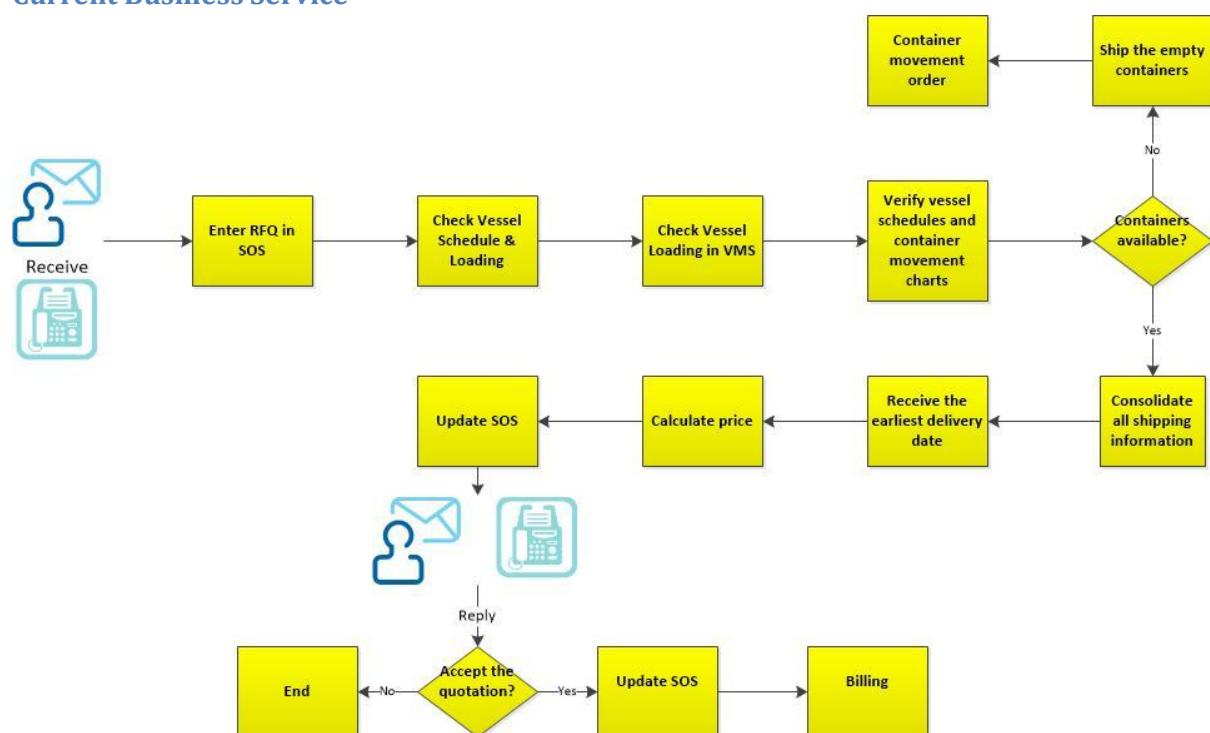
Name	Business Continuity
Statement	Mission critical IT systems should ensure maximum uptime and reduce business inability
Rationale	We must consider the reliability of mission critical systems throughout their design and use. The integrated applications are made available to customers and staffs 24x7 to ensure there is no service disruption for ordering, processing and billing processes
Implications	<ul style="list-style-type: none"> • Proper control and procedure in application team, infrastructure team and system operations team • Establish formal policies and procedures for mitigating risk such as resource turnover • Establish internal reporting/approval process, e.g.: <ul style="list-style-type: none"> ○ System migration and deployment ○ Change management ○ Incident resolution • Plan and schedule disaster recovery exercise

	<ul style="list-style-type: none"> Establish detailed Service Level Agreements (SLA) for all running applications To conduct regular training exercise for all IT and Operations team
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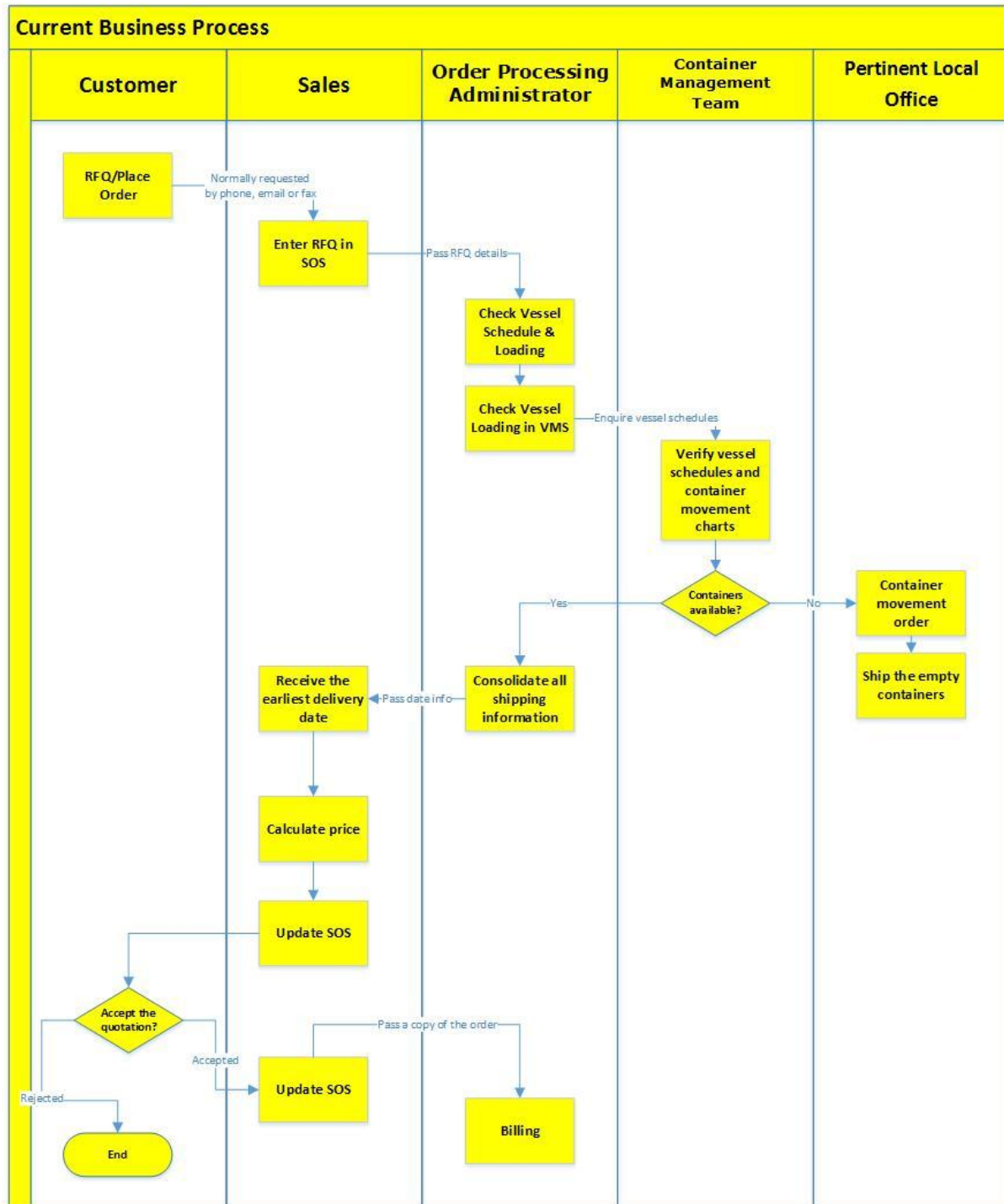
Name	Improve partner relationships
Statement	Enable multiple channels of access to the company by implementing Web Services to integrate partners' IT systems with the company
Rationale	Business partner is key value co-creator with the company. It is necessary to communicate with partner's IT systems in order to automate and optimize the company's own business processes
Implications	Implement service oriented approach which will enable integration of company's IT systems with partners' IT system

Core Business Process for Current and Target States

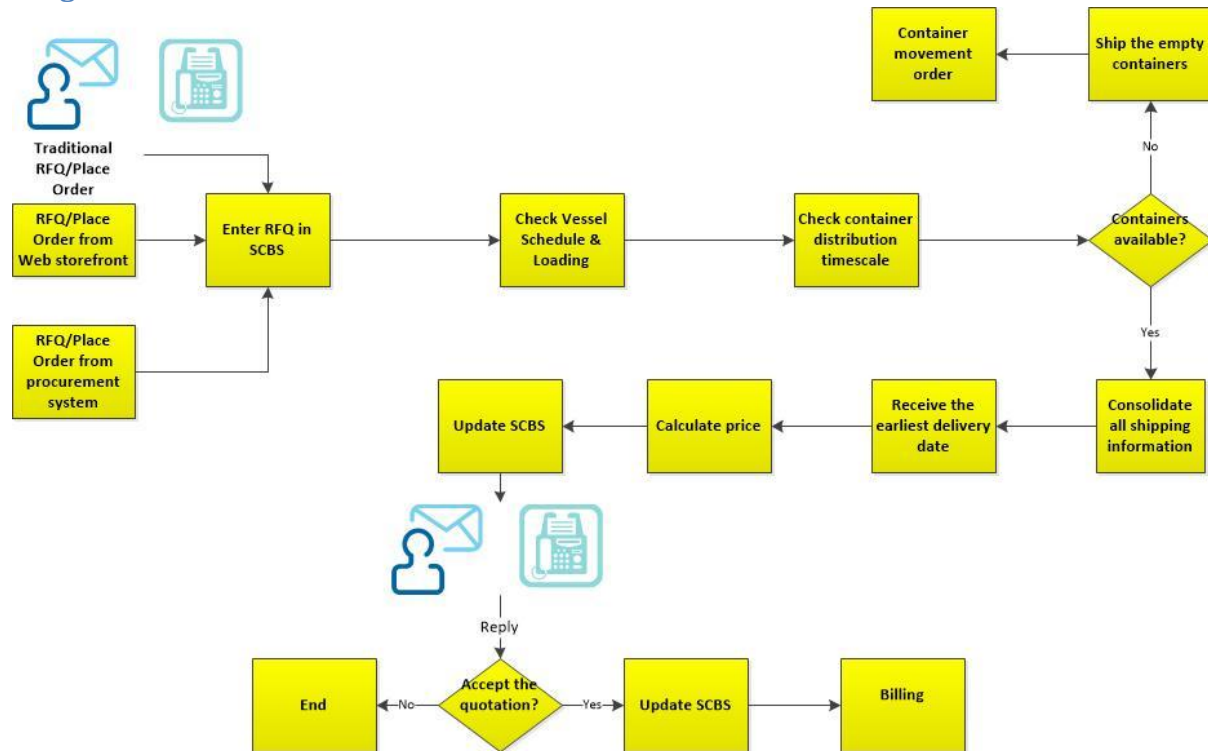
Current Business Service



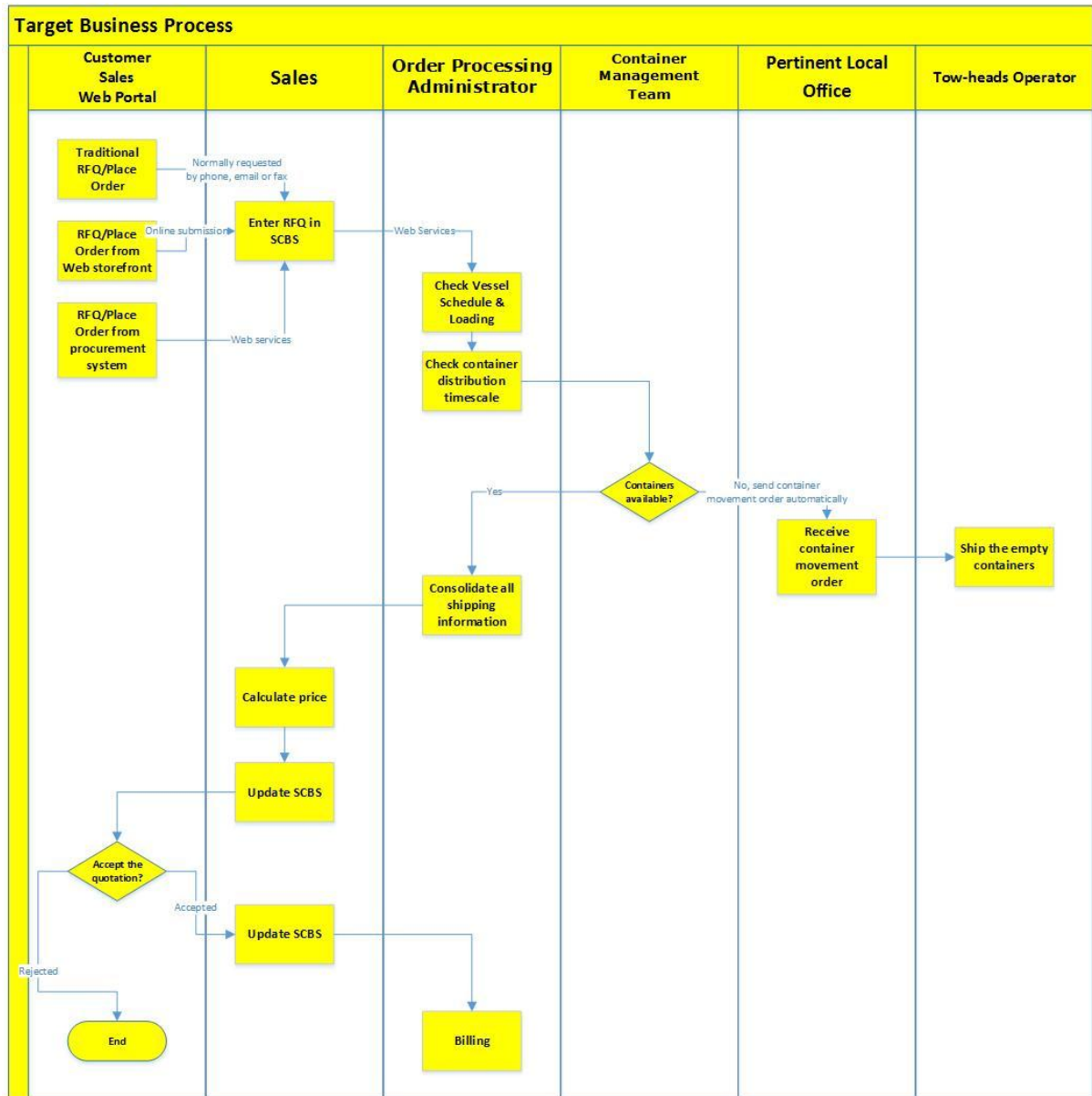
Current Business Process



Target Business Service



Target Business Process



List of Gap

Gap	Description	Current State	Future State	Importance/Benefit	Address by Architecture
Gap 1	Online order submission and tracking	Customer RFQ through email, fax and phone	Customer RFQ or order is placed through web storefront	Main business entry point Customer satisfaction and process efficiency	Information/Application
Gap 2	Integrated e-Business with partner and customer's IT system	Customer RFQ through email, fax and phone	Automated order process with customer 's procurement system	Enhance partner and customer relationship	Information/Application
		Different port operators to run their own optimization algorithm which resulted in poor space utilization	Web services provided by VCMS to optimize container movement and placement		
Gap 3	Sales and Customer Billing System	Separate Sales Order system and Customer Billing System	Integrated Sales and Customer Billing System (SCBS)	Accurate reporting to management Reduce human errors in the original process Streamline the business process to improve service quality	Information/Application
		RFQ/Order manually processed	Online order submission and tracking		
		Order pricing manually calculated	Integrated Sales and Customer Billing System (SCBS)		
		Customer billing is manually prepared and triggered by order processing administrator	Customer billing is automatically prepared and sent by SCBS		
		Quotation or order status are manually changed by sales	Quotation or order status are automatically updated		

		team	by SCBS		
Gap 4	Vessel Movement System and Container Movement System	These 2 systems in individual factories have unscheduled downtime of average 10% to 15%.	Centralized Vessel and Container Movement System (VCMS) should have high levels of redundancies to ensure 24 x 7 operations	Ensure high availability for mission critical system to reduce business lost	Information/Application
Gap 5	Centralized report generation and data management	Inaccurate sales report and transaction data due to human activities	SCBS will access VCMS's transaction data and produce management reports	Reports are a very useful method for keeping track of important information. The information contained in reports can be used to make very important decisions that affect our lives daily.	Information/Application

Information Architecture

Data Principles

Name	Data Integration
Statement	Data is defined consistently throughout the company, and the definitions are understandable and available to all users
Rationale	With integration between applications, it will allow quicker business turnaround times.
Implications	Multiple data standardization initiatives need to be co-ordinated.

Name	Data Replication
Statement	Data to be replicate and assessable without interrupting online transaction
Rationale	For efficiency and effectiveness in decision-making and service delivery.
Implications	Data is should be sufficiently, able to meet a wide range of requirement.

Name	Data is an Asset
Statement	Data is an asset that has value to the company and is managed accordingly
Rationale	The purpose of data is to aid decision-making.
Implications	Stewards must have the authority and means to manage the data for which they are accountable

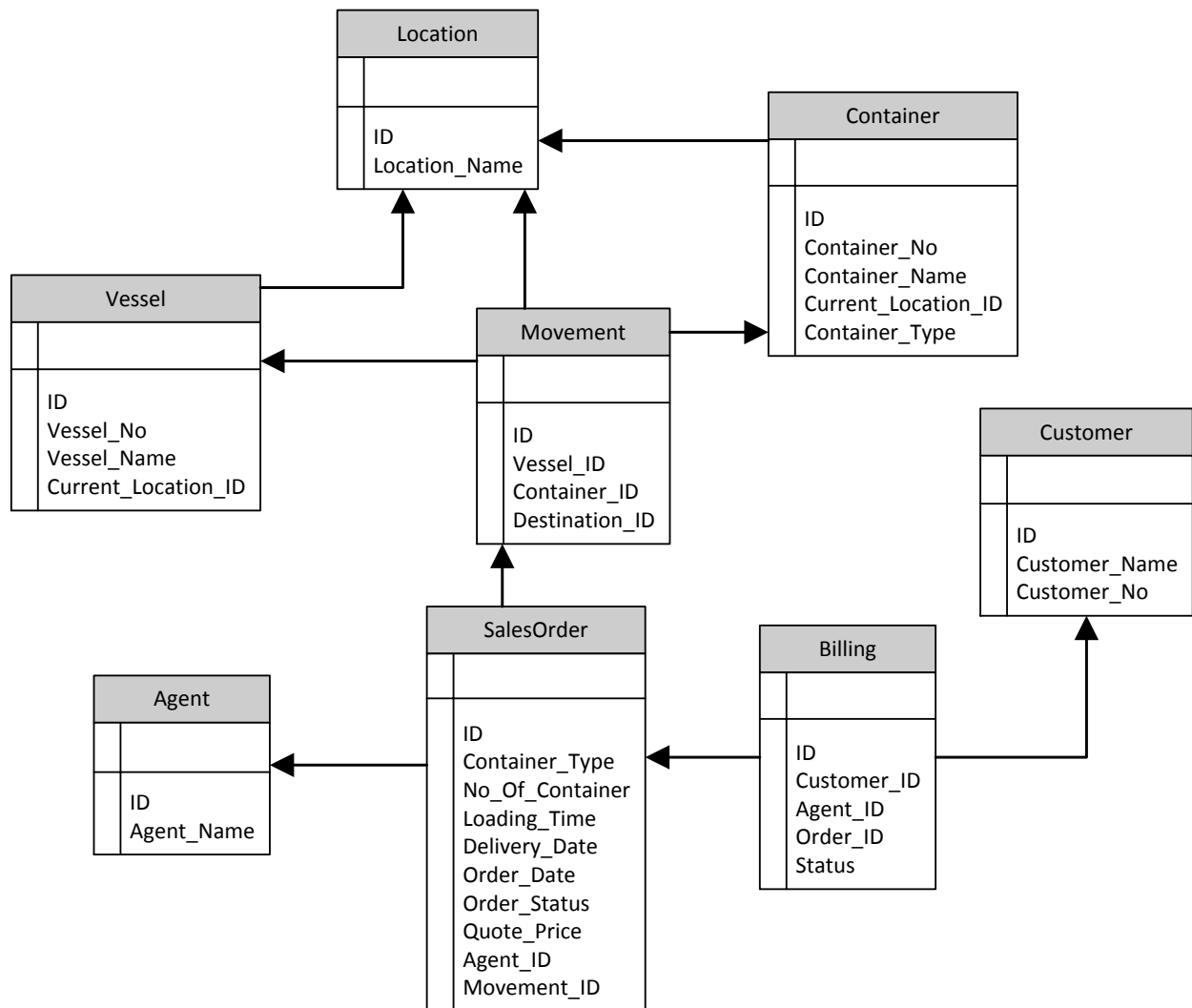
Date Entities Catalog

ID	Name	Description	Date	Category	Priority	Source	Data Category	Privacy Classification	Retention Classification	Owner
ISA_DE_01	Location	The location of the vessel, container and movement routes	2014	Data Architecture	Medium	Container Management Team	Data Architecture	Medium	Medium	IT
ISA_DE_02	Container	The container information	2014	Data Architecture	High	Container Management Team	Data Architecture	Medium	Medium	IT
ISA_DE_03	Movement	The movement tracks for specific containers	2014	Data Architecture	Medium	Container Management Team	Data Architecture	Medium	Medium	IT
ISA_DE_04	Vessel	The vessel information	2014	Data Architecture	High	Container Management Team	Data Architecture	Medium	Medium	IT
ISA_DE_05	Customer	Customer's profiles	2014	Data Architecture	High	Sales Team and Order Processing Administrator	Data Architecture	High	High	IT
ISA_DE_06	Billing	The billing info for specific orders	2014	Data Architecture	High	Sales Team and Order Processing Administrator	Data Architecture	High	High	IT
ISA_DE_07	SalesOrder	The order information	2014	Data Architecture	High	Sales Team and Order	Data Architecture	High	High	IT

						Processing Administrator				
ISA_DE_08	Agent	Agent information	2014	Data Architecture	Low	Container Management Team	Data Architecture	Low	Low	IT

Target Conceptual Data Model

The following target conceptual model gives the associated stakeholders a higher level understanding of the business entities as well as a tool by which they can view how their business relation information



Target Data Entity/Business Function Matrix

Data Entities \ Business Function	Vessel Loading/Schedules Maintenance	Container Movement Timescales Maintenance	Sales Order Maintenance	Billing Maintenance	Distribute empty shipping containers by Prediction Engine or Manual Intervention	Track sales of empty containers	Track transfer of containers from SG's vessels to 3 rd party vessels	Payment	Reporting Function	Shipment Tracking Maintenance
Sales Order	R	R	CRUD	RU					R	RU
Vessel	R		CRUD						R	RU
Container	R	R	CRUD		CRU	CRU	CRU		R	CRU
Billing			C					CRUD	R	
Agent			C						R	

Target Application/Data Matrix

Data Entities \ Application	Vessel and Container Movement System (VCMS)	Sales and Customer Billing System (SCBS)	Integrated Reporting System (IRS)	Ship Track System (ST)

Sales Order	R	R	R	R
Vessel	CRUD		R	
Container	R		R	
Billing		CRUD	R	

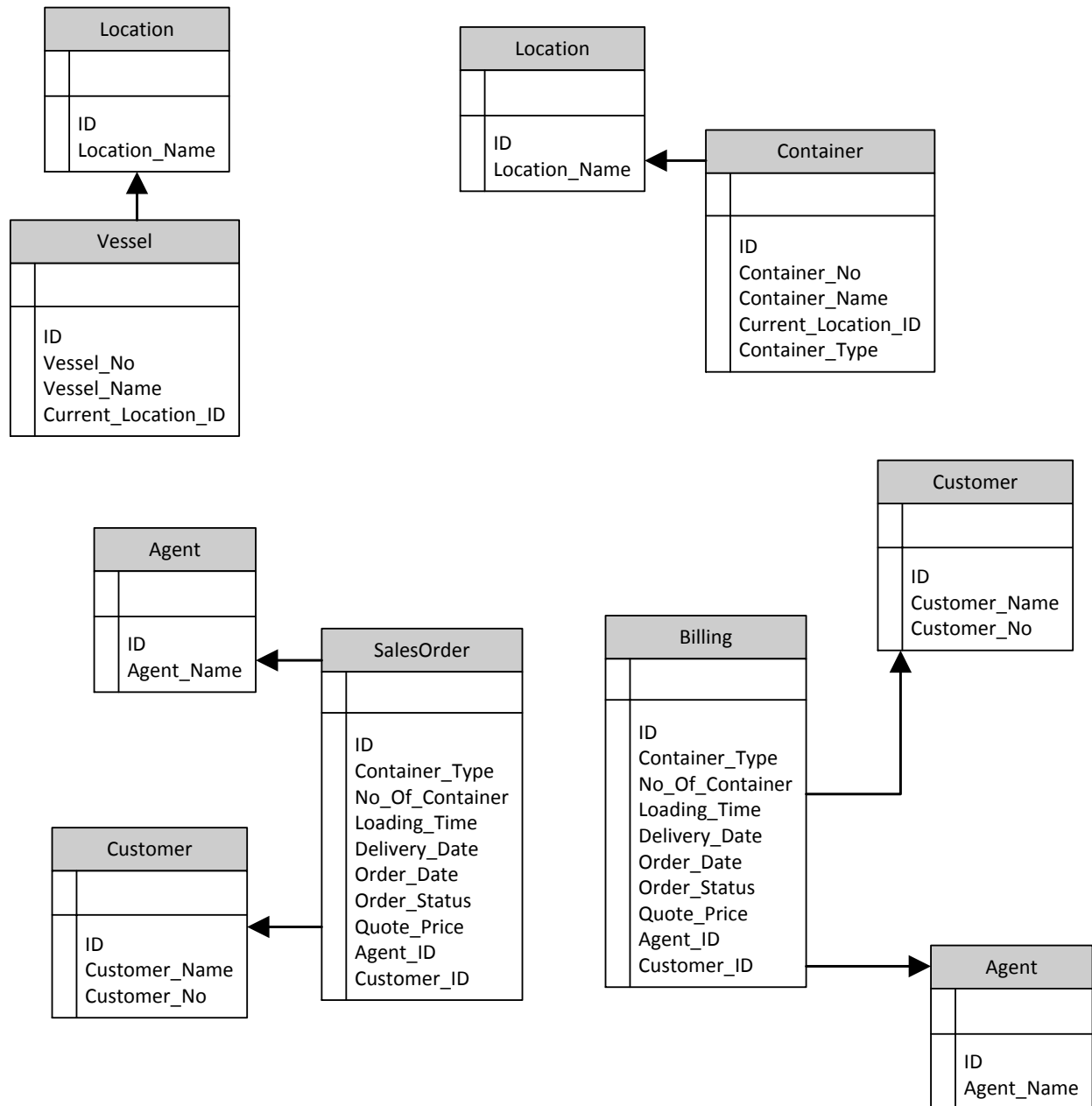
List of Stakeholders and Concerns

No.	Stakeholder	Concerns	View
1.	Customer	Order and billing details are captured, updated and deleted accurately. Data is secured with high availability.	Conceptual data model, Data entity/ Business Function Matrix
2.	Executive/Management team	Details are captured for business analysis and decision making. Details are captured accurately.	Data entity / business function matrix
3.	IT staffs	Data is secured with high availability. Data is controlled based on access rights. Data is accessible/update from web interface/web services.	Conceptual data model, Data entity / business function matrix
4.	Salesmen	Order and billing details are captured, updated and deleted accurately. Data is secured with high availability.	Conceptual data model, Data entity / business function matrix
5.	Container management team	Vessel details, container details are captured, updated and removed accurately. Data is secured with high availability.	Conceptual data model, Data entity / business function matrix
6.	Tow-head operator	Data passing to VCMS is captured, updated and removed accurately. Data is secured with high availability.	Data entity / business function matrix
7.	Port operator	Data passing to VCMS is captured, updated and removed accurately. Data is secured with high availability.	Data entity / business function matrix
8.	Order Processing Administrator	Vessel details, container details are captured, updated and removed accurately. Data is secured with high availability.	Conceptual data model, Data entity / business function matrix

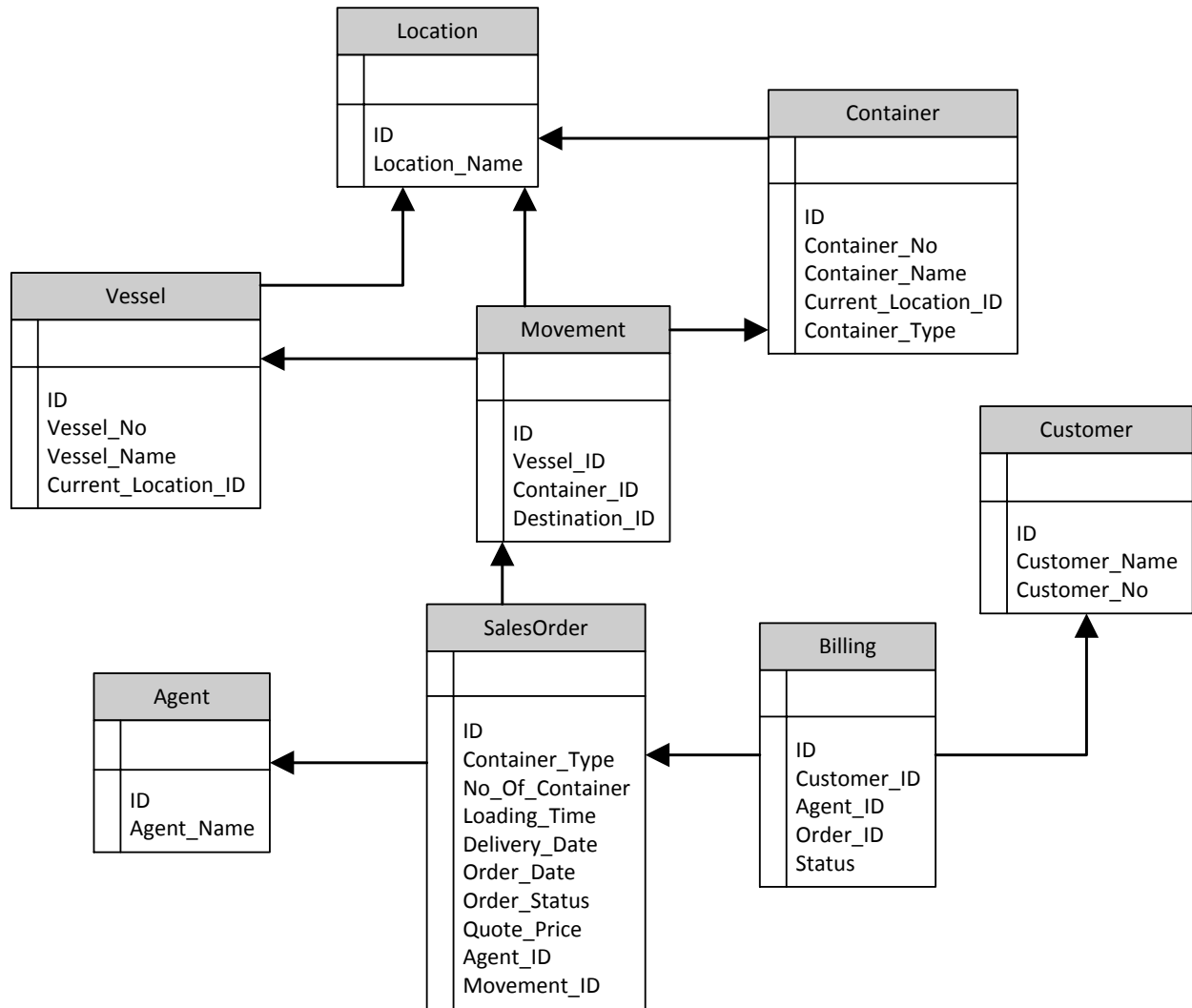
Current and Target Information Architecture

Current Information Architecture

Each individual system had their own data/information:



Target Information Architecture



Data Gaps and Recommendation

No.	Data Gaps	Recommendation	Potential Benefits
1.	Different data format between Company with Port Operators	Work together to follow or create a standard that be used by both parties	Unique data formatting standard for maintenance
2.	Duplicate Customer, Agent entity in Sales Order and Billing System	To be merged	Reduce data redundancy
3.	Duplicate Location entity in Vessel and Container Maintenance System	To be merged	Reduce data redundancy

Target	Vessel	Container	Movement	SalesOrder	Agent	Customer	Billing
Baseline							
Vessel	Included						
VesselLocation							
Container		Included					

ContainerLocation							
SalesOrder				Included			
SalesOrderAgent					Potential match		
SalesOrderCustomer						Potential match	
Billing							Included
BillingAgent					Potential match		
BillingCustomer						Potential match	
NEW			Gap: To be developed or produced				

Application Architecture

Application Principles

Business Principle	Enhance customer value
Name	Ease-of-use
Statement	Applications are easy to use. The underlying technology is transparent to users, so they can concentrate on tasks at hand.
Rationale	The more a user has to understand the underlying technology, the less productive that user is. Ease-of-use is a positive incentive for use of applications. It encourages users to work within the integrated information environment instead of developing isolated systems to accomplish the task outside of the enterprise's integrated information environment. Most of the knowledge required to operate one system will be similar to others. Training is kept to a minimum, and the risk of using a system improperly is low.
Implications	<p>Applications will be required to have a common "look-and-feel" and support ergonomic requirements. Hence, the common look-and-feel standard must be designed and usability test criteria must be developed.</p> <p>Guidelines for user interfaces should not be constrained by narrow assumptions about user location, language, systems training, or physical capability. Factors such as linguistics, customer physical infirmities (visual acuity, ability to use keyboard/mouse), and proficiency in the use of technology have broad ramifications in determining the ease-of-use of an application.</p>

Business Principle	Business Integration, Improve partner relationships
Name	Data Interchange Capabilities
Statement	Applications are able send and receive data to/from other application in the enterprise.
Rationale	Data are generated within the application. The data may be used by other application to automate the business process. The capabilities to interchange data between applications are a high priority task.
Implications	Failure to interchange data between applications will fail the whole applications integration process.

Application Portfolio Catalog for Current and Target States

Current State

No.	Application Name	Description	Business Owner	Maintainer	Hardware/Software Platform	Status	Related Applications	Remarks
1.	Vessel Movement System (VMS)	Provides data about vessel information and availability.	Order Processing Administrator	In-house	High-end WinTel servers / Old technology software	Operational	Container Movement System (CMS)	Long development time, lack of internal resources, 10% to 15% unscheduled downtime.
2.	Container Movement System (CMS)	Provides vessel information, schedules, and container movement timescales.	Container Management Team	In-house	High-end WinTel servers / Old technology software	Operational	Vessel Movement System (VMS)	Long development time, lack of internal resources, 10% to 15% unscheduled downtime.
3.	Sales Order System (SOS)	Provides quotation details, order details, and sales summary.	Sales Team	In-house	Running on a PC at each local office / Custom-built application, written in 1991 by an external software company that has since gone out of business.	Operational		More functions are required, but SOS source code is missing. Salesmen need mobile, online access.
4.	Customer Billing System	Allows Order Processing administrator	Order Processing	In-house		Operational		

	(CBS)	to requests for the customer to be billed.	Administrator					
5.	SGLines Website	Displays SGLines' marketing literature.	Marketing Team	In-house	Servers at local ISP's server	Operational		More features are required, e.g. RFQ, ordering, calculations of shipment time between destinations, etc. The website is not integrated with other SGLines' other IT systems.
6.	Account and Financial Information System (AFIS)	Keep track of account and financial information.	Finance and Account Team	In-house	AS400 servers	Operational		It has adapters for MQ series and a Java API which never been used before.
7.	Human Resource System (HRS)	Keep track HR related data.	HR Team	In-house	AS400 servers	Operational		It has adapters for MQ series and a Java API which never been used before.

Target State

No.	Application Name	Description	Business Owner	Maintainer	Hardware/Software Platform	Status	Related Applications	Remarks
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1.	Vessel and Container Movement System (VCMS)	<p>Order Processing Administrator to check for the availability of vessels.</p> <p>Container Management Team to check for vessel schedules and the overall container movement timescales.</p> <p>Port Operators to determine optimal container movement, placement within a vessel and support optimization decisions via VCMS's web services.</p>	<p>Order Processing Administrator and</p> <p>Container Management Team</p>	In-house	Internal Servers/Java, Oracle technology	Planned	Sales and Customer Billing System (SCBS)	<p>Prediction engine from the previous application needs to be migrated to the new system.</p> <p>Although prediction engine requires a high computational load, the system response time should not be adversely impacted when the prediction algorithm is running.</p>
2.	Sales and Customer Billing System	Provides quotation details, order details, and sales summary to Sales	Sales Team and	In-house	Internal Servers/Java, Oracle technology	Planned	Vessel and Container Movement System	Ensure 24x7 operations, high level redundancies.

	(SCBS)	Team. Allows Order Processing administrator to requests for the customer to be billed.	Order Processing Administrator				(VCMS)	Application processing and data management are to be hosted on separate servers.
3.	Integrated Reporting System (IRS)	Provides reports by collecting data from various applications.	Management Team	In-house	Internal Servers/Java, Oracle technology	Planned	VCMS, SCBS, ShipTrack	Collecting data for report generation should not affect the other application operation.
4.	ShipTrack System (ST)	Maintain shipment details, provides shipment information.	Container Management Team	In-house	Internal Servers/Java, Oracle technology	Planned		
5.	Account and Financial Information System (AFIS)	Keep track of account and financial information.	Finance and Account Team	In-house	AS400 servers	Operational	Sales and Customer Billing System (SCBS)	It has adapters for MQ series and a Java API which never been used before.
6.	Human Resource System (HRS)	Keep track HR related data.	HR Team	In-house	AS400 servers	Operational		It has adapters for MQ series and a Java API which

								never been used before.
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Target System/Business Function Matrix and System/Data Matrix

System \ Business Function	Vessel Loading/Schedules Maintenance	Container Movement Timescales Maintenance	Sales Order Maintenance	Billing Maintenance	Distribute empty shipping containers by Prediction Engine or Manual Intervention	Track sales of empty containers	Track transfer of containers from SG's vessels to 3 rd party	Marketing literature	Account and Financial Information	Payment	Human Resource Maintenance	Reporting Function	Shipment Tracking Maintenance
Vessel and Container Movement System (VCMS)	X	X			X	X	X						
Sales and Customer Billing System (SCBS)			X	X				X		X			
Account and Financial Information System (AFIS)									X	X			
Human Resource System (HRS)											X		
Integrated Reporting System (IRS)												X	
ShipTrack System (ST)							X						X

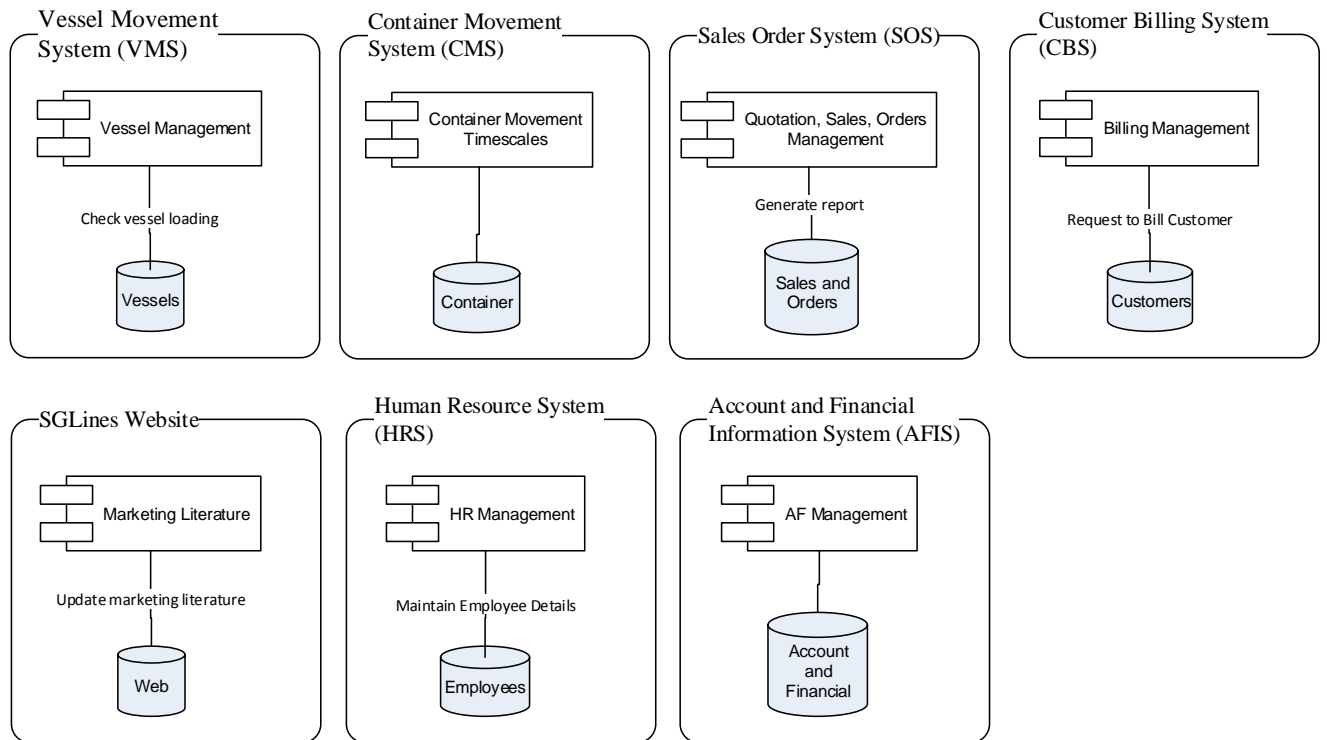
List of Stakeholders and their Concerns

No.	Stakeholder	Concerns	Applications
1.	Customer	Able to register and directly place orders online, or to integrate their IT systems with SGLines. RFQ, ordering, calculations of shipment time between destinations, etc.	Vessel Movement System (VMS) Container Movement System (CMS) Sales Order System (SOS) Customer Billing System (CBS) SGLines' Website
2.	Salesmen	Requires mobile access, online access.	Sales Order System (SOS)
3.	IT staffs	Provide high level redundancies and 24x7 operations. Reduce unscheduled downtime. Application processing and data management are to be hosted on separate servers.	All applications.
4.	Tow-head operator	Integrate with the SGLines' IT systems	Container Movement System (CMS) ShipTrack System
5.	Port operator	Improve algorithm for loading, unloading, and re-organisation of shipping vessels.	ShipTrack System
6.	Order Processing Administrator	Linkage between vessel schedules with the overall container movement charts.	Vessel Movement System (VMS) Container Movement System (CMS)
7.	Management team	Reduce unscheduled downtime	Vessel Movement System (VMS) Container Movement System (CMS)

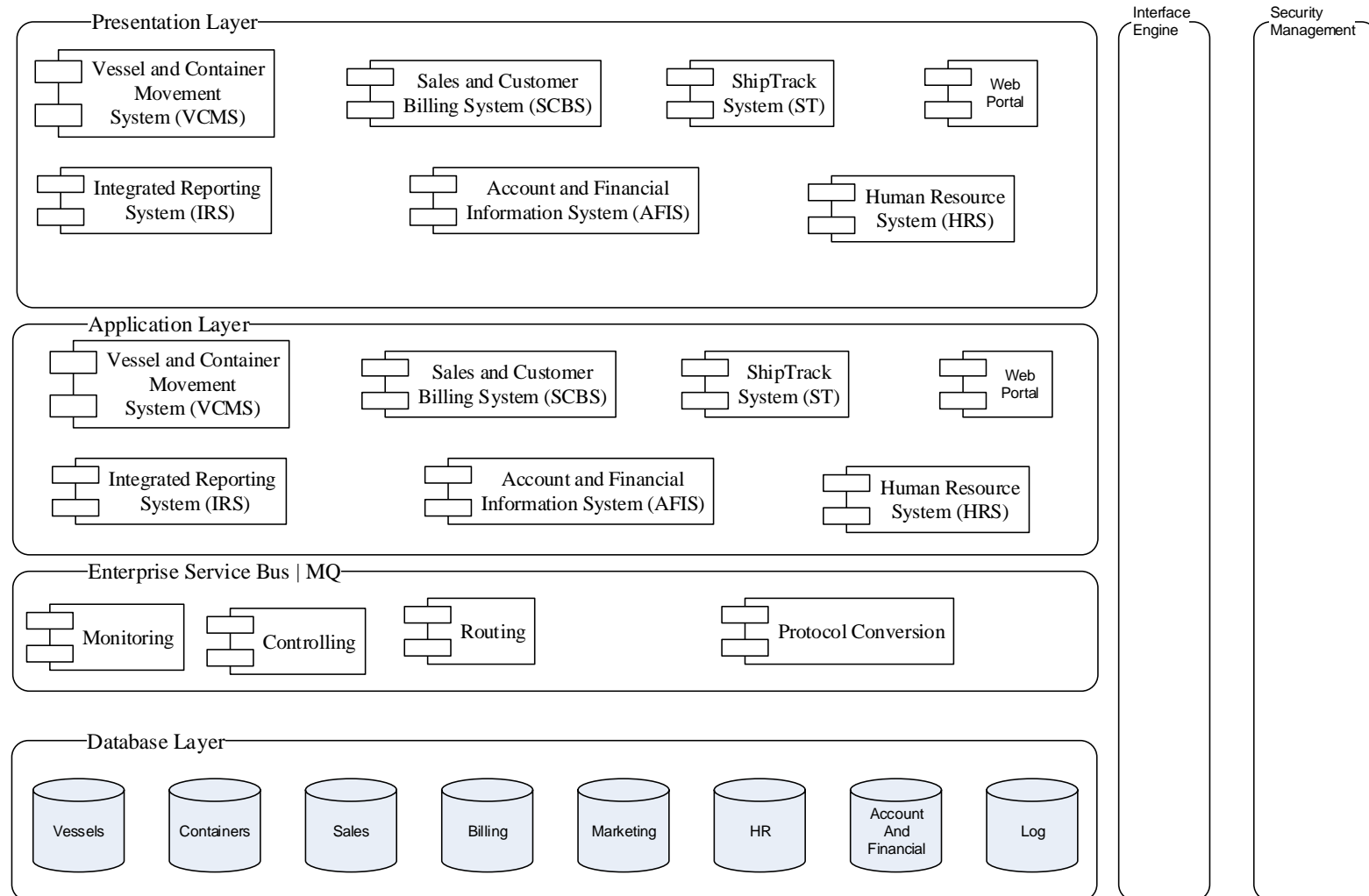
Current and Target Application Architecture

Current Application Architecture

Each software application does not interoperate and interchange data. All data is manually input and retrieved by the team members.



Target Application Architecture



Enterprise Service Bus | MQ provides all communication between software applications in a service-oriented architecture (SOA).

The primary function of ESB:

- Monitor and control routing of message exchange between services
- Resolve contention between communicating service components
- Control deployment and versioning of services
- Marshal use of redundant services
- Cater for commodity services like event handling, data transformation and mapping, message and event queuing and sequencing, security or exception handling, protocol conversion and enforcing proper quality of communication service

All applications: REPORT, ST, SCBS, VCMS, HRS, AFIS can interact between application via ESB | MQ.

Interface Engine will provide required data interchange to the external application, e.g. Web Portal and Customer Application.

List of Application Gaps and Recommendations

No.	Gap	Potential Benefits
1.	Customer Data Management	Reduce internal manpower to modify the data.
2.	Mobile access, online access for salesmen.	Time efficient for salesmen without going back to office. Faster response and feedback for salesmen.
3.	External system communication with the Sales Order System.	Allows faster order processing and reduce manpower.
4.	Optimal loading algorithm for port operators.	Space optimization and optimal resource management.
5.	Order status checking function for customer.	Reduce phone calls, faster time to response for customer, reduce manpower.
6.	Order submission by customer.	Reduce manpower.

Technology Architecture

Technical Reference Model

The technical reference model (TRM) identifies the key technical services required to support the business functionality and capability for SGLines.

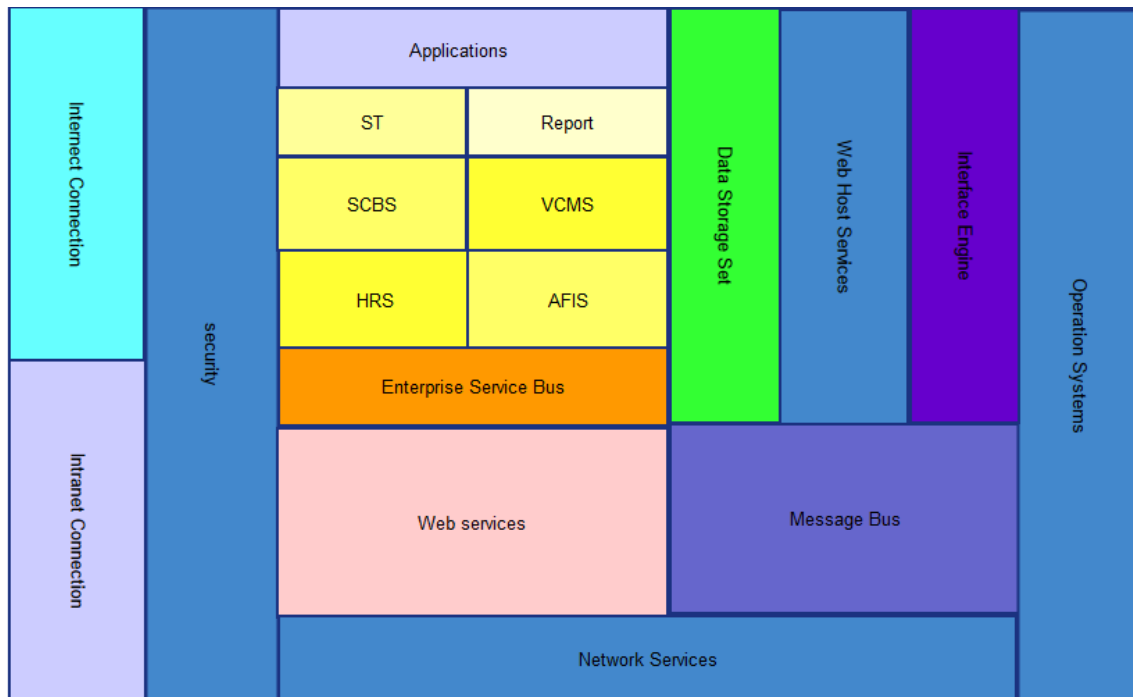


Figure 5 Technical Reference Model

- **Operation Systems** is the basic component for other applications. For security, stability and high performance purpose, and work with Oracle DB and Java language, Linux is the best choice in the market. On the market there are many distributions, and here the choice is RHEL: Red Hat Enterprise Linux, that means it's stable and handles heavy loads well.
 - Basic operation service
 - Datetime synchronization service
 - File storage service
 - Host for other services
- **Network service** provides low lever communcation service between physical servers.It's running at network application layer and above,provides data presentation , communication and validation using TCP/IP protocol.

To support network service for all servers, following compnents are needed:

 - Network adapter
 - Network router
 - TCP/IP Protocol
 - Other necessary component to support network connection
- **Security** component including necessary hardware components and related software which warpe all important factors,they are
 - Hardware firewal
 - Software firewall

- Server security components
 - Authorisation, Authentication and Access Control components
 - Log tracking
 - Encryption and Decryption components
- **Internet connection and Intranet connection**, by definition, an intranet is a computer network that uses Internet Protocol technology to share information, operational systems, or computing services within an organization. For security reason, internal project can only be accessed by intranet to protect its privacy.
- **Message bus**, is used for interprocess communication. It uses a queue for messaging – the passing of control or of content. Group communication systems provide similar kinds of functionality. This component is using for transfer data between VCMS and SCBS.
- **Web Services**, The W3C defines a Web service as: a software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.
When any application want to open API to other parties, the request will go through web service components.
- **Interface Engine**, This component is using for receive message and data from web service components and message bus components and delegate to target system with certain format.
- **Enterprise Service Bus**
 - Monitor and control routing of message exchange between services
 - Resolve contention between communicating service components
 - Control deployment and versioning of services
 - Marshal use of redundant services
 - Cater for commodity services, i.e. Message bus, web service and network services
- **Web Host service**
 - Website host service
 - API host service
 - File storage service
- **Data Storage Set**
 - Databases
 - Replication service
 - Disaster recovery service
 - Reporting generation service
- **Applications**, 6 applications are involved: Vessel and Container Movement System (VCMS), Sales and Customer Billing System (SCBS), Account and Financial Information System (AFIS), Human Resource System (HRS), Reporting Service and Shipment Tracking Service (ST)
Following services are included:

- Application UI Design Standard (IE,FF and Chrome supported)
- Application development
- Application testig
- Applicaion deployment
- Configuration Management
- Integration Services.

Technical Principles and Best Practices

Model Name	Technical Principles	Best Practise
Internet/Intranet	The appropriate security measures must be put in place to ensure security and privacy protection.	HTTP,FTP,Email Service
Security	The appropriate security measures must be put in place to ensure security and privacy protection	C2 Firewall Service Norton Security Service
Applications(VCMS,ST,SCBS,etc)	Reuse everything that can be reused. Design and produce with reusability in mind.	Oracle-Java programming best practise
Data Storage Set	Reuse everything that can be reused. Design and produce with reusability in mind.	Oracle Database group
ESB,IE,MessageBus,Web Service	Information from across all the regional units, customers and port operators should be integrated.	Json 1.0 XML Message Queue

Current List of Technology Architecture

No.	Technology Category	Technology Standard	Brand, make and model	Applications Supported	Location	Vendor	Quality of Service	Compliance to Product Standards
1.	Customer Billing System(CBS)	Java	Oracle, Version 7 Update 21	N/A	Unknown	SGLines	Nil	Yes
2.	Sales Order System(SOS)	C++	Borland	CBS	Local office	SGLines	Nil	Yes
3.	Container Movement System(CMS)	Prediction Engine	Nil	SOS,CBS	High-end WinTel Server	SGLines	Have 10%-15% unscheduled downtime	Yes
4.	Human Resource System(HRS)	Java	Oracle, Version 7 Update 21	MQ Series Java API	AS400 Server	SGLines	Nil	Yes
5.	Account and Financial Information System(AFIS)	Java	Oracle, Version 7 Update 21	MQ Series Java API	AS400 Server	SGLines	Nil	Yes
6.	Vessel Movement System (VMS)	C++	Borland	CMS,SOS CBS	High-end WinTel Server	SGLines	Have 10%-15% unscheduled downtime	Yes
7.	SGLines Website	HTML 4.0	N/A	N/A	Local ISP	SGLines	Nil	Yes

Target List of Technology Architecture

No.	Technology Category	Technology Standard	Brand, make and model	Applications Supported	Location	Vendor	Quality of Service	Compliance to Product Standards
1.	Operation System Services	Linux	Red hat Linux	Application Services	Cloud	Red hat	99.9999% Available	Yes
2.	Network Services	IEEE802	Starhub	Application Services	Telecom	Starhub	7x24 online	Yes
3.	Security	Firewall	C2 Hardware Firewall Norton Software firewall	Application Services	Cloud	C2, Norton	Enterprise support	Yes
4.	Interface Engine	Java, XML,Json	Oracle Java Version7 , XML 1.0 5 th Edition, Json 1.0	API Service	Server	SGLines	7x24 Available	Yes
5.	Web Service	XML,SOAP	W3C	API Service	Server	SGLines	7x24 Available	Yes
6.	Data Storage Set	T-SQL Standard	Oracle 11i	Application Services	Data Centre	SGLines	7x24 Available	Yes
8.	Web Host Service	HTTP,HTTPS	W3C,Apache Web Server	Web applications	Cloud	SGLines	7x24 Available	Yes
9.	Applications ST Report SCBS VCMS	Java,MVC,Javascript, HTML5.0, CSS3	Oracle 11i W3C	NA	Server	SGLines	7X24 Available	Yes

List of Stakeholders and their Concerns

Stakeholder	Concerns	View
Customer	Easy to access the web site Easy to access on-site data Able to direct RFQ, ordering and calculation shipment time online Security	Conceptual Data Model
IT Staffs	Able to maintain the system easily. Able to add new futures to current system	Target Technology Architecture
Sales Team	One-site access. Don't want to access different system to complete one task.	Target Technology Architecture
Order processing Administrator	More user-friendly and easy to use system	Target Technology Architecture
Management team	Real time report.	Target Technology Architecture
Port operator	Able to determine optimal container movement and placement within a vessel by web services.	Target Technology Architecture

Current and Target Technology Architecture

Current technology architecture provides the hardware level diagram.

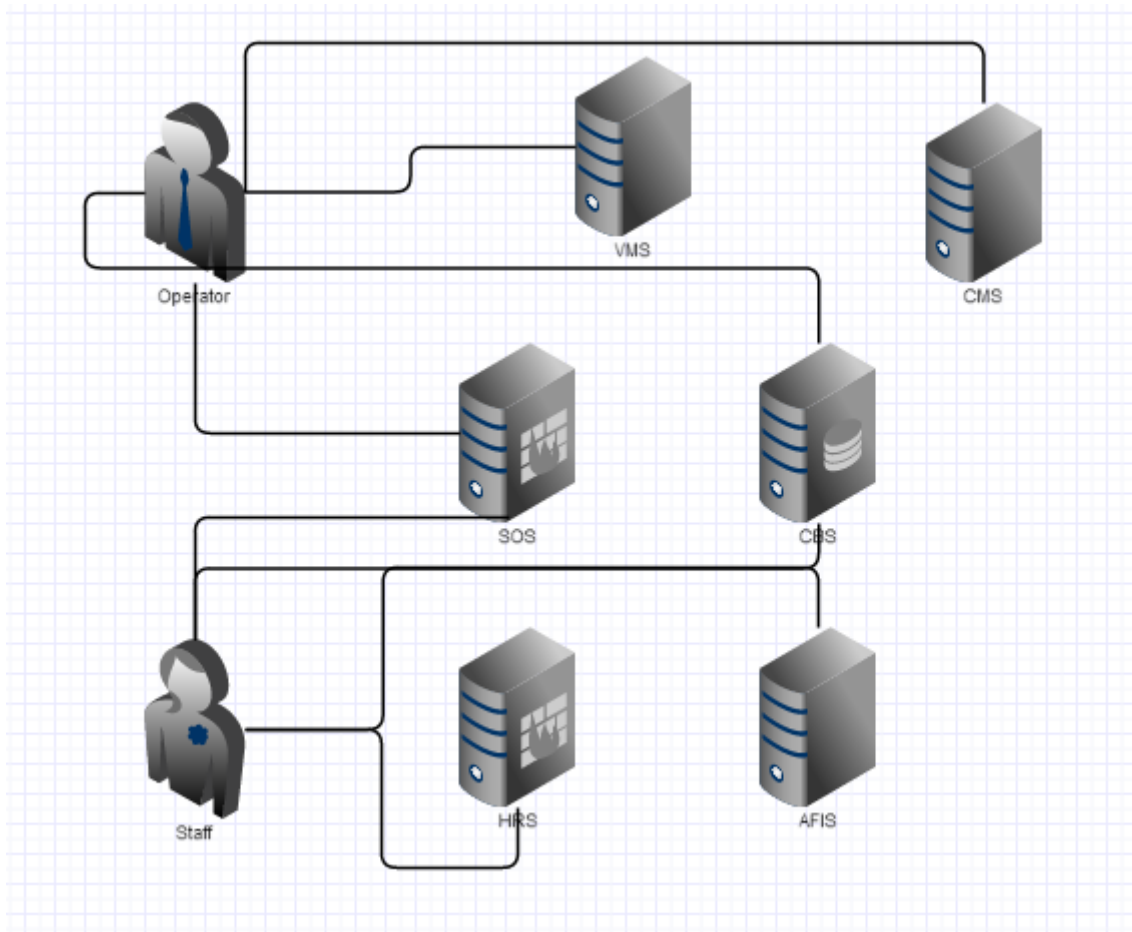


Figure 6 Current Technology Architecture

The target technology architecture gives an overview of the proposed system level design that the EA should be consolidated to.

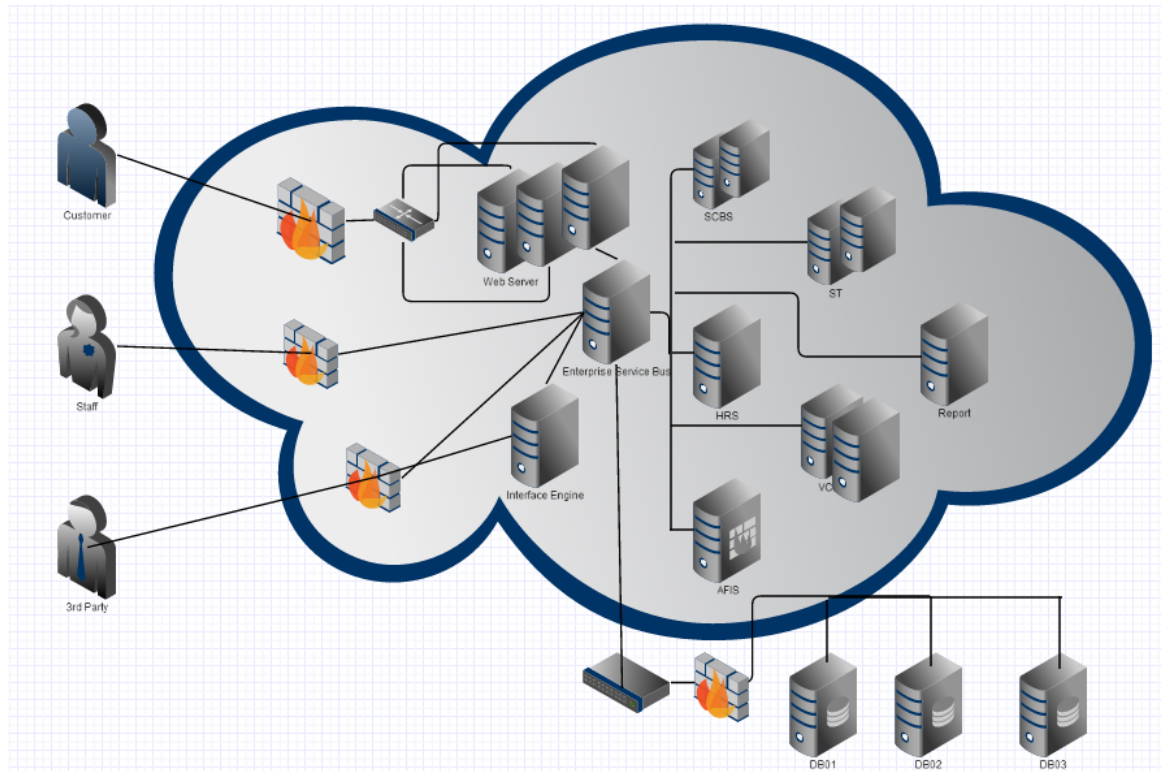


Figure 7 Target Technology Architecture

List of Technology Architecture Gaps

No.	Description	Current State	Future State	Importance/Benefit	Address by Architecture
1.	System security	No firewall found	Everything will hide under firewalls	Increase security	Technical
2.	Network latency	Not mention LB not	Will include in all web servers	Increase performance and usability	Technical
3.	VMS and CMS tend to have unscheduled downtime	10%-15% unscheduled downtime always happen	System availability should reach 99.97%	Unscheduled downtime will reduce usability	Technical
4.	VMS and CMS were developed based on old technology	Nobody can maintain that system	Will use Java to develop and follow the java standard, easy to maintain	Easy to maintain and enhance the system	Technical

Opportunities and Solutions

Initiatives Description, Traceability, Priority

Initiatives	Traceability to Gap	Priority
Re-engineer existing business processes	B1, B2, B5	High
Establish more customer focused services to improve customer satisfaction.	B3, A16	High
Re-structure application systems	B4, I6, I10, A11, A12, A18	High
Provide interface for internal/external system to integrate.	I9, A14, A15	Medium
Improve performance and enhance security in systems.	A13, A17	High
Standardize data storage for system integration.	I7, I8	High
Adapt new technology to improve system stability and ease for maintenance.	T19, T20	Medium
Produce management report for marketing analysis and strategy change.	B4	Medium
Procure new hardware.	T21, T22	Low

Checklist of Gaps and Addressed Gaps

No.	Architecture	Gap	Potential Solution	Dependencies
1.	Business	Too much manual intervention required	<ul style="list-style-type: none"> Re-engineer existing business processes to reduce manual effort and improve business efficiency 	
2.	Business	Integrate e-Business with partner and customer's IT system	<ul style="list-style-type: none"> Revamp and consolidate SOS and CBS Revamp and consolidate VMS and CMS Integrate internal systems to improve business process efficiency 	Drives Application 11, 12 and 18
3.	Business	Focus on customer service is not enough	<ul style="list-style-type: none"> Provide customer registration. Provide online order submission and order status tracking Provide online shipment tracking Accelerate process for repeat orders 	Drives Application 16 and 18
4.	Business	Inaccuracy in sales report and transaction data.	<ul style="list-style-type: none"> To provide management report from consolidated system for better marketing analysis and decision 	
5.	Business	Lack of management and monitoring in cooperation with local operators of tow-heads and port operators	<ul style="list-style-type: none"> Enhance existing systems to manage tow-heads operators and port operators Keep track of co-operators to help to make engagement and manage cost 	
6.	Information	Lack of knowledge in SOS system	<ul style="list-style-type: none"> Study the implementation of SOS Gather requirement of SOS before revamping the system 	
7.	Information	Legacy data from SOS system	<ul style="list-style-type: none"> Proper data migration to move the data to new 	

			system	
8.	Information	Data are stored with different standard in different systems	<ul style="list-style-type: none"> Standardize the data storage. To develop a common data dictionary as guideline 	Prerequisite for all applications
9.	Information	Lack of consistency in container and vessel optimization decision	<ul style="list-style-type: none"> Centralize and standardize the optimization algorithm for organizing container 	
10.	Information	Tow-head operator information is not managed	<ul style="list-style-type: none"> To capture tow-head operator details information in system 	
11.	Application	Develop centralized SCBS system by consolidating and revamping SOS and CBS system	<ul style="list-style-type: none"> Develop the required system Implement system failover to ensure system high availability 	Dependent on Information 6, 7
12.	Application	Develop centralized VCMS system by consolidating and revamping VMS and CMS system	<ul style="list-style-type: none"> To develop the required system To include tow-head operator management functions To implement system failover to reduce the unscheduled downtime 	
13.	Application	Container Movement prediction engine requires high computational load and it would affect the performance of VCMS	<ul style="list-style-type: none"> Separate the Container Movement prediction engine Deploy the engine in another distributed server To provide the remote method invocation to VCMS 	
14.	Application	Integration to SCBS for sophisticated customer's procurement system	<ul style="list-style-type: none"> Develop a set of Web Services in SCBS for integration 	
15.	Application	Integration to VCMS for Port Operators and internal applications	<ul style="list-style-type: none"> Develop a set of Web Service in VCMS for Port Operators to integrate Develop another set of Web Service in VCMS for internal system to integrate 	

16.	Application	Online RFQ and order submission is not supported	<ul style="list-style-type: none"> • Integrate SGLines Web site with SCBS to allow customer registration • Integrate SGLines Web site with SCBS to allow customer to submit RFQ and order online from a new Web storefront • Customize the Web contents for different customer type and country • Support different types of browsers 	
17.	Application	Generating management report would impact VCMS performance	<ul style="list-style-type: none"> • Replicate data for VCMS system using DB feature and set the replicated data to be read only • Access replicated DB to generate management report 	
18.	Application	Order process is not fully automated	<ul style="list-style-type: none"> • Allow customer to continue to place order after RFQ with the details stated in RFQ • Integrated SCBS and VCMS using Web Services provided for internal use to automate RFQ and order process 	
19.	Technology	VMS and CMS were developed based on old technology	<ul style="list-style-type: none"> • Adapt new technology when developing the consolidated VCMS system 	
20.	Technology	VMS and CMS tend to have unscheduled downtime	<ul style="list-style-type: none"> • Improve application architecture when developing the VCMS system • Improve code quality for VCMS development • Emphasize QA and plan sufficient review and testing to ensure the quality for the mission critical system • To implement system failover to reduce the unscheduled downtime 	

21.	Technology	Network latency	<ul style="list-style-type: none"> • Increase network bandwidth • Separate Web Servers for transaction from staff and customer • Install load balancer on top of Web Servers 	
22.	Technology	System security	<ul style="list-style-type: none"> • Install and configure firewall for systems • Separate Web Servers for transaction from staff and customer • Require staff to use signed Java applets for secured login and encrypted client side processing 	

Migration and Implementation Road Map

Costs, Benefits, Dependencies and Risks

Of the identified nine initiatives, we have derived the project list of nine and the respective implementation priority based on the risk and dependencies. We have also clustered the project list to three phases to the transition roadmap.

Project Initiatives	Category	Strategic Impact	Financial Impact	Risk	Opportunities for early success	Alignment with current initiatives	Resource Requirements	Dependency	Overall Priority Rank
1. SCBS	Business	H	H	H	L	M	H	M	H-3
2. VCMS	Business	H	H	H	M	M	H	M	H-2
3. Shipment Tracking (ShipTrack)	Business	H	M	M	M	L	H	M	H-4
4. ESB	Solution	M	L	M	M	L	L	H	H-1
5. MQ for HRS	Technical	L	L	L	H	H	L	M	L-8
6. MQ for AFIS	Technical	L	L	L	H	H	L	M	L-9
7. Interface Engine	Solution	M	L	M	H	L	M	H	M-5
8. Web Portal	Information	M	L	M	H	M	M	H	M-6
9. Management Reports	Information	M	M	M	H	M	M	M	M-7

SCBS

Sales order and customer billing system, this is a must-have requirement. As proposed to be a central system, with high degree of data integrity.

Major Costing:

Infrastructure:

Server: Windows Server 2012 Operating System (Blade Servers)

Cost: 20000 SGD (Investment for 5 Years)

Yearly Maintenance: Around 2000 SGD.

Internet: 2000 SGD (Investment for every year)

Application Development/Rollouts:

In-house Model

Database licensing:

Oracle: 35000 SGD (Standard) 11g

Resource:

Man Hours: 2880, 3 Months – (4 developers)

Cost: 100800 @ 35 SGD / Man Hr

Dependency:

ESB

Risk:

Compatible to the existing system integration.

Data migration.

Value & Benefits:

Reduce response time to customer queries.

Reduce time spending customer complaints.

Man power reduction. (Complaints Checks/Phone call to record the order)

Reduce 3 hr/day of man power, for 3 customer service representatives to record the purchase order over phone or by fax.

Saving, 64800 SGD per year @ 20 SGD man hr cost

VCMS

It is the central integrated system for the vessel and the container movement system. This is an operational system and categorized as a critical system and belongs to must-have requirement.

Major Costing:

Infrastructure:

Shares the infrastructure and maintenance cost for the server as of the technology architecture.

Application Development/Rollouts:

In-house Model

Database licensing:

Shares the investment cost for the database as of the central system defined by the technology architecture.

Resources:

Man Hours: 3840, 4 Months – (4 developers)

Cost: 134400 @ 35 SGD / Man Hr

Dependency:

ESB

Value & Benefits:

Reduce response time. (Time to market)

Man power reduction. (Manual Checks)

Improve quality.

Reduce 2 hr/day of man power, for 2 operations experts on checking the manual data verification.

Saving, 43200 SGD per year @ 30 SGD man hr cost

Shipment Tracking (ShipTrack)

It is a web implementation exposed to customers to track the shipping entity status. This is a must-have requirement.

Major Costing:

Infrastructure:

Shares the infrastructure and maintenance cost for the server as of the technology architecture.

Application Development/Rollouts:

In-house Model

Database licensing:

Shares the investment cost for the database as of the central system defined by the technology architecture.

Resources:

Man Hours: 960, 2 Months – (2 developers)

Cost: 33600 @ 35 SGD / Man Hr

Dependency:

VCMS (to track operations status) and SCBS (to track the delivery status)

Value & Benefits:

Reduce response time to customer queries.

Reduce time spending customer complaints.

Man power reduction. (Complaints and tracking the shipment status checks)

Reduce 1 hr/day of man power, for 2 customer representative to check the shipping status.

Saving, 14400 SGD per year @ 20 SGD man hr cost

ESB

We have proposed to implement as the open source, also enclosed a supportive result to make a decision.

Major Costing:

Infrastructure:

Shares the infrastructure and maintenance cost for the server as of the technology architecture.

Application Development/Rollouts:

Vendor selection: Plan is to consider the potential of an open source ESB and upgrade to more robust solutions as need arise. (MuleSoft)

In-house Model (Opportunities and Solutions)

Orchestrations of the applications for the integration are done as a part of the setting up the ESB. The further adding/removing the message registers is done as a part of the maintenance.

Resources:

Man Hours: 480, 1 Months – (2 developers)

Cost: 16800 @ 35 SGD / Man Hr

MQ for HRS/AFIS

These applications can be integrated using the MQ-Message Queuing, to the ESB for the enterprise integration. It is a nice to have requirement.

Major Costing:

Application Development/Rollouts:

In-house Model

Resources:

Man Hours: 480, 1 Months – (2 developers)

Cost: 16800 @ 35 SGD / Man Hr

Interface Engine, Management Reports and Web Portal

These are related to the primary interfaces for the major systems (VCMS, SCBS and Shipping tracking).

Major Costing:

Infrastructure:

Shares the infrastructure and maintenance cost for the server as of the technology architecture.

Application Development/Rollouts:

In-house Model

Database licensing:

Shares the investment cost for the database as of the central system defined by the technology architecture.

Resources:

Man Hours: 1920, throughout the transition (2 months & 4 developers)

Cost: 67200 @ 35 SGD / Man Hr

Dependency:

VCMS (to track operations status) and SCBS (to track the delivery status)

Value & Benefits:

Customer satisfaction and increase in customer retention.

Support B2B applications, using the Interface Engine. (Mass responses)

Benefit @40000~ 100000 per year.

	Year 1 (SGD)	Year 2 (SGD)	Year 3 (SGD)	Year 4 (SGD)	Year 5 (SGD)
Capital Cost (Infrastructure)	55000	0	0	0	0
Capital Cost (Development)	369600	0	0	0	0
Yearly Maintenance Cost	10000	10000	10000	10000	10000
Savings	0	162400	182400	202400	222400
Expenses	434600	282200	109800	-82600	-295000
ROI	0	0	0	82600	295000

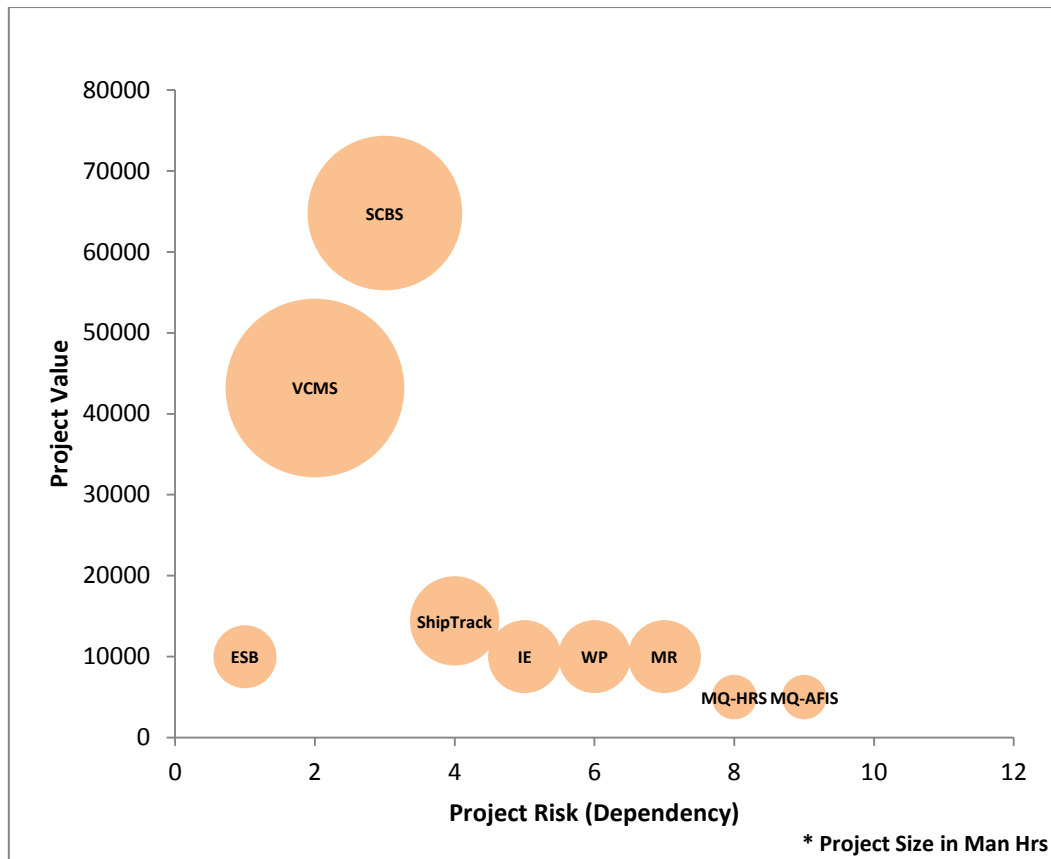


Figure 8 Project Bubble

Timelines, Milestones and Ownership

Phase 1: (1-6 Months)

The following are the project clusters that have higher dependency to go live together with good benefits in values for the first phase. This also facilitates the seamless integration capability with account to the decommissioning of existing system:

- ESB,
- VCMS, Data migration for VCMS, VCMS Compatibility support to existing systems,
- Management Reports,
- Interface Engine and
- Web portal.

Phase 2: (4-10 Months)

The following are the project clusters that have next higher dependency with less risk to the earlier phase; this also facilitates an enterprise level integration:

- SCBS, Data migration for SCBS,
- Shipment Tracking,
- Management Reports,
- Interface Engine and
- Web portal.

Phase 3: (6-12 Months)

The less prioritized projects, moderate business values with low risk, follow the legacy systems that to integrate using ESB:

- MQ implementation for HRS and AFIS,

- Management Reports,
- Interface Engine and
- Web portal.

	Projects	Ownership
Phase 1	ESB	IT/Operations
	VCMS	Container Management Team
	IE	IT/Operations
	Web portal	Container Management Team
	Reports	Container Management Team
Phase 2	SCBS	Order Processing Team
	ShipTrack	Order Processing Team
	IE	IT/Operations
	Web portal	Order Processing Team
	Reports	Order Processing Team
Phase 3	MQ HRS	HR & Finance Team
	MQ AFIS	HR & Finance Team
	IE	IT/Operations
	Web portal	HR & Finance Team
	Reports	HR & Finance Team

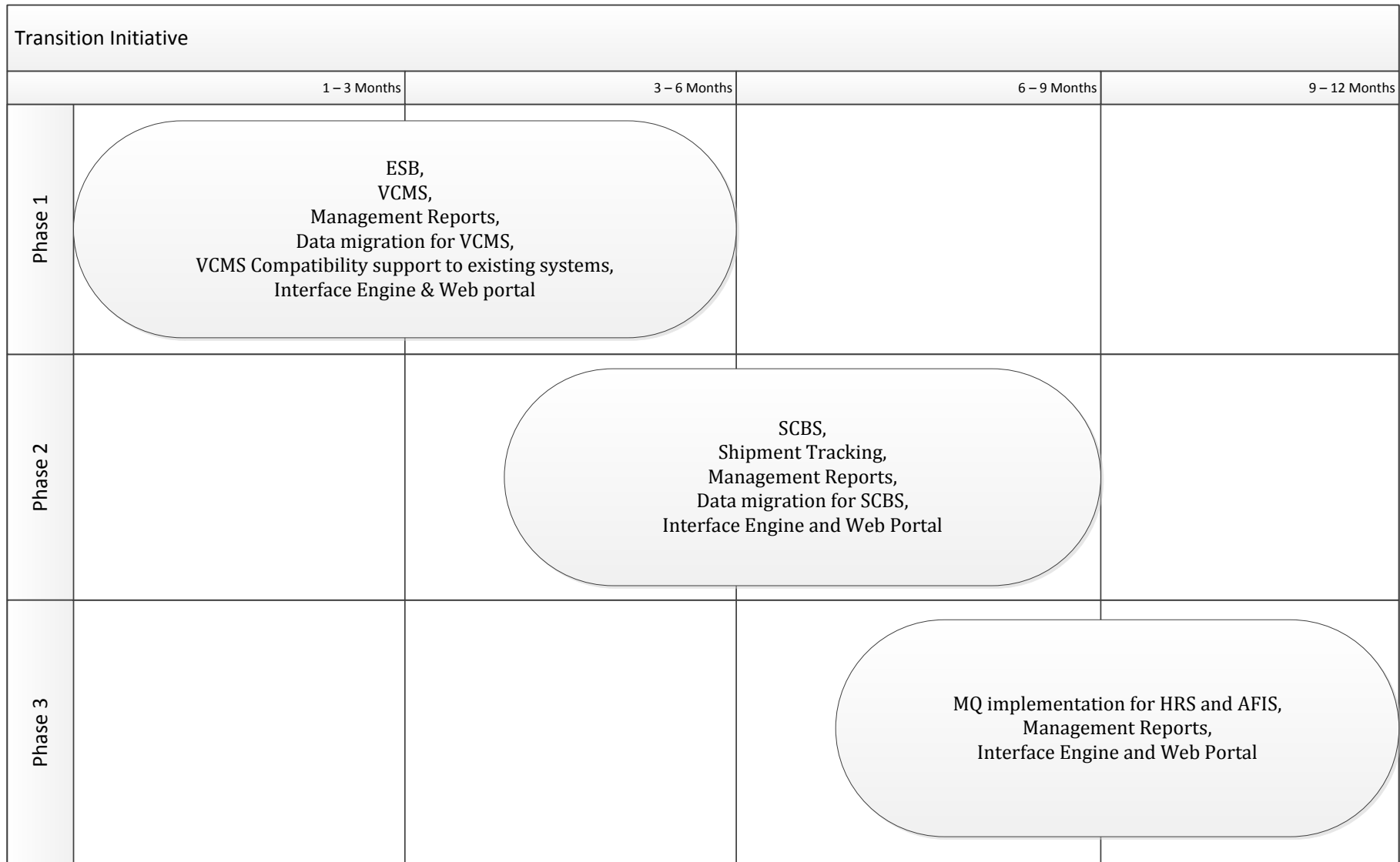
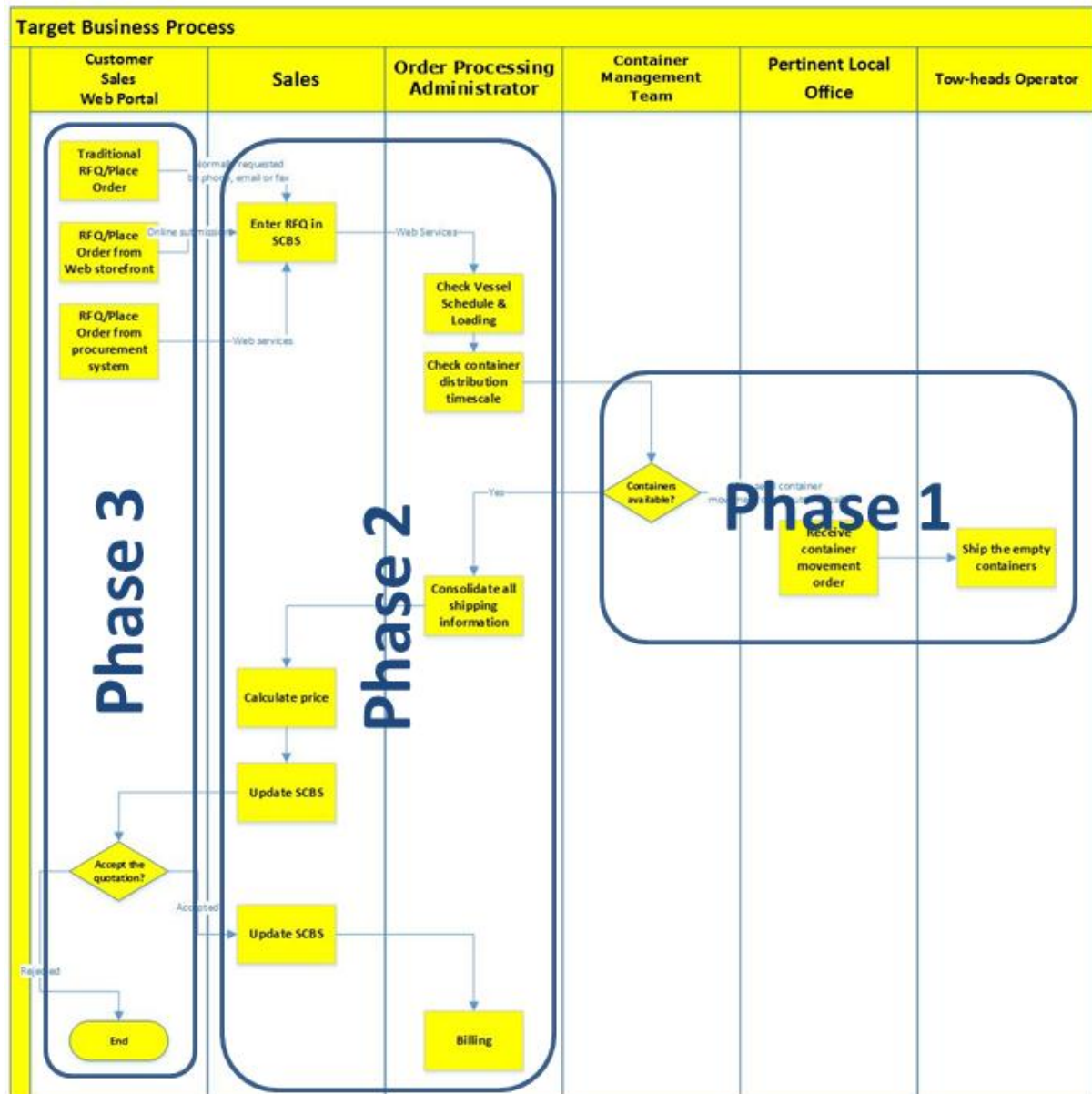


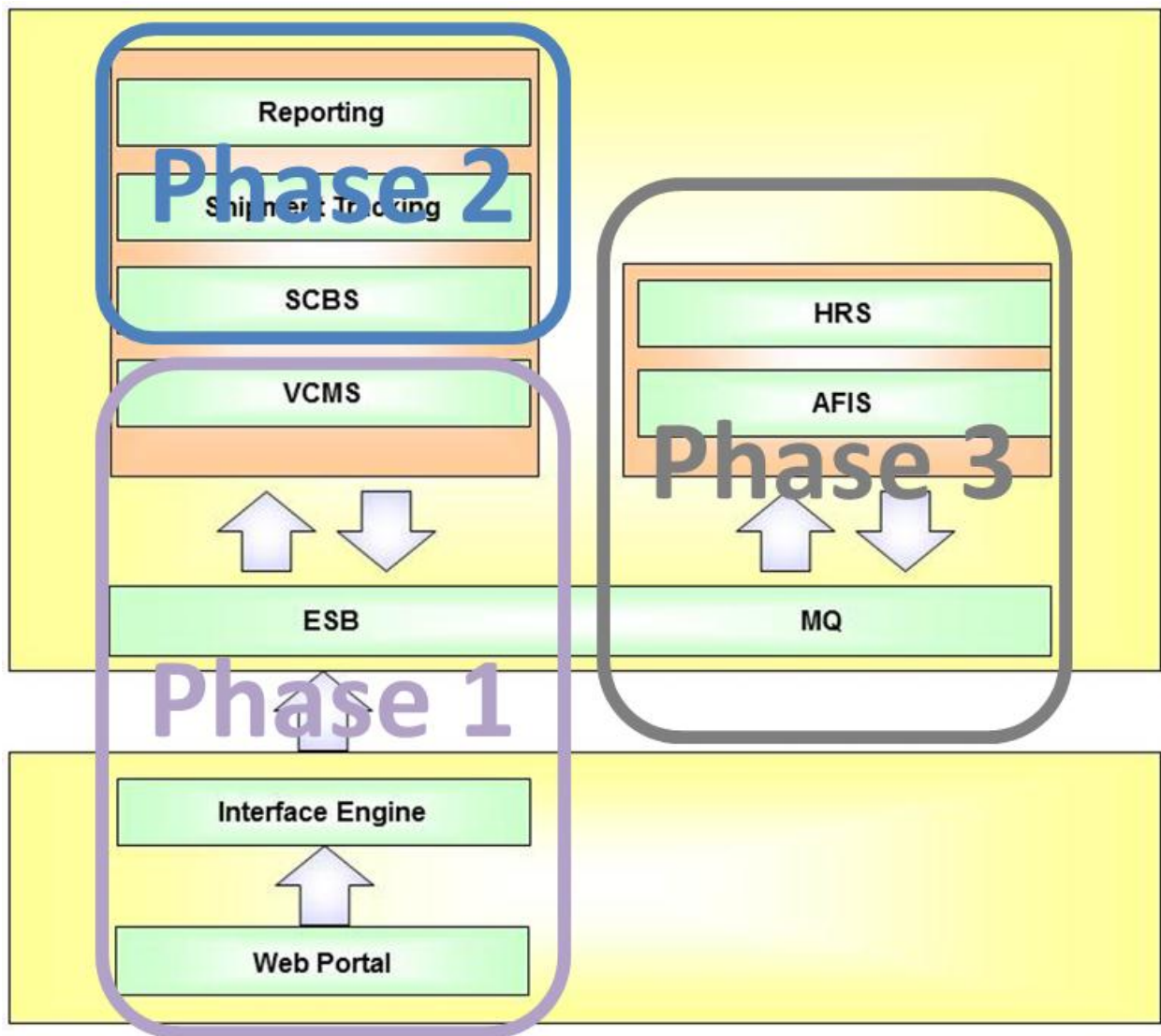
Figure 9 Transition Initiative

Architecture Implementation Roadmap and Migration Plan

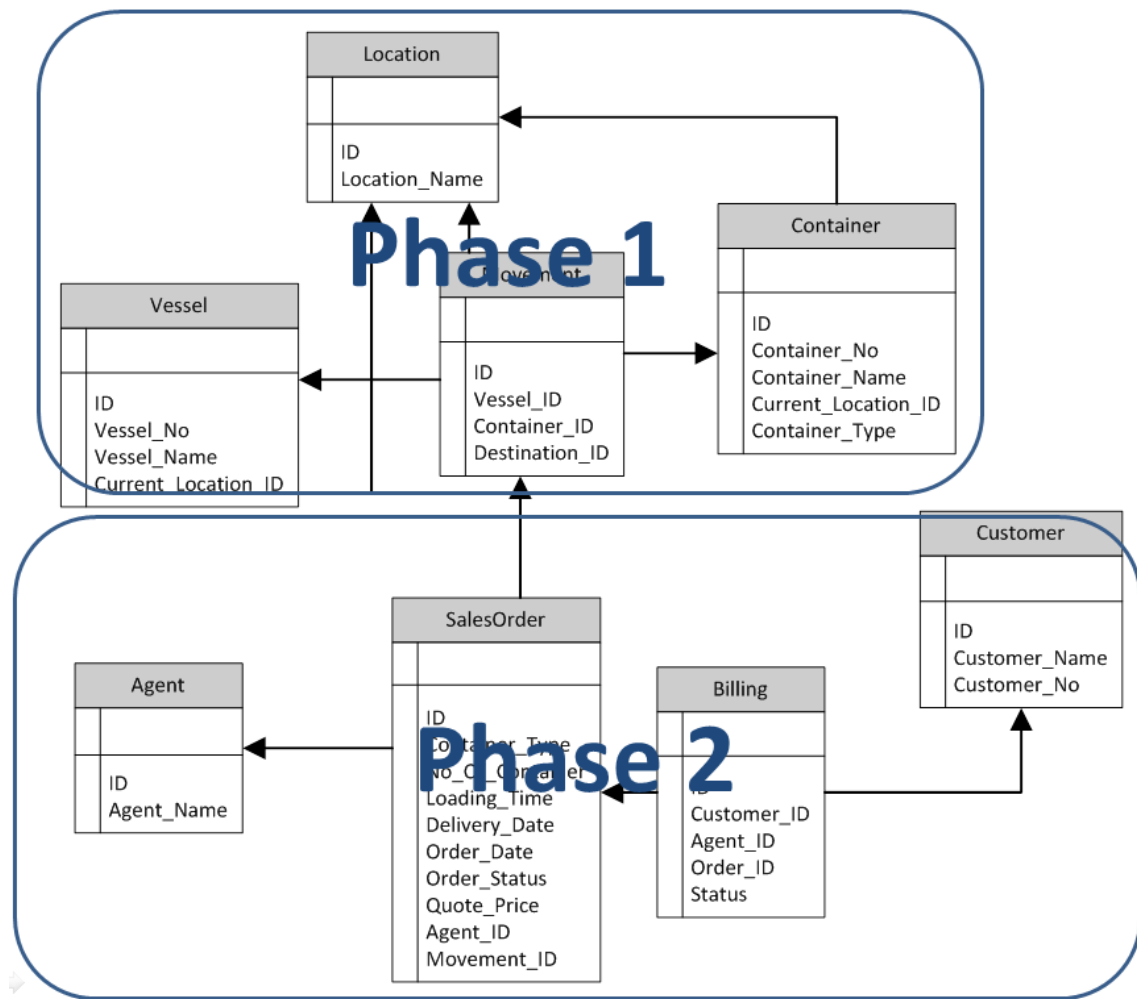
Business Architecture by Phases:



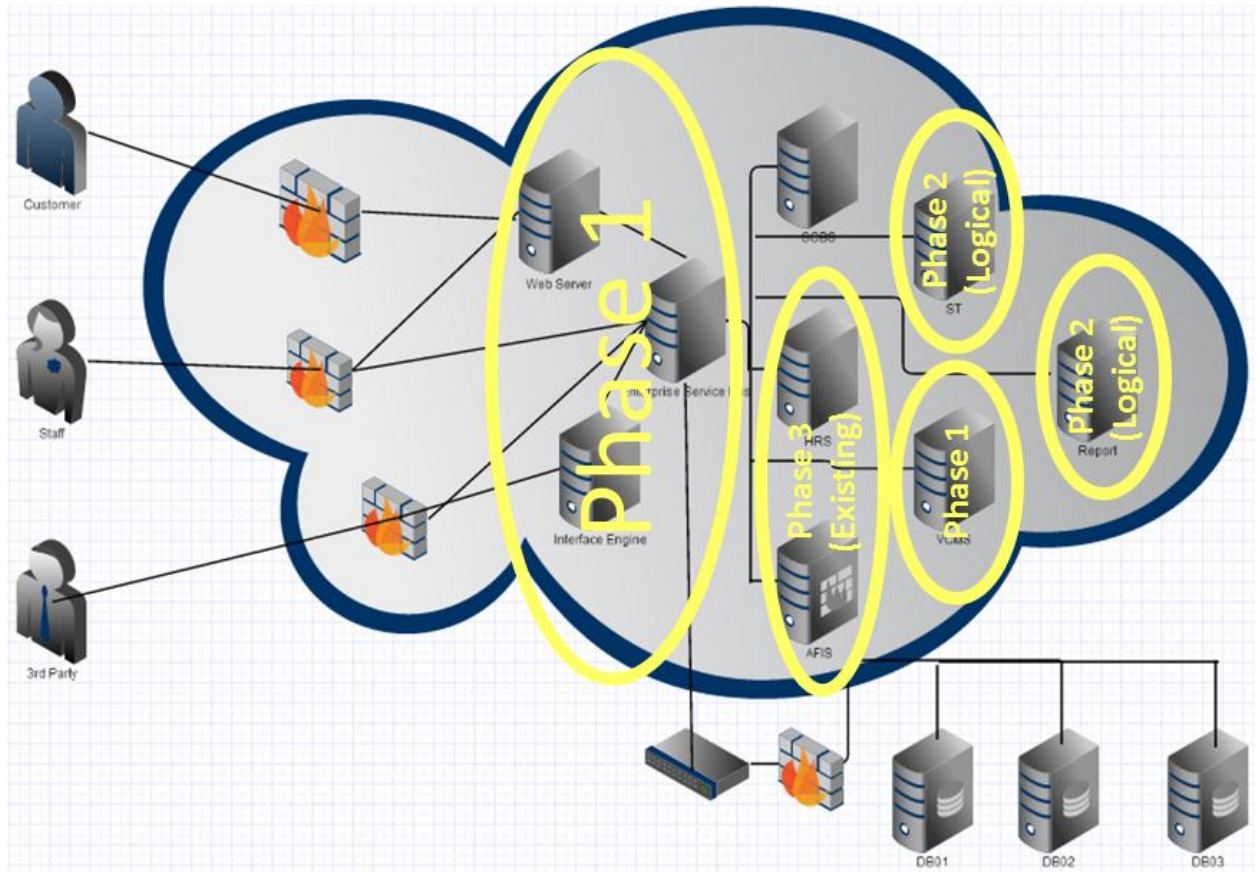
Application Architecture by Phases:



Information Architecture by Phases:



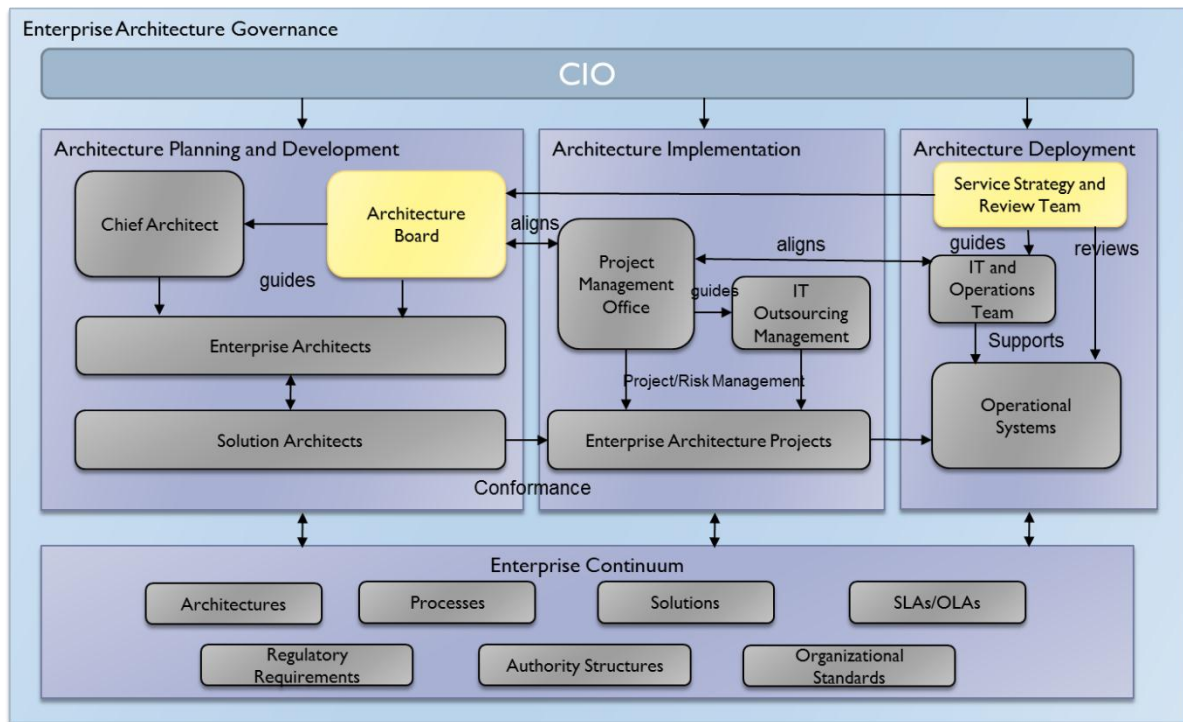
Technology Architecture by Phases:



Architecture Governance and Management

Governance Management Structure and Role and Responsibilities

The governance of the Enterprise Architecture is overseen by the Governance Management as described in the structure below.



The CIO remains as the main personnel to oversee the Enterprise Architecture initiative from planning and development to implementation and eventually its deployment.

The Enterprise Architecture governance structure is divided into 3 parts:

- Architecture Planning and Development
- Architecture Implementation
- Architecture Deployment

The role and responsibilities of the personnel involved in the Enterprise Architecture Governance is described in the table below:

No.	Job Title	Role and Responsibilities
1.	CIO	Overall decision maker. Oversees the Enterprise Architecture initiative from the planning to development to deployment
2.	Chief Architect	Key lead for Enterprise Architecture initiatives. Organizes the team for discussion and approval of the reviews.
3.	Architecture Board	A team of representatives from the architect team, business users, IT department. The main steering committee for the Enterprise Architecture initiative.
4.	Enterprise Architects	Main Enterprise Architecture team responsible for working on the

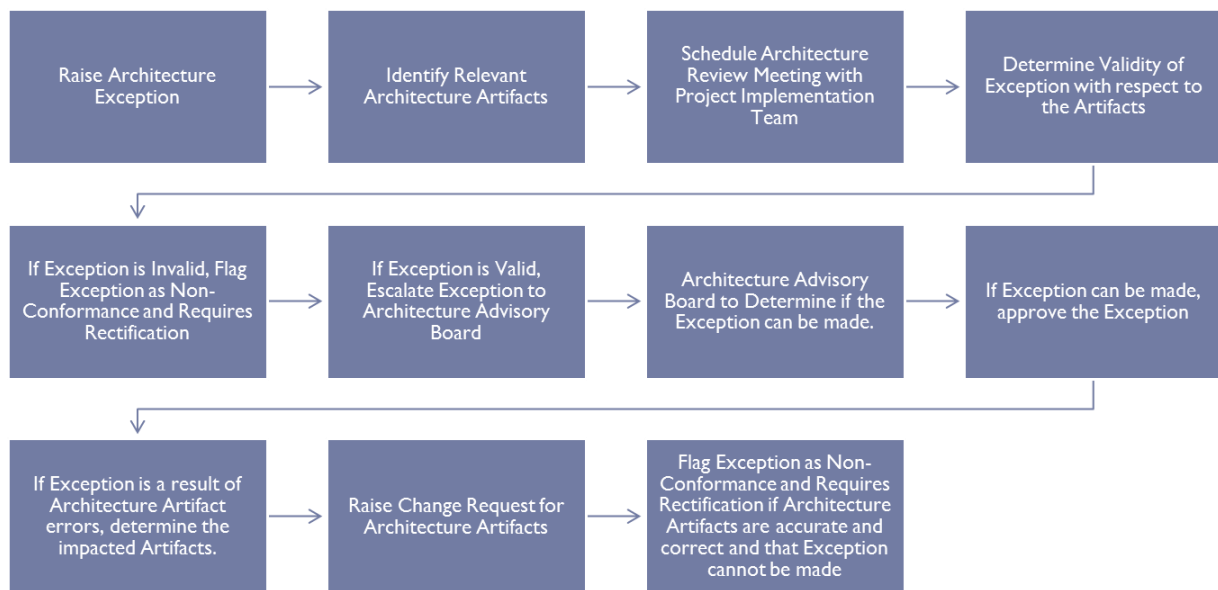
		Enterprise Architecture of SGLines.
5.	Solution Architects	The Solution Architects helps to provide technical expertise for the Enterprise Architects during their planning and development of the Enterprise Architecture.
6.	Project Management Office (PMO)	The PMO handles the implementation of the all Enterprise Architecture initiatives after the Enterprise Architects have confirmed the current projects to be implemented. This includes all outsourcing initiatives.
7.	IT and Operations Team	Handles the maintenance and support of the systems after deployment.
8.	Service Strategy and Review Team	Reviews the current services created and deployed and feedback to the Architecture Board for future improvements.

Processes for Architecture Compliance, Exceptions and Vitality

The following diagram describes the process for Architecture Compliance and Vitality:



The following diagram describes the process for handling Architecture Exception:



Governance Policies

The governance policies shall guide SGLines in the decision making process about the architecture. The policies are applicable throughout the Enterprise Architecture phases. The following lists the governance policies of SGLines:

- The Enterprise Architecture blueprint shall form the basis for all acquisition of systems for the purpose of fulfilling the business functions that require them
- A single Enterprise Architecture Repository shall be established for the purpose of storing the artefacts and information so as to enable availability to this information for the entire enterprise
- All regional units shall operate in accordance to the Enterprise Architecture blueprint that was set by the Enterprise Architecture team and approved by the Enterprise Architecture Board
- There shall be strict compliance with the Enterprise Architecture vision, procedures and technical specifications set out in the blueprint. Any exceptions shall be raised and subjected to the Architecture Compliance process
- All policies shall be reviewed yearly

Governance Practices

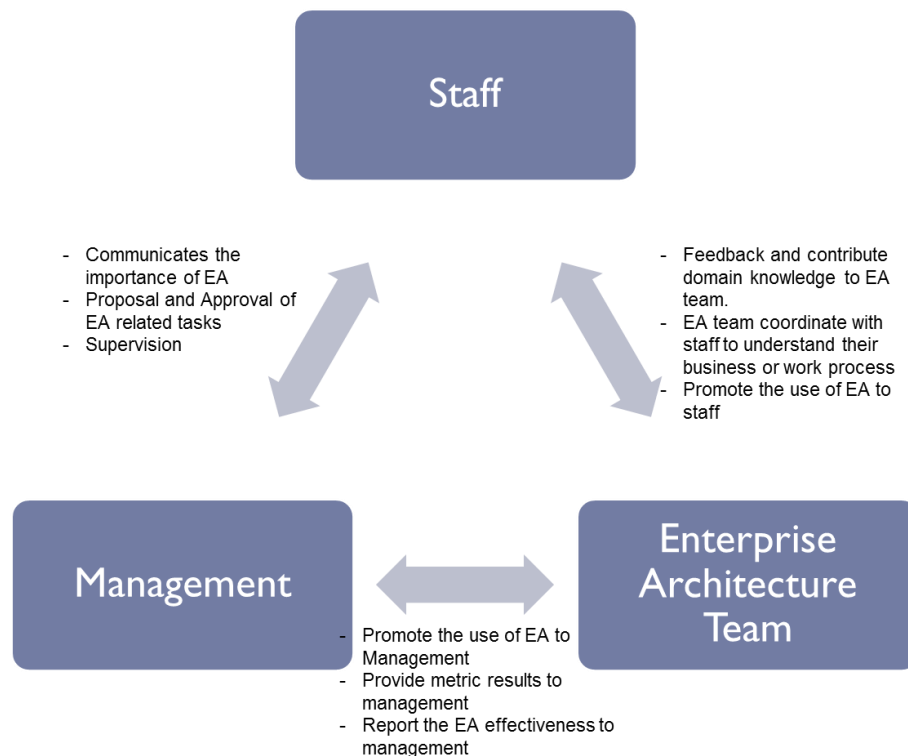
The following practices are recommended for good architecture governance:

- Before any initiatives for business process and systems improvements, seek the Enterprise Architecture blueprint for guidelines and procedures before proceeding.
- Policies shall be in place for governing the use of Enterprise Architecture
- Any changes or amendments required for the Enterprise Architecture due to business process change and to adapt to the new business climate, change request for the Enterprise Architecture shall be raised and reviewed.

- Establish the roles and responsibilities of all stakeholders involved in the Enterprise Architecture initiatives.
- Adopt the use of tools and processes to help in the adoption of the Enterprise Architecture.
- Should there be any exceptions to the adoption of Enterprise Architecture, always consult the Chief Architect or raise an exception to the Architecture Board for review.

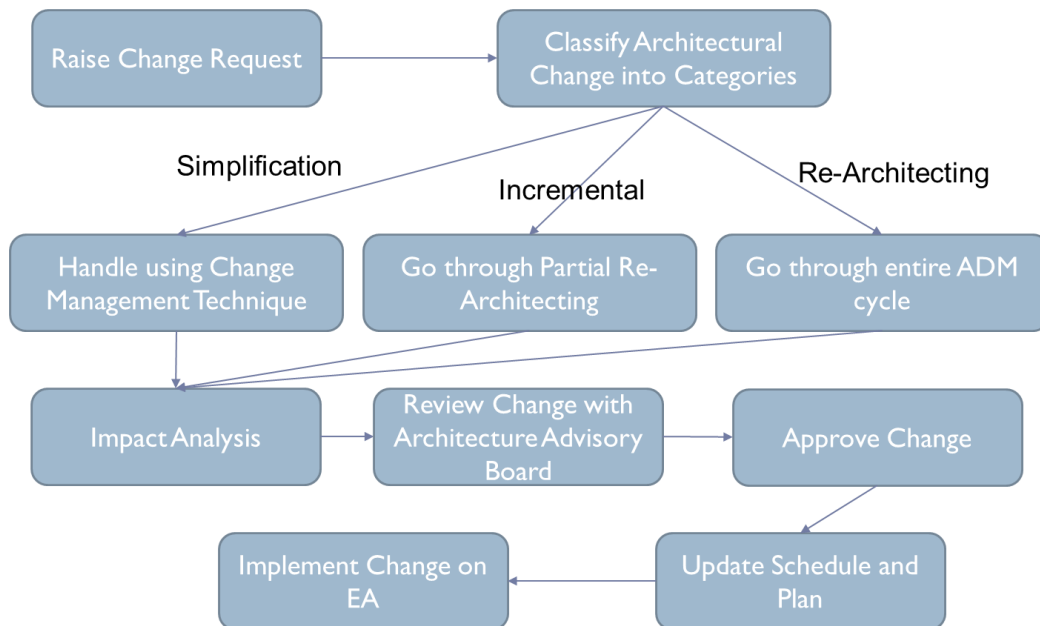
Skeletal Communication Plan

The following diagram proposes the skeletal communication plan of the organization with the Enterprise Architecture team:



Change Management Process

The purpose of the architecture change management process is to ensure that there is a formal process to the review of the change by the Architecture Board, proper impact analysis shall be done and then approved by the board for adoption of the change. This shall ensure that all changes are reviewed and ensured that they are still in line with the overall business objectives and that the change shall not have a huge impact on the existing function of the Enterprise Architecture. After the change has been approved, the necessary artefacts and documents shall be updated in the Enterprise Architecture Repository. The following diagram shows the change management process:



Guidance to Outsourcing Initiative

The following lists some of the outsourcing initiative guidance:

- Never outsource the entire EA function to a vendor
- Only outsource the non-core functions or systems
- Always do a Request for Proposal (RFP) before deciding on any vendor
- Evaluate and select vendor based on the value they offer and their expertise in the domain area
- Avoid selecting the vendor that only offers the cheapest quotation
- Ensure that the selected vendor has compliance with the target Enterprise Architecture principles
- Manage the vendor by a development contract or service contract (SLA)
- Manage the vendor by the result they produce and evaluate and review the result with them regularly
- Always communicate the portion of the organization's Enterprise Architecture that the vendor is handling to the vendor to ensure they meet the requirements for development

Metrics to Measure Effectiveness

The following metrics are selected to measure the effectiveness of the Enterprise Architecture so that any improvement initiatives could be tracked for effectiveness and changes made based on the metric results:

- Time taken for the customer to receive a Request for Quotation (RFQ) response
- The amount of time that a customer's shipment was delayed
- The number of customer complaints per month for service non-fulfilment
- The number of new customers per month
- The turnaround time of the customer's shipment
- Amount of increased revenue annually

Conclusion

The purpose of the EA is to ensure that IT aligns with business goals of the corporation and successfully meets business needs for which they are designed.

This document provides a detailed blueprint of SGLines' Enterprise Architecture initiative. The Publication of this blueprint is understood to be a living document. At any given time, some section or part will be undergoing revision and improvement. And at any point in time, if this document is unclear or vague, clarification should be looked for via the SGLines' Enterprise Architecture Team 1.

In version 1.0, the contents are based on initial proposal and feedbacks collected from SGLines' Management Team in EA Project Presentation. When questions are raised in the future, they will be answered, and captured and exposed on the EA Blueprint portal.