



Kent Ridge Technology



MERLION BANK

ENTERPRISE TRACK SYSTEM PROPOSAL

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1. Baseline Project Plan

In this section, we will present a brief description of the proposed Merlion Banking System (MBS). In it, a feasibility assessment for the system will be conducted as well as the team's configuration and management.

1.1 Introduction

Although there have been indicators suggesting a decline in global economy, Singapore as a flourishing financial center of international prestige, stood out in 2014 for its continued vibrancy. In 2003 alone, financial services contributed for 11.6% of Singapore's gross domestic product, while employing merely 5% of the country's population, rendering it the most profitable service industry in Singapore (Tan, 2005). In 2016, Singapore has edged past Hong Kong to become the third largest financial center in the world, further proving the vitality of Singapore's economy.

The repute of Singapore is premised on its strong monitoring framework and pro-business environment, cultivating it as an international harbor for finance industry. As a result, both overseas and local financial institutions base their headquarters in Singapore. Today, there are as many as 117 foreign banks and 6 local banks fighting for a share in the market. Meanwhile, an increasing number of banks have chosen to base their operational headquarters in Singapore to better cater for their regional group activities. Clearly, Singapore, as a regional financial center, hosts a promising yet highly competitive market.

Since Merlion Bank is entering the market dominated by traditional banking giants, it is crucial to ensure its survival by finding its competitive edge. As information technology is playing a more and more important role in our daily lives, digitalized online banking system, with its benefits of reducing cost and increasing efficiency, will largely benefit Merlion Bank (Deutsche Bank, 2015). It has been shown that banks could manage to remove 20 to 25 percent of their cost by leveraging a digital shift to their operation. On the contrary, laggards could suffer from 35 per cent of net profit eroded (Olanrewaju, 2014).

Thus, Merlion Investment Holding decides to position its newly established Merlion Bank as a top-notch direct bank, which aims to fully digitalize its banking service. Emphasizing

strongly on online banking system which incorporates Business Intelligence (BI) and analytical Customer Relationship Management (CRM) system, Merlion Bank visions to reward our customers with higher interest rates by mitigating cost on brick-and-mortar branches. Furthermore, customer analytics enables Merlion Bank to know our customers well and obtain valuable insights about them. Subsequently, by taking actions to address customer concerns, our bank may reduce churn rate and retain customer loyalty so as to gain competitive edge over other more established traditional banks.

Thus, Kent Ridge Technology has proposed a detailed system proposal for the successful implementation of Merlion Banking System (MBS) based on the requirements from Merlion Investment Holding, to facilitate, complement, and enhance the operations of Merlion Bank's business processes. This proposal includes comprehensive analysis of Merlion Bank, and our proposed features for each subsystem of MBS. We believe that with our recommended solutions, MBS will greatly streamline their operations and survive in the competitive financial market.

1.2 Enterprise System Description

The Merlion Banking System is a corporate-wide information system, which is designed to coordinate and synchronize the business processes across various divisions of the company. Although this system is planned in a modular fashion to customize its functionalities within each division for better efficiency, it also encourages communication and data sharing across departments to achieve higher productivity on the corporate level.

1.2.1 Proposed Organization Hierarchy

The diagram below depicts the organizational structure of Merlion Bank.

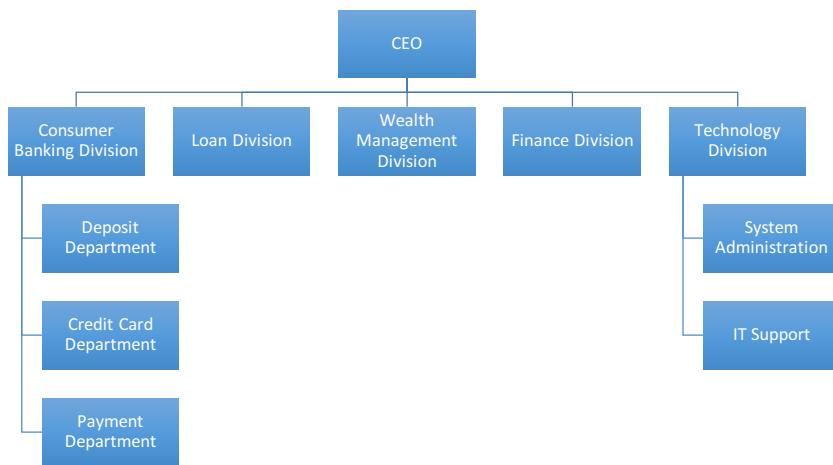


Figure 1: Organizational Structure of Merlion Bank

The Chief Executive Officer (CEO) of Merlion Bank makes strategic, unstructured decisions. CEO sets goals and direction for the company based on the historical report and his/her projection of the future. These decisions include launching of a new product, acquisition of an external company, and expansion of the business field.

The strategic vision from the CEO is then passed down to various divisions where the corporate-level goal is interpreted in the context of different specializations. Division managers make semi-structured decisions based on the reports submitted from various departments and then digest these reports to summarize the performance of the entire division, making sure it is succinct for CEO to view and understand.

Finally, the departments on the operational level realize the requirements given by division managers through day-to-day business activities. Department managers supervise daily operations and handle exceptional pop-up cases that cannot be solved by ordinary employees. They are mainly in charge of structured, repetitive tasks including account opening, loan approval, and IT maintenance.

1.2.2 Business Flow

The diagram below demonstrates the business operations and interactions among different business entities introduced earlier in the organization hierarchy. The arrows represent the information flow from high level management to operational level as well as the data and reports transmitted within Merlion Bank's business process.

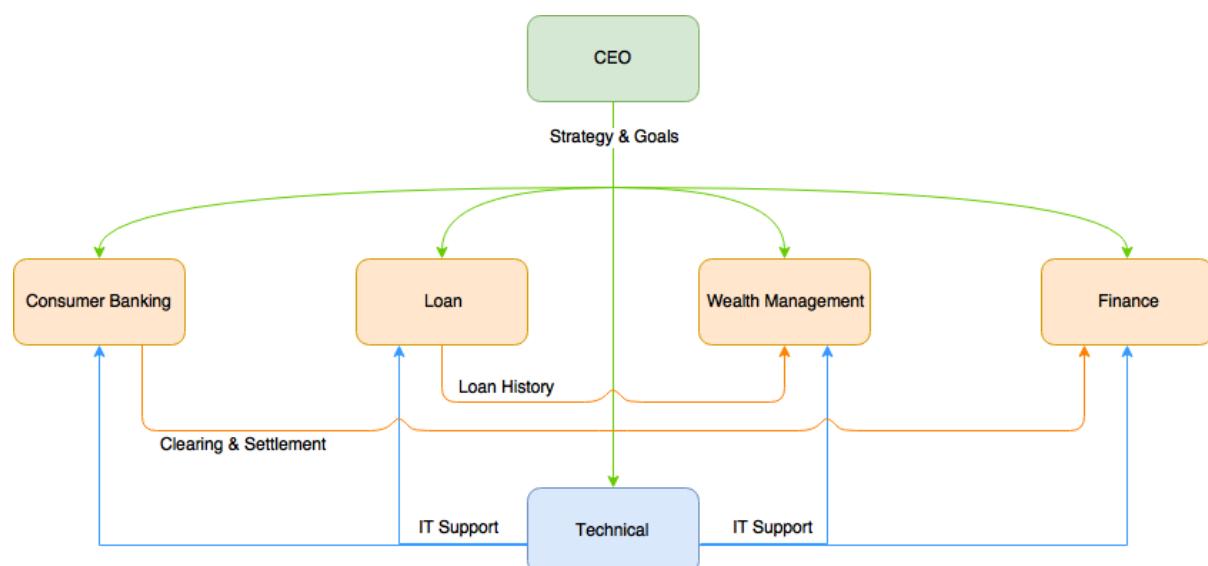


Figure 2: Merlion Bank Business Flow

1.2.3 Business Entity Description

The system is designed modularly and Merlion Bank employee will only be able to access modules and functions applicable to their assigned role. The table below summarizes the roles and corresponding responsibilities of each role.

Staff	Description of Responsibilities
CEO	<p><u>Strategy & Planning</u></p> <p>The CEO of Merlion Bank is concerned with the performance of business and operation process of the bank. By monitoring the earnings, expenditures, reserves and risks of the bank through analytical reports, the CEO aims to analyze the effectiveness of adopted methodologies in each department and then makes critical decisions pertaining to the development of Merlion Bank.</p> <p>With the assistance of the business intelligence system of Merlion Bank, the CEO is able to segment customers, forecast the demand and spot potential business opportunities. Based on the CEO's knowledge and experience, he/she could propose strategies regarding banking services and products. Meanwhile, the CEO is also responsible for verifying strategies proposed by other employees of Merlion bank.</p>
Card Department Staff	<p><u>Card Management</u></p> <p>Card Department Manager is responsible for approving credit card application, monitoring customer's card related activities and then update customer's credit report based on customer's behaviors. Chargeback is also managed by Card Department Manager.</p>

Loan Department Staff	<p><u>Loan Management</u></p> <p>Loan Officer is responsible for communicating with customers to understand their demands and record application information. Mortgage Appraiser is in charge of valuating loan appliers' collateral assets. With documentations collected by loan officer and assets valuation report provided by mortgage appraiser, Underwriter is responsible for evaluating each loan application and then either approve or reject it.</p> <p>Loan Officer, who follows up loan repayment progress, is in charge of monitoring loan balance and taking care of bad debt and mortgage redemption. Underwriter is the one entitled to update status of each loan application.</p>
Sales Department Staff	<p><u>Wealth Management</u></p> <p>Relationship Managers (RMs) are in charge of wealth management process of their own assigned customers. They approach customers to understand their financial goals and suggest wealth management products according to each customer's case. RMs need to follow up with each wealth management portfolio to adjust products, valuate and review portfolio performance.</p> <p>Sales Department Manager is responsible for assigning RM to customers and monitoring sales department's activities. With higher authority, the sales department manager is able to access all wealth management portfolios to view performance and make higher-level decisions.</p>

	<p><u>Customer Analysis</u></p> <p>Sales Department Manager is concerned with locating potential customers for wealth management products. By accessing the opportunity list generated by the business intelligence system, the sales department manager carries on with further research and analysis to find potential business opportunities.</p> <p><u>Customer Relationship</u></p> <p>It's RMs' responsibility to be aware of their own customers' activities, no matter relating to wealth management or not. Despite the fact that RMs are not necessarily always be the one who handle each enquiry and proceed each activity, it's crucial for RMs to follow up the progress and maintain a good relationship with each customer.</p>
Counter Teller	<p><u>Customer Service</u></p> <p>Counter Tellers provide face-to-face service to customers and offer instant support for financial matters, including account opening and closure, fund transfer, loan application, cash deposit and withdrawal, billing and payment, and other general enquires.</p>
Call Center Staff	<p><u>Customer Enquiry</u></p> <p>Call Center Staff is responsible for answering incoming calls to deal with customers' enquiries. For enquires which call center staff couldn't handle, they record the case and pass to corresponding department to proceed.</p>

System Administrator	<p><u>Employee Management</u></p> <p>System Administrator is responsible for creating and managing employee accounts and is in charge of assigning roles to each employee. Role permission is also managed by System Administrator to edit access right of each role.</p>
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1.2.4 Subsystem Description

To fully support the daily operation of Merlion Banking System, four subsystems are constructed. They are: Merlion Bank Internal System; External Parties System; Internet Banking System; Mobile Web Application. Since MBS is a large enterprise system which involves multiple entities, the subsystems target different user groups and define their operation scope.

Subsystem	User	Core Functionality Provided
A. Merlion Bank Internal System	Bank Staff	<p><u>Banking Activities Automation</u></p> <p>Merlion Bank's Internal System is responsible for all backend processing, including interest accrual, balance debit/credit, transfer, report & statement generation. The digitalization and automation of these business processes saves effort and time for bank employees and allows them to focus more on personalized profitable activities such as wealth management services.</p> <p><u>Save and Retrieve Customer Records</u></p> <p>Merlion Bank Internal System enables document digitalization. It manages customer personal</p>

		<p>information, transaction history, account balance in a centralized database. Its powerful yet flexible search function helps bank staffs to retrieve customer information effectively and efficiently. The entries in the database also provide data source for customer analytics and business intelligence which supports high-level decision making process.</p> <p><u>Customer Service</u></p> <p>Customer-fronting employees such as counter tellers and call center agents benefit largely from Merlion Bank Internal System because it enables them to record customer reported issues, track status, update customer information and perform many more activities on a computer to effectively shorten their processing time and improve quality of service.</p>
B. External Parties System	<p>Merchant; Acquirer; Card Networks; ACH; MEPS; SWIFT;</p>	<p><u>Data Sharing</u></p> <p>External Parties System is responsible for data sharing among different external entities and networks. It involves service such as payment, billing, transfer and allows external systems to access to relevant account information from Merlion Bank. This system enables Merlion Bank to extend its service to offer more options which lead to greater flexibility and convenience to customers.</p>

C. Internet Banking Website	Customer	<p><u>Self-service Banking</u></p> <p>As a direct bank, Merlion Bank has to offer Internet Banking Website where customers can conduct major banking service online. After customer applies for a bank account on the website, he/she will be given an online banking account. Customers could use this account to log in and perform transfer, payment, loan application and other activities by themselves.</p> <p><u>Communication</u></p> <p>If customers have concerns or enquiries about their banking experience at Merlion Bank, they could compose and send an enquiry on the Internet Banking Website. The enquiry will then be routed to a specialist who is responsible to reply incoming enquiries as soon as possible. Merlion Bank wish to provide customers the most professional answer within 3 working days.</p>
D. Mobile Web Application	Customer	<p><u>Accessibility</u></p> <p>Merlion Bank also allows its customers to log in to Merlion Internet Banking Website on their mobile devices. The Mobile Web Application provides responsive user interface which will fit the screen of any mobile devices and hence ensure an easy user experience. As such, Merlion Bank clients are able to manage their bank accounts wherever and whenever they prefer.</p>

1.3 Feasibility Assessment

This section evaluates the overall feasibility of the entire project, which will be assessed based on three criteria: technical feasibility, operational feasibility, and schedule feasibility.

1.3.1 Technical Feasibility

During the development and implementation of the proposed system, our team uses several software resources. Some of the core resources are listed in the table below:

Software	
Integrated Development Environment	NetBeans 8.0.2
Server Software	Glassfish 4.0.1
Database Software	MySQL 5.7.14
Platform	Java EE 7
Browser	Chrome 53, Firefox 48
Source Code Management	GitHub
Security	HTTPS, Hashing, Encryption

Due to the unique business requirement of banking service, MBS should enable real-time data synchronization and integration. Hence, after careful consideration, our team believe that a multi-tenancy approach would best suit the needs and bring remarkable business value to the bank.

The notion of ‘software multi-tenancy’ refers to an architecture where a single instance of software runs on a server and serves many users at the same time. As data integration is utterly important to a core banking system to keep track of the latest status and activity of each one of its customers, it is essential to view, edit, and save customer information in a single centralized database via various contact points. Only by adopting this approach, data can be shared and synchronized among different departments of Merlion Bank and bank staffs are assured that they have the access to the latest version of the document. If multi-tenancy is not implemented, each department will be isolated on their business process and record data separately for their

own usage. This causes severe data duplication problem and will cost company extra expense on managing these unnecessary duplicates. More troubles might be created if the duplicates recorded in each department conflict with each other in terms of content.

Although there are some weaknesses when adopting a multi-tenancy approach, we are confident that these disadvantages could be minimized. One possible downside is the scenario where the main system is not functioning properly which will consequently cause each department's business activity to be stagnant. However, this hazard can be effectively avoided if we prepare backup power supply in advance to prevent system blackouts during emergency and observe regular system maintenance and data backup. Overall, we are certain that a multi-tenancy approach will largely benefit Merlion Bank's daily operations.

Another potential technical risk faced by MBS is its security mechanism. Since bank possess some of the most personal and private customer information, it is crucial to protect it from external parties for malicious usages. Security is one of the most, if not, the most important business value a bank has to offer to its clients. To safeguard the entire system, access control is incorporated into the proposed system to ensure only the right person is given permission to perform certain action according to his/her role. Upon login or before some critical activities, identification and authentication is required to reject unauthorized access. Security and privacy can be further strengthened by encryption. Nevertheless, there are still some destructive cyber-attacks, such as Distributed Denial of Service (DDoS) and dictionary attack which pose serious danger towards the overall security of the system. Hence, regular maintenance and revision of the security mechanism according to the current trend is highly necessary to protect MBS from any potential attacks.

1.3.2 Operational Feasibility

Operational feasibility mainly illustrates how the proposed system addresses business problems and opens up more business opportunities for Merlion Bank. In addition, it describes how MBS will revolutionize daily operations in a bank.

As a new entrant into the banking industry, Merlion Bank will face difficulty in attracting customers from its main competitors. To engage customers more effectively, it is crucial to find out customer's expectations and define business processes accordingly to meet those

expectations. MBS, being a highly automated system, enables Merlion Bank to compete with its major competitors as a direct bank, which offers more irresistible service and products to its clients. By making a strategic shift towards online banking, Merlion Bank is able to mitigate cost on its brick-and-mortar branches and provide its customers with lower service charges and significantly higher interest rates.

In this digitalized world, people are highly adapted to services. In fact, these consumers have already been comfortable and reliant on information technologies in other industries, such as booking flights and hotel and purchasing music and books via online platforms. So far, there has been a vacancy of such well-developed online service available in banking industry. Once MBS is launched, it will meet popular demand and it will undoubtedly be welcomed by the clients who have been anticipating it for a long time. As such, MBS opens up an innovative path for Merlion Bank to embrace a large group of IT-savvy customers who are willing to experience online banking service. Once Merlion Bank ushers in its first batch of clients, MBS equipped with operational CRM will help the staff to address customer concerns promptly which effectively reduces churn rate and ensures customer satisfaction. Benefited from analytical CRM, Merlion Bank is able to better understand our customer's needs and hence offer them with more customized service, especially for personalized wealth management products.

If MBS is implemented, it will completely change the way how a traditional bank operates on a day-to-day basis. By switching its focus from physical branches to online banking websites, Merlion Bank provides accessibility, convenience, productivity, and efficiency to its customers. Since almost every Singaporean owns a smart phone which connects to the Internet, MBS web application allows customers to perform transaction and many other activities on their fingertips instead of traveling a long way to a nearby bank. It simply brings a bank counter right in front of customer regardless of their current time and location. As every single piece of customer information is captured and saved safely in Merlion Bank's centralized database, the bank knows its customers well so that customers will never be asked to enter their personal particulars repeatedly once their data is captured in the system. This reduces a lot of unnecessary trouble and saves customer's precious time. Moreover, staffs are also benefited from system digitalization. MBS automates many business processes on its own, liberating employees from tedious paperwork and documentation. At the same time, it also improves accuracy of the data recorded in the system by eliminating possible human errors.

1.3.3 Schedule Feasibility

The Merlion Banking System (MBS) is given a total of 14 weeks to complete with several stages including analysis, design, development, implementation, and testing. The project kicks off on 10th August and the final system release is scheduled on 10th November.

Week Number	Milestone	Atomic Assessment Units
Week 5	Proposal Submission	---
Week 7	First System Release	AAU1: Common Infrastructure AAU2: Customer Management System AAU3: Deposit Account Management System
Week 10	System Analysis and Design Report Submission	---
Week 11	Second System Release	AAU4: Card Management System AAU5: Loan Management System AAU6: Billing and Payment System
Week 13	Final System Release	AAU7: Wealth Management System AAU8: Portfolio Management System AAU9: Customer Analytics and Business Intelligence

According to the table above, our team will be mainly focusing on common infrastructure, Customer Management System and Deposit Account Management System. Once these three AAUs are completed, both customer and employee accounts will be created in the database which provides basic information for the later AAUs to link to. After the first system release, our team will be mainly focusing on the loan and payment modules which involves some external systems for clearing and settlement purpose. When the second system release is done, the core banking system will be 80% finished. As for the final system release, we will shift our emphasis on some of the more advanced modules in customer analytics and business intelligence which may require complicated algorithms. The results generated from these advanced data analytics modules will support the decisions made by Relationship Managers (RMs) in the wealth management system where they are required to provide proposals based

on each customer's personal and financial information. Before our final system release, all modules should be completed, revised based on user feedbacks and well tested.

Based on the three feasibility assessments above, our team is confident that the benefits MBS brings to Merlion Bank outweighs its risks. When this project is officially released, it will address various business problems and provide Merlion Bank with a competitive edge over its main competitors in the market.

1.4 Team Management

Team Member	AAU Ownership	Secondary Role
Guo Ziyu	Card Management System Billing and Payment System	<p><u>Team Leader & Project Management</u></p> <ul style="list-style-type: none"> • Scheduling of project deadlines (internal and external deadlines) and project meeting • Ensure proper alignment with business objectives • Ensure proper integration of subsystems
Han Fengwei	Common Infrastructure Third Party Management System	<p><u>Technical Lead & Security</u></p> <ul style="list-style-type: none"> • Spearhead System architecture planning • Set common coding structure • Set user access control structure
Lai Qing	Loan Management System	<p><u>User Interface Design</u></p> <ul style="list-style-type: none"> • Design logo of Merlion Banking System(MBS) • Design the common look and style across all interfaces • Provide required artworks for any part of the system

Peng Yongxue	Deposit Account Management System Customer Analytics and Business Intelligence System	<u>Business Domain Experts</u> <ul style="list-style-type: none"> • Research and understand the specific business domain thoroughly and be the point of reference for all business domain clarifications • Anchor baseline project plan
Yang Shuanghe	Customer Management System Customer Mobile Web Applications	<u>Primary Report Editor</u> <ul style="list-style-type: none"> • Organize the layout of all deliverable reports • Ensure cohesion of report and impression of professional writing • Present essential business logic in required UML diagrams
Zhou Jingyuan	Wealth Management System Portfolio Management System	<u>Testing & Technical Support</u> <ul style="list-style-type: none"> • Set common infrastructure for unit testing, integration testing, and system testing • Handle integration and reliability check of open source codes

Team Configuration

During the entire system development life style, each team member is involved in business domain research, requirement analysis, system architecture design, and implementation phases. At the initial stage, the team was divided into 3 pairs to do business domain research for the purpose of ensuring both efficiency and comprehensiveness of the research. Each pair was required to do research about business concepts, business processes, and important functionalities of AAUs they had been assigned to.

During the implementation phase, every member takes ownership of one or two AAUs based on their own preference and skill sets. By specifying the ownership, every member will be able to focus on the breadth and depth of his/her AAUs and take responsibility for his/her working outcome.

Besides the ownership for AAUs, each team member will also have a secondary role which determines his/her leadership role in the team. The secondary role is assigned to each team member based on each individual's interest, preference, competency, and prior experience. Responsibilities for each role have been demonstrated clearly in the table above in case of any future confusion.

Communication Plan

During the requirement gathering and analysis phase, the team met almost every weekday to discuss about the business processes, system requirements, as well as system architecture and analysis. In order to convey the ideas more clearly, the team also made use of tools such as activity diagrams and use case diagrams to facilitate the communication.

During the implementation phase, each coding pair meets at least three times a week to code together and coordinate development of systems, modules, and functions. The whole team meets twice a week to update one another each individual's progress, the obstacles each team member has met, and plan for the next few days.

The team uses MySQL as database management system, and uses GitHub as source code version controller. To minimize the code conflict, there is a development branch for integration and a production branch for system release. Besides, for each system that is being developed, there will also be a branch for AAU owner to work on his own and test the code thoroughly before pushing the codes to development branch. After finishing the integration testing, the codes will then be pushed to production branch with a version number (e.g. V1.0) for the purpose of version control in the future.

Throughout the whole system development process, the team makes use of instant messaging functions of WeChat and mobile phones for immediate communication and clarifications. To facilitate collaboration, the team uses Draw.io, an online diagram editor built around Google

Drive, to create all the UML diagrams that are used in deliverable reports. The team also makes uses of Google Drive to share and synchronize important files.

2. High-level System Architecture

2.1 List of System, Sub-system & Application

ID	Name	AAU ID
A.	Merlion Bank Internal System	
A.1	Common Infrastructure	1
A.1.1	System User Account Management Module	1
A.1.2	Internal Communication Module	1
A.1.3	External Communication Module	1
A.1.4	Security Module	1
A.2	Customer Management System	2
A.2.1	Customer Information Management Module	2
A.2.2	Customer Advanced Information Management Module	2
A.2.3	Enquiry Management Module	2
A.3	Deposit Account Management System	3
A.3.1	Account Management Module	3
A.3.2	Account Balance Management Module	3
A.3.3	Interest Crediting Management Module	3
A.4	Card Management System	4

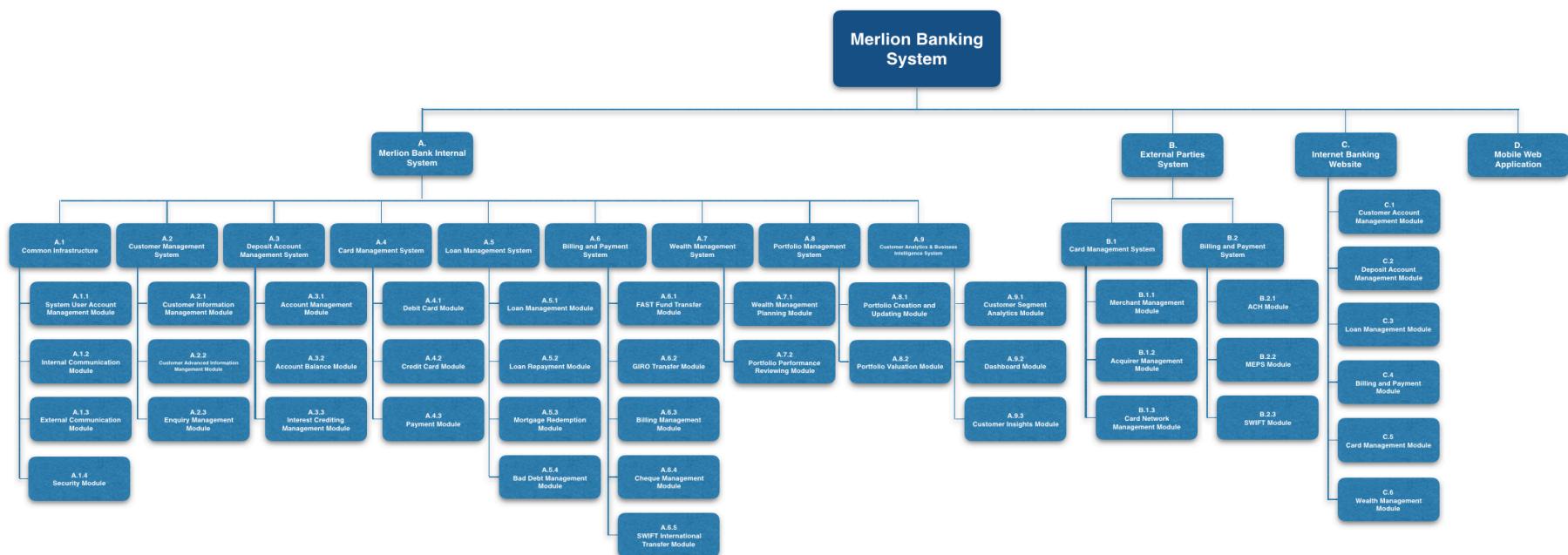
A.4.1	Debit Card Module	4
A.4.2	Credit Card Module	4
A.4.3	Payment Module	4
A.5	Loan Management System	5
A.5.1	Loan Management Module	5
A.5.2	Loan Repayment Module	5
A.5.3	Mortgage Redemption Module	5
A.5.4	Bad Debt Management Module	5
A.6	Billing and Payment System	6
A.6.1	FAST Fund Transfer Module	6
A.6.2	GIRO Transfer Module	6
A.6.3	Billing Management Module	6
A.6.4	Cheque Management Module	6
A.6.5	SWIFT International Transfer Module	6
A.7	Wealth Management System	7
A.7.1	Wealth Management Planning Module	7
A.7.2	Portfolio Performance Reviewing Module	7
A.8	Portfolio Management System	8
A.8.1	Portfolio Creation and Updating Module	8
A.8.2	Portfolio Valuation Module	8
A.9	Customer Analytics and Business Intelligence System	9

A.9.1	Customer Segment Analytics Module	9
A.9.2	Dashboard Module	9
A.9.3	Customer Insights Module	9
B	External Parties System	
B.1	Card Management System	4
B.1.1	Merchant Management Module	4
B.1.2	Acquirer Management Module	4
B.1.3	Card Network Management Module	4
B.2	Billing and Payment System	6
B.2.1	ACH Module	6
B.2.2	MEPS Module	6
B.2.3	SWIFT Module	6
C	Internet Banking Website(for customers)	
C.1	Customer Account Management Module	1, 2
C.2	Deposit Account Management Module	3
C.3	Loan Management Module	5
C.4	Billing and Payment Module	6
C.5	Card Management Module	4
C.6	Wealth Management Module	7
D	Mobile Web Application(for customers)	
D.1	Customer Account Management Module	1, 2

D.2	Deposit Account Management Module	3
D.3	Loan Management Module	5
D.4	Billing and Payment Module	6
D.5	Card Management Module	4
D.6	Wealth Management Module	7

2.2 Visual Table of Contents

* “D. Mobile Web Application” shares the same functionalities as “C. Internet Banking Website”



3. Business Requirement Analysis

In this section, we will document a business analysis of all the subsystems that have been previously marked out in the preliminary requirements specification received by Kent Ridge Technology. This shall contain the core *Business Objectives* of each subsystem as well as the *Business Assumptions* we have made. A detailed analysis of the *Business Processes* of each subsystem will then be provided, followed by a System Requirements Analysis section where we explain how we intend to craft our Merlion Banking System(MBS) to address these needs. Finally, an exhaustive list of the *System Functionalities* will then be provided to present a detailed picture of the final system we are going to implement.

3.1 Common Infrastructure (AAU ID:01)

3.1.1 Business Analysis

The Common Infrastructure system is to provide functionalities for user account management, user access control, as well as logging. System administrator should be able to manage employee accounts such as account creation, updating, and deleting. For each employee, once his account is created by system administrator, he/she should be able to reset his/her password for security reasons. Besides, system administrator should be able to assign, update, and cancel role for an employee as well.

Logging functionalities should also be provided by Common Infrastructure System to traces all the users' financially material transactions and sensitive user actions. In this way, a robust and resilient platform of high security standards will be created to protect the integrity of the system and ensure accountability of the users.

Business Objectives

- Allow system administrator to manage employee account, such as create, update, and delete employee account
- Allow system administrator to assign, update, and delete role for an employee

- Allow employees should only be allowed to access functions needed to perform their duties.
- Allow staff of Merlion Bank to reset his/her password of employee account
- Allow staff of Merlion Bank to communicate with one another with internal communication system
- Keep track of all important activities at both user level and system level for security and troubleshooting purpose

3.1.2 Business Process

A) Create Employee Account & Assign Role

System administrator should be able to create account newly hired employees so that they would be able to access systems to perform their duties.

Scenario: System Administrator Elsa creates a new account for an employee Anna

1. System administrator Elsa enters personal particulars for Anna as follow:
 - a. Name: Anna Chua
 - b. Department: Loan Department
 - c. Position: Manager
2. Elsa selects “Loan Department Manager” from drop-down menu for Anna’s first role and “Sales Department Manager” for her second role
3. System checks database and does not find any conflicts.
4. System assigns a user account id of 0001 and generates a password “xwqocwc” for Anna.
5. System displays the notification saying that “A new employee account has been successfully created!”

B) Edit Employee Account

This enables system administrator to edit employee account and edit role of an employee.

Scenario: System Administrator Elsa edits account for an employee Anna

1. System administrator Elsa logs in to Merlion Bank Internal System
2. Elsa searches for loan department staff Bob by keying in “Anna”
3. System displays a list of user account profile of which the field “Name” contains “Anna”
4. Elsa selects the correct user account profile and clicks “Edit” button
5. All the fields become editable

After all the fields become editable, system administrator can edit department and position of a staff, as well as delete role of a staff if the staff no longer need to perform a role.

Scenario: System Administrator Elsa deletes a role of an employee Anna

1. Elsa clicks “Delete” icon besides first role (“Loan Department Manager”) of staff Anna’s user account profile
2. System displays a notification saying that “Are you sure to delete the role?”
3. Elsa confirms the action by clicking “Yes”
4. System deletes the role of Anna in database and role “Loan Department Manager” disappears from Anna’s user account profile
5. Elsa clicks “Save” button
6. System displays a notification saying that “User account has been successfully updated”

C) Delete Staff Account

This enables system administrator to delete a staff account from database if the staff is no longer employed by Merlion Bank.

Scenario: System Administrator Elsa creates a new account for an employee Anna

1. System administrator Elsa logs in to Merlion Bank Internal System

2. Elsa searches for loan department staff Bob by keying in “Bob”
3. System displays a list of user account profile of which the field “Name” contains “Bob”
4. Elsa selects the correct user account profile and clicks “Delete” button
5. System displays the notification saying that “Are you sure to delete the the user account?”
6. Elsa confirms the action by clicking “Yes”
7. System displays the notification saying that “User account has been successfully deleted”

D) User Log in & Log out

Employees and customers should be able to log in to and log out from Merlion Banking System using their user account id and password.

E) Forget password

If employees or customers forget their user account password, they can reset the password using Merlion Banking System.

Scenario: Employee Danny resets his password.

1. Danny clicks “Forget Password”.
2. Danny enters his email.
3. System detects for Danny’s email address and sends to his email a link that expires in five minutes to change his password.
4. Danny clicks on the email link and enters his new password as follow:
 - a. New Password: danny1970
 - b. Type new password again: danny1970
5. System did not detect any error.
6. System accepts changes to account password
7. System displays the notification saying that “Your password has been successfully updated”

F) Reset Employee Account Password

This enables staff of Merlion Bank to change password of his/her own user account.

Scenario: Loan department manager Anna resets password for her employee account

1. Loan department manager logs in to Merlion Bank Internal System with the following information:
 - a. User Account ID: 0001
 - b. Password: xwqocwc
2. System verifies user account id and password from database, and does not find any conflict
3. Anna clicks her own user account profile and then clicks “Reset Password” button
4. System displays the page for changing password.
5. Anna input the information as follow:
 - a. Old Password: xwqocwc
 - b. New Password: anna1970
 - c. Confirm New Password: anna1970
6. System checks that no conflict appears for the new password that is keyed in twice
7. System displays the notification saying that “Your user account password has been successfully updated!”

G) Internal Messaging

Communication and collaboration are key processes in helping to create business value. Therefore, it is important that Merlion Banking System provide a platform for employees to communicate with their co-workers in an easy and secure manner.

H) Send firm-wide announcement

It can be troublesome to send a message to all staff of Merlion Bank due to the large number of staff members. Announcements and broadcasts help ensure that all staff members receive the information in a timely manner and can thus act on it immediately.

I) Send Notifications & Emails to Customer

System should be able to send notifications to customer's mailbox on Internet Banking Website to remind customers of events such as application result of loan, monthly bank statement, reply to customer's enquiry, etc. System should also be able to automatically send bank statement or notifications to customer's personal email account.

3.1.3 System Requirement Analysis

Business Assumptions

- All staff have access to Merlion Bank internal communication system
- One employee can only have one employee account
- When creating a new employee account, system administrator must assign role(s) to the employee
- One employee can be assigned multiples roles
- Staff can only have access to functionalities which are necessary to perform their duties

To address the business requirements of the Common Infrastructure System in the preliminary requirements specifications, a System User Account Management Module, an Internal Communication Module, an External Communication Module, and a Security Module will be constructed for Merlion Bank Internal System. These four modules are described as follows:

a) System User Account Management Module

The module will be used by employees and system administrators of Merlion Bank. Employees would be able to reset their password for user account. System administrators would be able to manage employee user account creation, editing, deletion, as well as role assignment, editing,

and deletion. Additionally, it will be used to review logs and identify suspicious activities of users or suspicious activities carried out on systems.

b) Internal Communication Module

The module will be used by all employees of Merlion Bank for timely and seamless communication. All employees can send messages to individual person and some employees will be able to post announcements and broadcasts which can notify all staff members of Merlion Bank.

c) External Communication Module

The module will be used for purpose of sending notifications and emails to customer. Certain events will trigger system to send emails to customer's personal email account. Besides, system will also be able to send notifications to customer's mailbox on Internet Banking Website to remind customers of certain events.

d) Security Module

This module will be used to protect the confidentiality and integrity of all data handled by the system at both transport and application layer. All the online banking activities and other activities involving sensitive data are protected by Secure Socket Layer (SSL) as a method of transport layer security. At application layer, various security methods will be adopted, including but not limited to robust login and logout protection, role-based and need-based access control, hashing of sensitive information and logging at both system and user level.

To address the business requirements of the Common Infrastructure System in the preliminary requirements specifications, a Customer Account Management Module will be constructed for Internet Banking Website and Mobile Web Application. The module is described as follows:

e) Customer Account Management Module

The module will be used by customers to manage their user account. Customer will be able to log in and out of his user account. For security purpose, customer can replace his old password

with new password. If customer forgets his password, he/she will be able to retrieve his lost password through email verification. Besides, customer can also choose to delete his user account for Internet Banking Website.

System Functionalities

Function	Name	Remark	AAU
Code			ID
A.1 Common Infrastructure			
A.1.1 System User Account Management Module			
A.1.1.1	Create staff account	System administrator creates new staff account	1
A.1.1.2	View staff accounts	System administrator views all the staff accounts, and associated roles and permissions	
A.1.1.3	Update staff account	System administrator updates staff account information	
A.1.1.4	Delete staff account	System administrator deletes staff account	
A.1.1.5	Reset account password	Staff resets password of his user account	
A.1.1.6	View role	System administrator views all roles assigned to a staff	
A.1.1.7	Assign role	System administrator gives staff certain access right by assigning them a new role	
A.1.1.8	Delete role	System administrator deletes a role of staff, and the access right attached to the role deleted will be canceled	
A.1.1.9	Log in	Staff logs in to Merlion Bank Internal System	
A.1.1.10	Log out	Staff logs out from Merlion Bank Internal System	
A.1.1.11	Forget password	Staff retrieves lost password through email verification	
A.1.2 Internal Communication Module			
A.1.2.1	Send messages	Staff sends messages to individual staff	1
A.1.2.2	View messages	Staff views messages sent by other staff	

A.1.2.3	Delete messages	Staff clears history	
A.1.2.4	Send announcements	Staff sends announcements	
A.1.2.5	View announcements	Staff views announcements	
A.1.3 External Communication Module			
A.1.3.1	Send notifications to customer's mailbox	System sends notifications to customer's mailbox on Internet banking Website	1
A.1.3.2	Send email to customer's personal email account	System sends email to customer's personal email account	
A.1.4 Security Module			
A.1.4.1	Session inactivity logout	Session will automatically logout after 15 minutes of inactivity	1
A.1.4.2	Logging	System traces all the users' financially material transactions and sensitive user actions	
A.1.4.3	Hash password	System uses hashing to protect password	
A.1.4.4	Encrypt sensitive data	System uses Secure Socket Layer(SSL) to encrypt sensitive data for transport layer security	
A.1.4.5	Account lock out	If customer inputs password wrongly for three times at login page, system will send one-time password (OTP) to customer's phone number. The OTP is required for customer to login again to his/her online banking account.	
A.1.4.6	Captcha mechanism	If customer inputs password wrongly for three times at login page, system will require customer to pass the simple test before login to protect website against bots	
A.1.4.7	Second factor authentication	System sends SMS to customer's phone number to facilitate authentication if customer	

		requests for any service on the online banking system	
C.1 Customer Account Management Module			
C.1.1	Delete account	Customer chooses to delete his/her account for Merlion Online Banking	1
C.1.2	Change password	Customer replaces old password with a new password	
C.1.3	Forget password	Customer retrieves lost password through email verification	
C.1.4	Log in	Customer logins to their account by user account number and password	
C.1.5	Log out	Customer logs out of their account	
D.1 Customer Account Management Module			
D.1.1	Delete account	Customer chooses to delete his/her account for Merlion Online Banking	1
D.1.2	Change password	Customer replaces old password with a new password	
D.1.3	Forget password	Customer retrieves lost password through email verification	
D.1.4	Log in	Customer logins to their account by user account number and password	
D.1.5	Log out	Customer logs out of their account	

3.2 Customer Management System (AAU ID: 02)

3.2.1 Business Analysis

The Customer Management System is required to provide both **operational** and **collaborative** CRM capabilities to Merlion Bank.

Operational CRM is to ensure a consistent data usage and sharing across all department within Merlion Bank. To achieve information consistency, a centralized database is managed to store all customer information in its most updated version. This system tracks both basic and

advanced customer information for various usages, from mailing, loan application, to wealth management decisions and customer analysis. As a direct bank, Merlion Bank's Customer Management System enables customer to edit and change their basic profile over the Internet easily without making their way to the physical branches. However, for verification and security purposes, customers are still advised to meet their Relationship Managers (RM) for advanced information management. Since all customer-related information is captured and stored in Customer Management System, the Personal Data Protection Act (PDPA) must be complied with. Moreover, a comprehensive security mechanism should be implemented to ensure a specific bank employee could only view customer data he/she needs to know without exceeding the boundaries.

Collaborative CRM provides seamless customer service across all contact points of Merlion Bank, which include brick-and-mortar branch, call center, postal mail, as well as online channels such as Internet banking website and email. When a customer reports an issue via any of the contact points mentioned above, the system should create a new case which may consist of a single issue or multiple issues. The case will be auto-forwarded to a relevant specialist regarding the nature and content of the problem. Customer Management System promotes a smooth customer experience by sharing case status and customer information among all contact points so that minimal information is required from customer when they contact Merlion Bank. To build a stronger tie with our valuable clients, RM will be notified by the system when RM's customer creates a new case. Similar to customer profiles, customer report cases should also be kept within a tight security mechanism.

Business Objectives

- Allow customers to edit their basic information.
- Allow RMs to manage customer's advanced information.
- Search customers through various dynamic filters for bank employees to find out the relevant customer information.
- Ensure all contact points have the access to the updated customer information when a customer report a case.
- Inform RMs with the latest customer case status.

3.2.2 Business Process

A) Edit Customer Basic Information

As a direct bank, Merlion Bank allows its customers to change their basic information via online banking system. Alternatively, customers can change their basic information by approaching any of the contact points maintained by Merlion Bank.

Scenario: Edit customer basic information (Via online banking system)

1. Customer Tom logs in to Internet Banking Website of Merlion Bank
2. Tom clicks “Update personal profile”
3. Tom looks for “Mobile phone Number” column under “Contact Details” section
4. Tom changes his number from 94631826 to 83357621
5. Tom clicks “Update” button at the bottom of the webpage
6. System displays “Mobile number updated” message

Scenario: Edit customer basic information (Via call center)

1. Call center employee Kim receives a phone call from Customer Tom
2. Tom informs Kim that he wants to update his new phone number
3. Kim asks Tom for his name and NRIC/Passport number
4. Kim searches for Tom in Merlion Bank Internal System according to the ID number provided by him
5. Kim clicks “Update customer profile”
6. Kim changes mobile phone number from 94631826 to 83357621
7. Kim clicks “Update” button at the bottom of the webpage
8. System displays “Mobile number updated” message

B) Edit Customer Advanced Information

Since only customers with wealth management services have their advanced information captured in the system, not all customers are required to manage their advanced profile. If customer needs to change advanced information, he/she has to inform RM. RM may arrange a

meeting with customer or a chat over the phone to discuss and finally update the customer's advanced profile. The reason why customer cannot edit their own advanced information is because a slight change in advanced profile may cause a big difference in wealth management decisions, and hence the portfolio of wealth management. Therefore, Merlion Bank encourages all of its customers to discuss with RM before changing advanced profile.

Scenario: Edit customer advanced profile

1. Customer Tom contacts his RM Mike and discusses his change in advanced information field
2. Mike acknowledges and verifies the change
3. Mike logs in to Merlion Bank Internal System as an RM
4. Mike clicks "Update customer advanced profile"
5. Mike changes Tom's "Financial Goal" from "\$50,000/year" to "\$70,000/year"
6. Mike clicks "Update" button at the bottom of the webpage
7. System displays "Financial goal updated" message

C) Search Customer

The search function enables Merlion Bank to discover more information from its customers and use it in profit-driven activities, such as email marketing. Various filters provided allow the bank to group customers into different categories according to their information recorded.

Scenario: Sales manager Terry searches for potential customer

1. Terry logs in to Merlion Bank Internal System
2. Terry clicks "Search customer"
3. Terry sets "Customer Age" to be "less than 50 years old" and sets "Deposit Account Balance" to be "more than \$8,000"
4. System searches through the entire database and displays a list of customers whose age is under 50 with monthly income higher than \$8,000

D) Record an Enquiry

Customers of Merlion Bank are provided with a wide range of options when they encounter a problem during their banking experience. They may compose an enquiry on Merlion Internet Banking Website, or write an email. If customers prefer an offline approach, they are able to call hotline or come down to the Merlion Bank home branch.

Scenario: Customer composes an enquiry on Internet Banking Website

1. Customer Tom logs in to Merlion Bank Internet Banking Website
2. Tom clicks “Message” and then selects “Write an enquiry”
3. Tom chooses “Enquiry Type” as “Customer Account” from the dropdown menu
4. Tom then writes in the text box for “Description”:
“If someone overseas wishes to transfer fund to my Merlion Bank deposit account, what information do I need to provide him other than my SWIFT code?”
5. Tom clicks “Submit” button at the end of the webpage
6. System displays “Your enquiry has been sent” message and issues a Case ID (e003289) to Tom

Scenario: Customer makes enquiry at the counter

1. Customer Tom informs Counter Teller Ben that his new debit card has not been mailed to his address
2. Ben clicks “Record a customer enquiry”
3. Ben asks Tom for his account number and selects Tom’s account in Merlion Bank Internal System
4. Ben selects “Debit Card” from the dropdown menu and types in the “Case Description” text box:
“Customer has not received his newly issued debit card from his home address recorded in our system. Please update the status of card issuance and speed up the process. Thanks.”
5. Ben clicks “Submit” button
6. System displays “Customer case submitted” with a Case ID (c002849)
7. Ben copies the Case ID (c002849) and passes to Tom for status tracking.

E) Add Follow-up Questions

After customer's enquiry is answered, system will notify customer for the result. When customer views the solution to the case, he/she may be unsatisfied with the result. Then, there is an option provided by the website for customer to post a follow-up question to the previous case. The follow-up question shares the same Case ID and is attached to the previous case so that the problem-solving employee will have a better understanding of the background information.

Scenario: Customer adds follow-up question

1. Customer Tom logs in to Merlion Internet Banking Website
2. Tom selects "Notifications" and clicks on "Your enquiry has a new response"
3. Tom views the response which does not fully answer his question
4. Tom clicks "Add follow-up questions"
5. Tom writes his follow-up questions:

"Thank you for your answer. However, I am uncertain about the address you mentioned. Should it be the address of Merlion Bank home branch or the address of the branch where I opened my account?"
6. Tom clicks "Submit" button
7. System displays "Follow-up question submitted" message

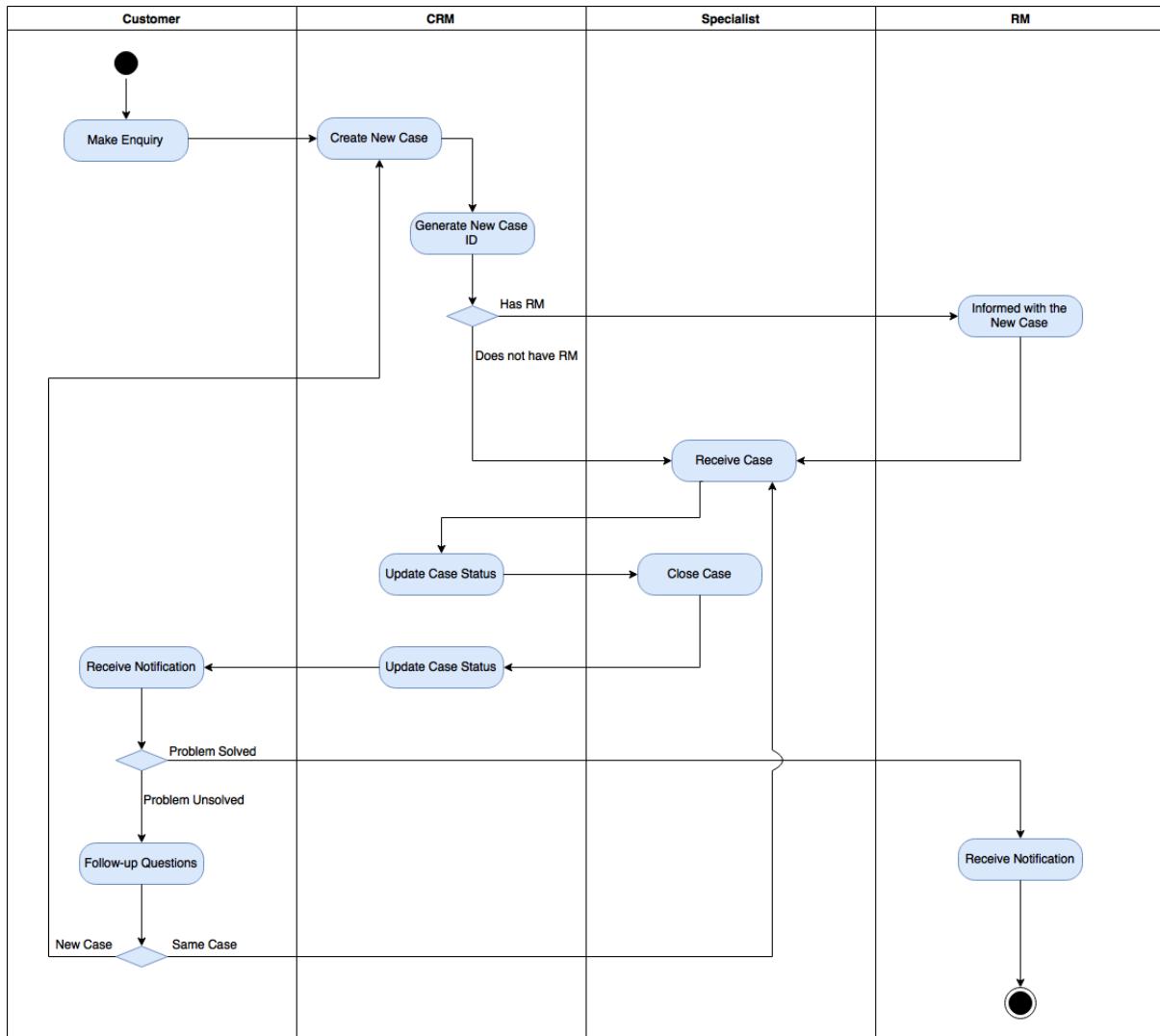


Figure 3: Activity Diagram - Enquiry Process

3.2.3 System Requirement Analysis

Business Assumptions

- Customer profile is created when customer opens an account at Merlion Bank.
- Advanced customer information is only created when customer subscribes to wealth management services and is managed by customer's RM.
- Customer is only able to edit basic information.
- Cases received via phone call, postal mail and email are recorded into Merlion Bank's system by customer service center employees.
- When a new case is created by the system, a unique case ID is auto-generated.

- Customer Management System implements a security mechanism that restrict access to customer information on a “need-to-know” basis.

To address the business requirements of Customer Management System, a customer information module, a customer advanced information module, and an enquiry management module should be constructed.

a) Customer Information Module

This module will be used by customer-fronting employees to acquire basic information about a customer and support identification purpose if necessary. Call center employees and counter tellers are able to edit customer information when they are informed by the customer about the latest change of personal particulars, such as phone number or home address. All staffs are given the access right to view basic customer profile inside this module to assist them with their daily business processes.

b) Customer Advanced Information Module

This module will mainly be used by Relational Managers. RMs are required to manage customer's advanced profile personally as the profile contains many private and secrete information about customers who have subscribed to wealth management services. RMs use this module to extract customer's advanced information and make wealth management related decisions based on it. When customer wishes to change advanced profile, such as financial goal, customer is advised to inform his/her RM about the change which will then be completed by the RM. Moreover, this module allows RMs and their sales managers to search for potential customers by setting criteria for different filters. After acquiring various groups with similar characteristics, they may conduct marketing activities targeting these groups of people according to their traits.

c) Enquiry Management Module

This module is used by customer service employees, including call center employees and counter tellers. They record customer enquiry in this module so that it can be routed to specialists for resolution according to the enquiry type selected. The module will auto-generate

a Case ID every time a new case is recorded in the system. When customers refer to their previous cases, client-facing employees can easily search for the case customer is mentioning either through Case ID or customer name and personal ID. This module helps Merlion Bank to store customer's enquiry history which can be viewed whenever it is necessary to promote efficiency.

d) Customer Account Management Module

This module enables Merlion Bank customers to manage their personal profiles through viewing and editing account functionalities. On Merlion Internet Banking Website, customers are also able to write and submit enquiries online. This module builds a closer tie between customers and Merlion Bank.

System Functionalities

Function	Name	Remark	AAU ID
Code			
A.2 Customer Management System			
A.2.1 Customer Information Management Module			
A.2.1.1	Edit basic customer information	Teller updates basic customer information such as, contact information and address	2
A.2.1.2	View basic customer information	Teller views basic customer information	
A.2.2 Customer Advanced Information Management Module			
A.2.2.1	Edit advanced customer information	RM updates advanced customer information mainly used in wealth management such as, individual risk profile and financial goals	2
A.2.2.2	View advanced customer information	RM views advanced customer information	
A.2.2.3	Search customer	RM searches customer information through dynamic filters and searching criteria	

A.2.3 Enquiry Management Module			
A.2.3.1	Create enquiry case	Customer-fronting employees add a new case to customer enquiry with detailed description of the problem. A case can consist of one or many issues	2
A.2.3.2	Update enquiry status	Customer service employees update enquiry status	
A.2.3.3	Forward enquiry to specialist	According to its category, system routes enquiry to relevant customer service employee for resolution	
A.2.3.4	Search enquiry	Customer-fronting employees and RM search case by its case ID	
A.2.3.5	View enquiry	Customer-fronting employees and RM view a list of customer enquiries with corresponding status	
C.1 Customer Account Management Module			
C.1.6	View accounts	Customer views his/her own account information	2
C.1.7	Update accounts	Customer updates his/her basic information such as, contact number, home address, etc	
C.1.8	Submit enquiry	Customer submits enquiry by briefly describe the problem encountered	
C.1.9	View enquiry	Customer views the status of the enquiry submitted, whether it is solved by an employee or not	
C.1.10	Add follow-up questions	If the resolution does not address customer's concern, customer may add follow-up questions	
D.1 Customer Account Management Module			
D.1.6	View accounts	Customer views his/her own account information	2
D.1.7	Update accounts	Customer updates his/her basic information such as, contact number, home address, etc	

D.1.8	Submit enquiry	Customer submits enquiry by briefly describe the problem encountered	
D.1.9	View enquiry	Customer views the status of the enquiry submitted, whether it is solved by an employee or not	
D.1.10	Add follow-up questions	If the resolution does not address customer's concern, customer may add follow-up questions	

3.3 Deposit Account Management System (AAU ID: 03)

3.3.1 Business Analysis

The Deposit Account Management System (DAMS) is the core of Merlion Banking System. It manages some of the most important information of customer accounts, including account balance, transaction history, and interest rates. DAMS acts as a centerpiece in Merlion Banking System since all deposit account management task must be assigned back to DAMS to ensure a consistent account balance and transaction records across all channels.

Although DAMS connects with many other systems, it functions on its own most of the time and seldom requires human processing. Firstly, it debits or credits a certain amount from customer's account when customer makes a transaction or pays a bill. Secondly, it accrues interest of each account on daily basis and credits the accumulated interest at the end of each month. Thirdly, DAMS records transaction history of each account and prepares an e-statement for customer to check monthly.

DAMS is also used for account opening and account closure process. As a direct bank, Internet Banking Website of Merlion Bank encourages its customers to apply for an account online. DAMS then receives the application request with necessary customer information and uploaded document for verification. It should allow deposit account manager to view application request with supplementary documents attached and makes a decision whether to approve or reject the application.

DAMS is also responsible for internal fund transfer within Merlion Bank. When a customer of Merlion Bank wishes to transfer fund to another Merlion Bank account, DAMS debits on the paying account and credits on the payee account without going through clearing and settlement process via external parties. In addition, customer is able to manage up to a maximum number of 20 payees in their online banking account to speed up transaction process without the hassle of entering payee information.

Business Objectives

- Provide online account opening and account closure service
- Calculate daily interest of each account
- Maintain customer transaction history and produce e-statement monthly
- Manage customer account balance and ensure the balance is updated and shared across all operational systems
- Allow customer to transfer fund within Merlion Bank without passing through external entities for clearing and settlement procedures
- Allow customer to manage up to 20 payees and save their payment information to accelerate transaction process in the future

3.3.2 Business Processes

A) Open Account

As a direct bank, Merlion Bank encourages its customers to begin their Merlion banking experience by opening accounts online. This means that it is no longer necessary for customers to approach a counter teller in a branch before they can create an account under their name. To open an account via Merlion Internet Banking Website, customer only needs to select account type, provide mandatory personal information, add initial deposit, and upload supplementary document for verification. Ideally, customer is able to open account within ten minutes if all information provided is correct.

Scenario: Customer opens an account on Internet Banking Website

1. Customer Tom clicks “Open Account” on Merlion Internet Banking Website
2. After reading detailed information about each account type, Tom chooses “Monthly Saving Account”
3. Tom then fills in all the mandatory information required by the system:
 - a) Name: Tom Tan
 - b) Gender: Male
 - c) Nationality: Singaporean
 - d) NRIC/Passport: S9384832K
 - e) Address: 35 Smith Avenue #03-25
 - f) Postal Code: 637283
 - g) Contact Number: 93848492
 - h) Email Address: tom_tan@hotmail.com
4. Tom upload the scanned copy of his NRIC
5. Tom clicks “Submit” button
6. System verifies customer information and issues an account number for Tom
7. Tom deposits \$5,000 into his new account as initial deposit
8. System displays Terms & Conditions and require customer digital signature
9. Tom signs using a mouse and saves it into the system
10. System sends a confirmation email to Tom

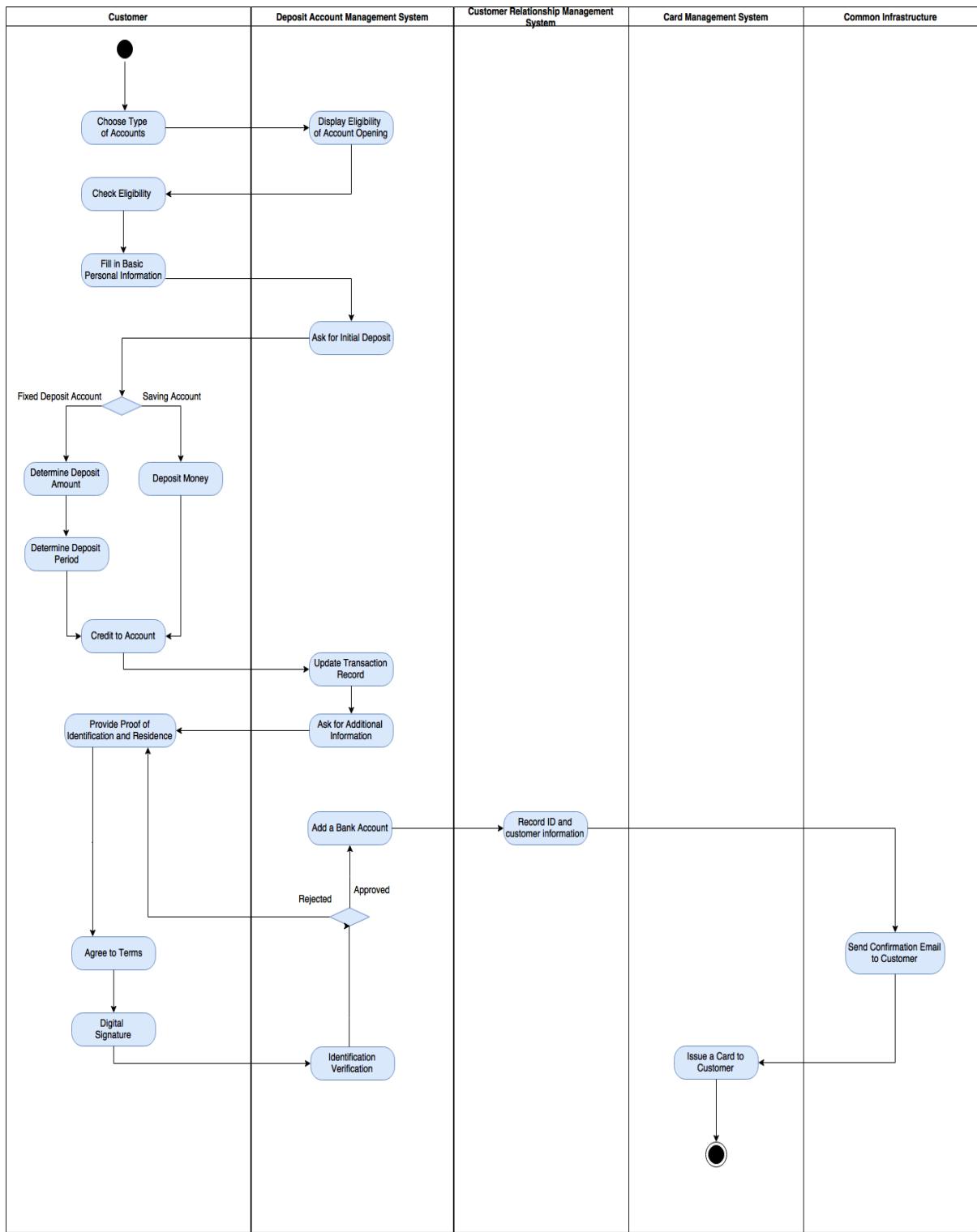


Figure 4: Activity Diagram - Online Account Opening

B) Close Account

When customer wishes to close a Merlion Bank Account, he/she could also achieve this online. However, before account closure customer needs to ensure there is no account balance left

either through transfer or withdraw. When customer intends to close account, system will also ask customer for their feedback to identify areas of improvement to enhance Merlion Bank's service in the future.

Scenario: Customer closes an account on Internet Banking Website

1. Customer Tom logs in to Merlion Internet Banking Website
2. Tom clicks "View my accounts"
3. Tom selects the account he wishes to close and clicks "Delete account"
4. System displays a dropdown menu containing some of the common reasons for account closure
5. Tom selects "I'm going to live/study abroad" from the dropdown menu
6. System detects there is no balance left in the deleting account
7. System requires Tom to fill in and sign a closure form
8. System detects there are other accounts under Tom and deletes information associated with this account only
9. System sends a confirmation email to Tom

C) Payee Management

If customer makes transfer frequently to certain accounts, he/she is allowed to add up to 20 accounts in the system. By saving payee information, customer do not need to input information repeatedly before every transfer process which makes it much more efficient. When customer uses up the 20 vacancies and wishes to add more payee account, he/she has to make a decision to clear some of the previous records to open up a space for new payee.

Scenario: Add a payee

1. Customer Tom logs in to Merlion Internet Banking Website
2. Tom clicks "Payee Management" and then clicks "+ Add a payee"
3. Tom enters Payee information as below:
 - Recipient's Name: Sharon Tan
 - Recipient's Account Number: 1232-1122334455
4. Tom clicks "Save" button
5. System displays "Payee added successfully" message

Scenario: Delete a payee

1. Customer Tom logs in to Merlion Internet Banking Website
2. Tom clicks “Payee Management” and then clicks “Delete” button beside Payee Tony’s name
3. System displays warning message “Are you sure to delete this payee?”
4. Tom selects “Yes”
5. System displays “Payee deleted” message

D) Intra-bank Fund Transfer

DAMS enables customer to transfer funds between two Merlion Bank accounts which requires no external clearing and settlement processes. If customer transfers to an account frequently, he/she may choose to add the account to payee list in order to speed up the whole transfer process. If this is just a one-time transfer, customer do not need to add recipient into payee list which has a limited size of 20.

Scenario: Transfer to a Merlion Bank account

1. Customer Tom logs in to Merlion Internet Banking Website
2. Tom clicks “Transfer” button
3. Tom chooses “One-time transfer”
4. Tom enters payee information:
 - Recipient’s Name: Sharon Tan
 - Recipient’s Account Number: 1232-1122334455
5. Tom enters transfer amount \$150
6. Tom clicks “OK”
7. System displays “Are you sure to transfer \$150 to Amy Wong?”
8. Tom clicks “Yes”
9. System displays “Transfer completed” message

E) Cash Deposit / Withdrawal

Since Merlion Bank targets itself as a direct bank, it focuses its service online while maintaining only one home branch in Singapore. In order to drive more customer from its brick-and-mortar branch to online banking website, over-the-counter (OTC) transactions at Merlion Bank may be charged with service fees accordingly. Hence, it is not recommended to deposit cash or withdraw cash at Merlion Bank's home branch. Alternatively, customers are encouraged to perform online transfer to other cards or accounts. Merlion Bank also plans to join the ATM network so that customers will be given more options for performing transactions, including cash deposit and withdrawal. Merlion Bank customers may be able to enjoy ATM service at Phase Two of the project.

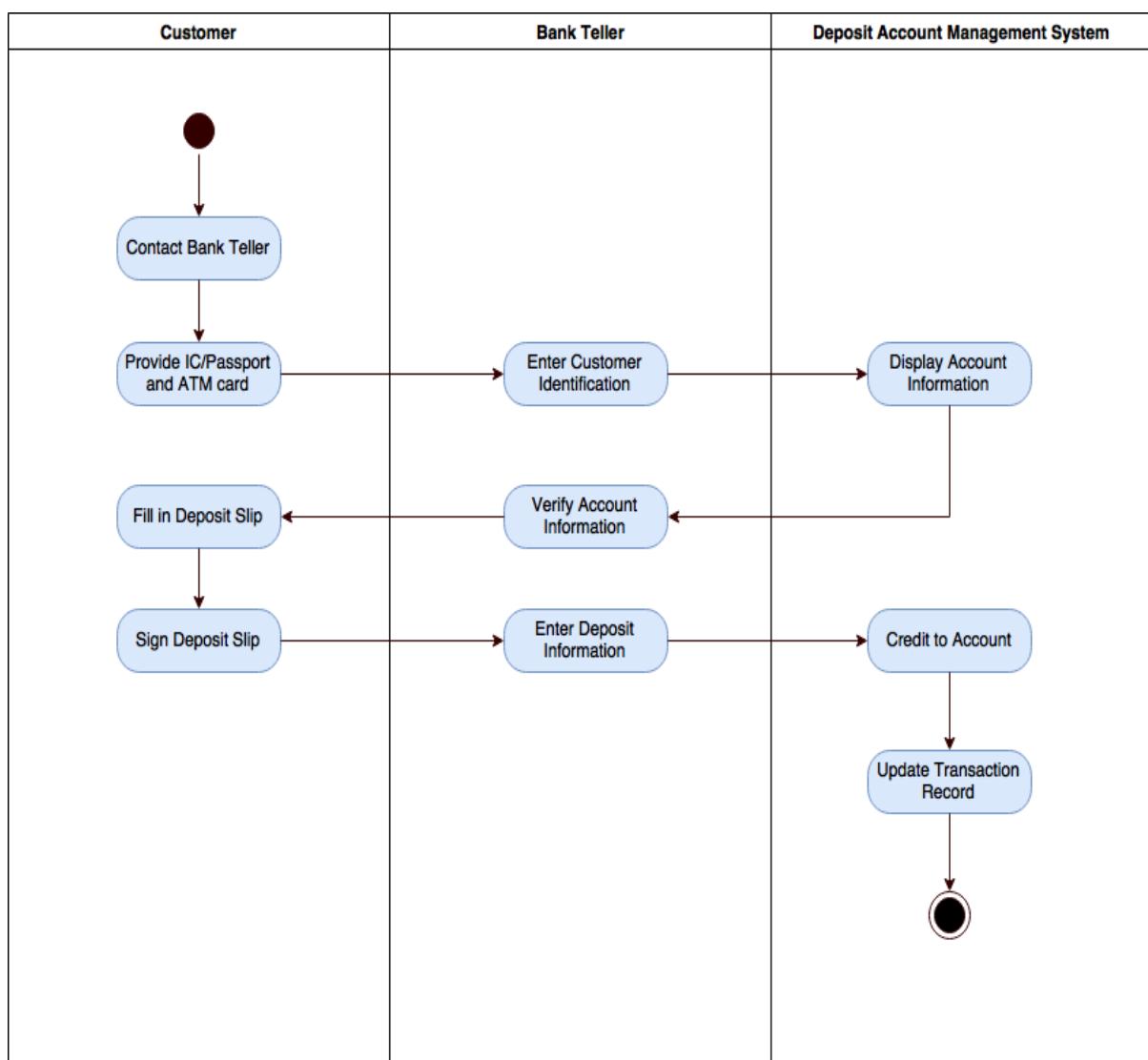


Figure 5: Activity Diagram - Cash Deposit

F) View Transaction History

Merlion Bank staff and customer will be able to view transaction history of an account. It is essential for loan officer to review a loan applicant's credibility and make informed decisions based on the transaction records.

Scenario: Customer views transaction history

1. Customer Tom logs in to Merlion Internet Banking Website
2. Tom clicks "View my transaction history" and chooses the range to be "Past 30 days"
3. System retrieves and displays Tom's transaction records for the past 30 days

G) View e-Statement

At the end of each month, DAMS will automatically generate an e-statement and send it to customer's registered email address. Every e-statement will contain account balance and transaction history of all deposit accounts at Merlion Bank which will help customers to understand their monthly income and spending in details.

H) Interest Accrual and Crediting

At Merlion Bank, interests are accrued on a daily basis and credited to each account at the end of the month. Each account may follow a different interest rate scheme based on the account type. Currently, Merlion Bank offers 3 types of savings account (Basic Savings Account, Bonus Savings Account, Monthly Savings Account) and Fixed Deposit Account.

Basic Savings Account is the most fundamental account type which only requires \$1 initial deposit. This account follows a tiered interest rate scheme with a base interest rate of 0.05%. When the account balance is between \$350,001 to 1000,000, the interest rate will be compounded at a rate of 0.08%. When it is above \$1000,000, the interest rate is 0.1% annually.

Bonus Savings Account requires an initial deposit of \$10,000. This account type shares a same base interest rate of 0.05% as Basic Savings Account. In addition, there is a bonus interest of 0.75% monthly if customer does not withdraw money within that month.

Monthly Savings Account does not require an initial deposit but demands a minimal monthly saving of \$50. It has a base interest rate of 0.05% and if customer makes no withdrawal within the month a bonus interest of 0.35% will be activated.

Interest rates for Fixed Deposit Account vary according to tenure and principal amount. Interest is credited to the account at the end of the tenure and early withdrawal may cause penalty. Normally, the longer the tenure the higher the interest rate.

3.3.3 System Requirement Analysis

Business Assumptions

- The digital signature provided by customer is his/her own signature. Customer is expected to reproduce the same signature whenever required in future activities
- Customer needs to ensure there is zero account balance before applying for account closure
- Interest is accrued at 23:59 daily and accumulated interest is credited to deposit account at 23:59 of the last day of each month
- It is the customer's responsibility to ensure the accuracy of payee's information
- Customer can only deposit Singapore dollar as the only currency in their deposit account

To address the business requirement of the DAMS, an account management module, an account balance management module, and an interest crediting management module should be constructed.

a) **Account Management Module**

This module will be used mainly by Merlion Bank to help its customers keep track of their banking history and their account balance. It also marks the beginning of every customer's banking experience with Merlion Bank where customers can open their deposit accounts via Internet Banking Website. At the end of each month, system will generate and send an e-statement summarizing the transactional activities of customers' accounts for that particular month which assists customers to recognize their spending habits and keep track of their finances.

b) Account Balance Management Module

This module will primarily be used by counter tellers to perform fund transfer as well as cash deposit and withdrawal. After transaction, account balance will be debited or credited accordingly.

c) Interest Crediting Management Module

This module basically manages interest calculation in every account. At Merlion Bank, interests are accrued on a daily basis and paid out at the end of the month.

d) Deposit Account Management Module

This module is used by customers to perform deposit account related operations, including account opening and closure, intra-bank fund transfer, payee management. It also offers customers better visibility to their account, being able to view transaction history and e-statement monthly.

System Functionalities

Function	Name	Remark	AAU ID
Code			
A.3 Deposit Account Management System			
A.3.1 Account Management Module			
A.3.1.1	Add a New Account	Teller helps customer to create a new account.	3

A.3.1.2	Delete a Account	Teller helps customer to closes his/her bank account.	
A.3.1.3	View Transaction History	Staff views customer transaction history.	
A.3.1.4	View Information of All Accounts	Staff views all customer account information including account number, account type, etc.	
A.3.1.5	View Bank e-Statement	Teller may view and print bank statement for customer.	
A.3.2 Account Balance Management Module			
A.3.2.1	Fund Transfer	Teller performs bank internal fund transfer	3
A.3.2.2	Cash Deposit	Teller collects cash from customer and helps to deposit cash	
A.3.2.3	Cash Withdrawal	Teller withdraws cash and hand over to customer	
A.3.3 Interest Crediting Management Module			
A.3.3.1	Accrue Interest	System calculates the interest accrued on the end-day balance of each account.	3
A.3.3.2	Credit Interest	System credits interest for saving accounts monthly.	
C.2 Deposit Account Management Module			
C.2.1	Open an account	Customer creates a new deposit account	3
C.2.2	Delete an account	Customer closes his/her deposit account	
C.2.3	View transaction history	Customer views his/her transaction history of a particular account	
C.2.4	View account balance	Customer views his/her account balance	
C.2.5	View account information	Customer views the account related information, including account number, account type, etc	

C.2.6	View e-statement	Customer views his/her bank statement in pdf version	
C.2.7	Intra-bank fund transfer	Customer transfers money to an account which is also under Merlion Bank	
C.2.8	Add payee	Customer adds a payee for internal bank fund transfer	
C.2.9	Delete payee	Customer deletes existing payees	
D.2 Deposit Account Management Module			
D.2.1	Open an account	Customer creates a new deposit account	3
D.2.2	Delete an account	Customer closes his/her deposit account	
D.2.3	View transaction history	Customer views his/her transaction history of a particular account	
D.2.4	View account balance	Customer views his/her account balance	
D.2.5	View account information	Customer views the account related information, including account number, account type, etc	
D.2.6	View e-statement	Customer views his/her bank statement in pdf version	
D.2.7	Intra-bank fund transfer	Customer transfers money to an account which is also under Merlion Bank	
D.2.8	Add payee	Customer adds a payee for internal bank fund transfer	
D.2.9	Delete payee	Customer deletes existing payees	

3.4 Card Management System (AAU ID: 04)

3.4.1 Business analysis

The card management system is one of the key operational components in the core banking system, including both the debit card and credit card management. Customers are allowed to

apply for debit cards and credit cards, manage the cards, and use their cards to make payments via various channels, such as supermarket, shopping center, and online e-commerce websites.

The debit card is used by the customer to make a deposit, withdraw money, and make payments. The customer's debit card would be created immediately upon the completion of the card application. Debit cards are automatically linked with the customer's deposit account to ensure the basic operations. The card also provides cashback rewards for customer payments.

The application of credit card goes through a more rigorous process, where employees in the credit card management department need to evaluate the customer's creditworthiness and set credit limit based on the evaluation upon approval of the credit card. Customers can purchase goods and services by the credit card and make repayment at the end of each month, while interests are charged on the unpaid balances. The repayment history is also recorded as part of the credit report of the customer.

Payment for goods and services can be done by both debit card and credit card. Merlion Bank performs the role of a card issuer, and is integrated with the payment systems of global card network such as EuroPay, MasterCard and Visa. The payment authorization process goes through the chain of merchant, acquiring bank, card network, Merlion Bank, and is finally approved or declined by the Merlion Bank. The clearing and settlement is done at the end of day to settle payments for different financial parties involved.

Business objectives

- Allow customers to apply for debit card and credit card
- Allow customers to make payment by debit card and credit card
- Allow customers to manage their debit and credit card
- Manage customers credit card repayment and update customer's creditworthiness
- Facilitate the clearing and settlement for the transactions of the day

3.4.2 Business processes

A) Apply for debit card

The customer is required to possess a Merlion Bank deposit account before applying for a debit card. After customer applies for a debit card, the card will be linked with the deposit account that customer specified in the application form. The debit card is mailed to the customer upon successful application, and the activation information is emailed to the customer. After the customer receives the card, he/she is required to login to his/her online banking account and activate the card by entering the card number and the activation code. The card is only available to use after activation.

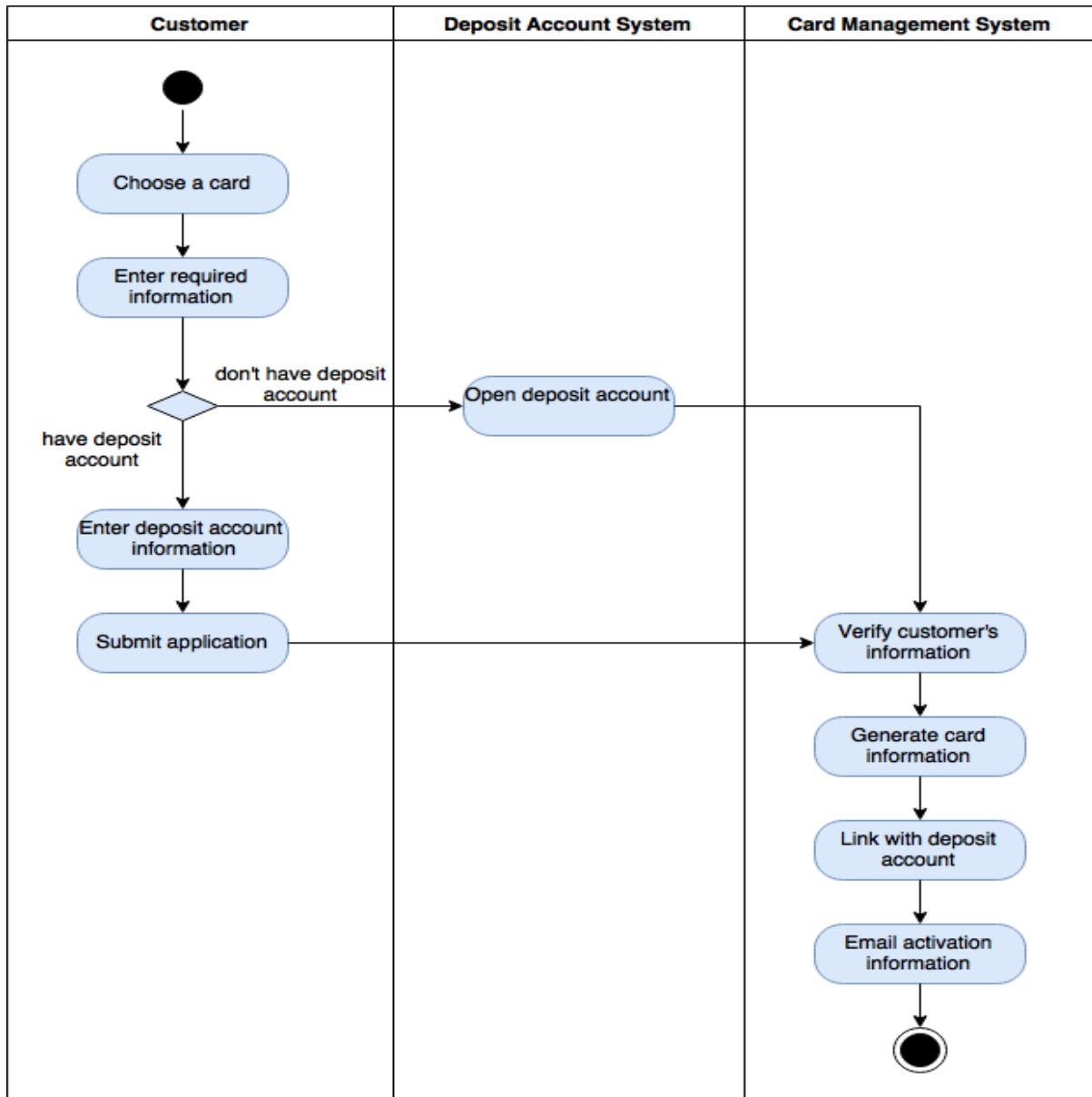


Figure 6: Activity Diagram: Debit Card Application

B) Apply for credit card

Customer need to submit his/her personal information, residential details and employment details in order to apply for a credit card. System will do the basic information verification and evaluation of eligibility, and presents the application information to staff in the credit card department for further evaluation and decision on the credit limit of the card. This should also be supported by the business intelligence of the system in terms of customer's credit report and risk analysis. The credit card is mailed to the customer upon successful application, and the activation information is emailed to the customer. After the customer

receives the card, he/she is required to login to his/her online banking account and activate the card by entering the card number and the activation code. The card is only available to use after activation.

Scenario: Customer Tom applies for a credit card

1. Tom clicks on “apply for credit card” button.
2. Tom views the list of credit cards available, and chooses the VISA-enabled credit card.
3. Tom checks that he meets the minimum income requirement and is eligible to apply for the credit card
4. Tom is required to input his contact information as follow:
 - Title: Mr.
 - Name: Tom Ng
 - Contact number: 83****21
 - Email address: tomng1980@gmail.com
5. Tom is required to input his personal information as follow:
 - Name (to appear on card): Tom Ng
 - Nationality: Singaporean
 - NRIC/Passport Number: S055****E
 - Home country: Singapore
 - Date of birth: 1980/08/07
 - Marital status: married
 - Number of dependent: 1
 - Gender: male
 - Education: university
 - Annual income: S\$45,000
 - Proof of income: CPF
6. Tom uploads his CPF statement
7. Tom is required to input his residential information as follow:
 - Residential address: House 5, Level 2, Unit 1. Tampines, 7 Hougang Avenue 3.
(S)530007
 - Residential ownership: self-owned

- Residential type: condominium
 - Length of stay at address: 3 years 5 months
8. Tom is required to input his employment information as follow:
- Employment status: employee
 - Job title: senior management
 - Company name: IBM
 - Company address: 10 Marina Boulevard, #43-01, Tower 2, Marina Bay Financial Center
 - Business type: IT
 - Length of employment: 2 years 1 month
 - Billing address: home
9. Tom declares that he has read and understood the credit card declaration. Tom sets credit limit preference to \$3,000 per month.
10. Tom clicks on the “submit” button and finishes his application
11. System verifies Tom’s information and checks if Tom has met the basic requirement
12. Staff evaluates Tom’s ability and reliability to make repayment.
13. Staff creates credit card for Tom and sets the credit limit to \$3,000 per month.
14. The credit card is emailed to Tom, and email is send to Tom for activation.

C) Report lost card

The customers can go through certain authentication process on his/her online banking website to report a lost card and request for issuance of a new card. The card will be terminated and all the information will be transferred to the new card. The new card will be mailed to the customer and is required to go through the activation process as well.

Scenario: Customer Tom reports a lost debit card

1. Tom logs in to his online banking account.
2. Tom clicks “report lost card” button.
3. Tom sees the authentication page. Tom clicks on “get OTP via SMS” button and enters the OTP code he received via email.

4. Tom views the list of cards and chooses the lost debit card
5. Tom clicks on the “report lost card”.
6. Tom is required to pay \$10 for the new card. Tom chooses to deduct the \$10 from his deposit account.
7. Tom is notified that the lost card is terminated and a new card will be mailed to him.
8. Tom receives email regarding the activation code of the new card.
9. Tom receives the new debit card.
10. Tom logs in to his online banking account.
11. Tom activates his new card.

D) Cancel credit card

If the customer requires to cancel the credit card, system will check if the customer’s outstanding balance has been paid in full and alternative arrangements have been made to the recurring bill payments. The card is only cancelled after successful settlement of all the debts.

E) Make payment

The customer can use debit card and credit card to pay for goods and services at the places accepting VISA or MasterCard payments. To process the transaction, the merchant’s EFTPOS terminal generates the transaction authorisation request and forwards it to the merchant’s acquiring bank. The acquiring bank forwards the request to the respective card network, such as VISA and MasterCard. The card network then routes the request to the card issuing bank, in this case, Merlion Bank, to check the eligibility of the transaction. After Merlion bank approves or declines the request, the authorization information is then sent back to the merchant via the same route in order for the merchant to complete the transaction. The amount of transaction is immediately locked in the customer’s account if the customer pays by debit card.

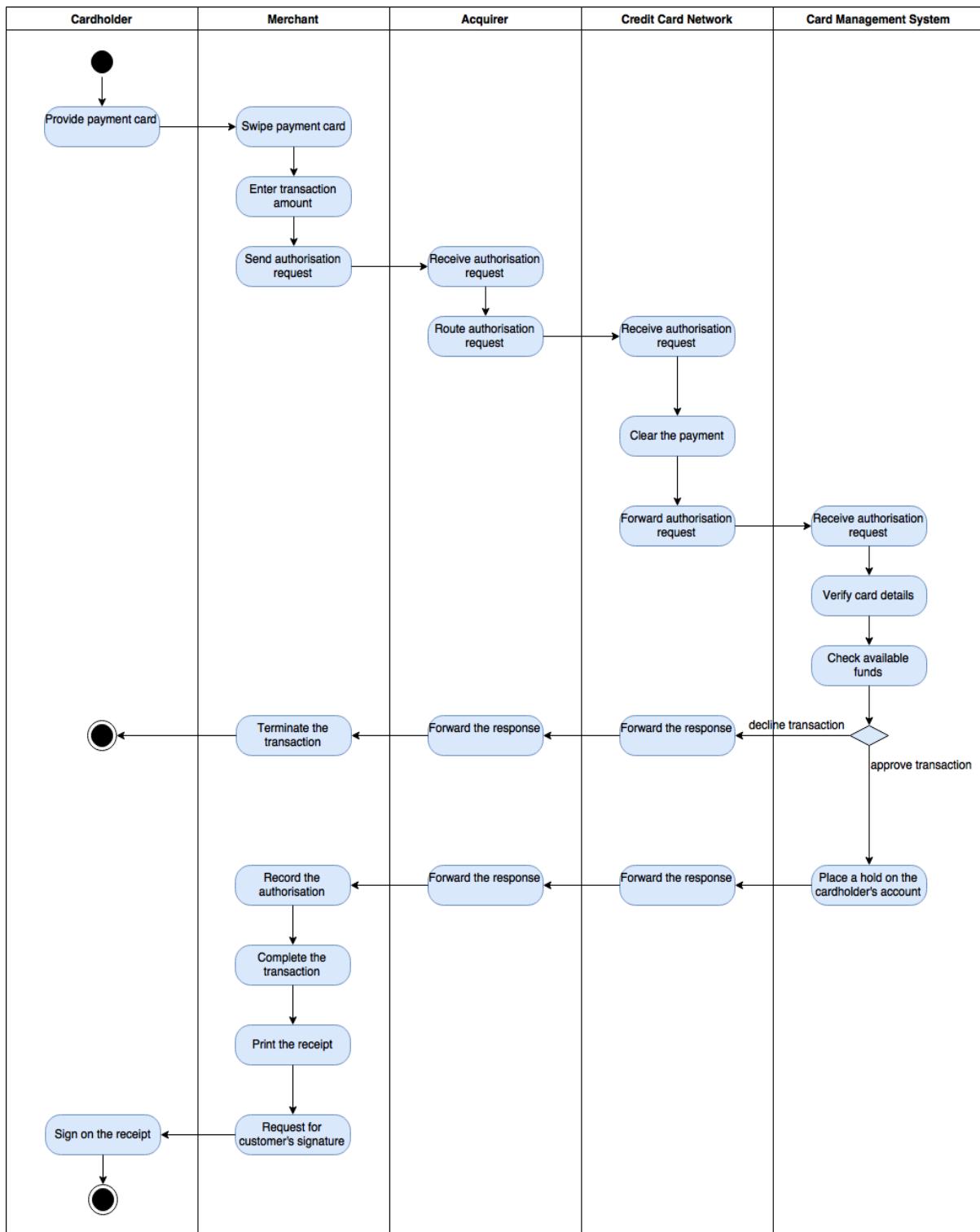


Figure 7: Activity Diagram - Transaction Process

F) Facilitate clearing and settlement

The merchant's EFTPOS terminal will record down all the authorised transactions of the day. At the end of the day, all the transactions are summarized in a batch and forwarded to the

merchant's acquiring bank. The acquirer then credits the merchant's account and electronically submits the batch to the card network for settlement. The card network pays the acquirer, debits Merlion Bank's account, and sends the transactions to Merlion Bank. The Merlion Bank posts the transactions to the customer's account, and sends statement to the customer at the end of each month.

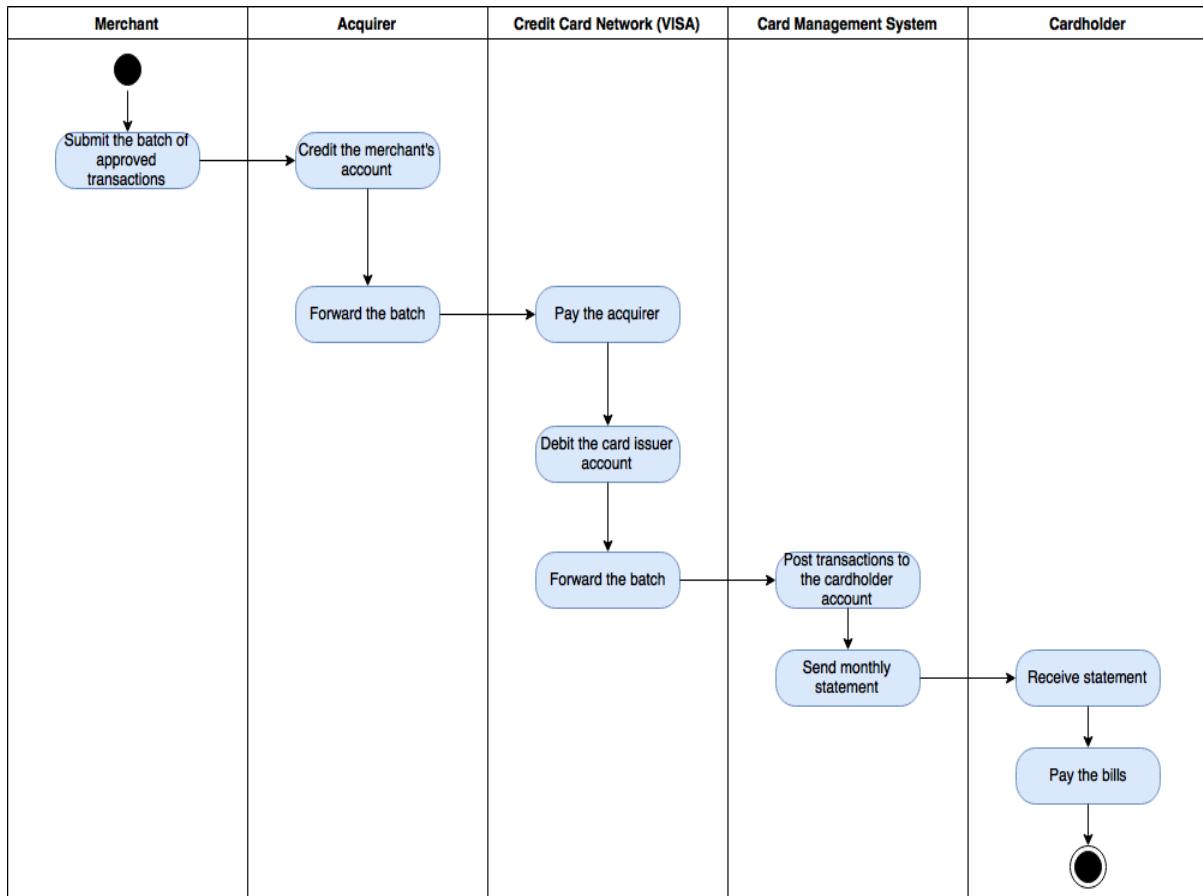


Figure 8: Activity Diagram - Clearing & Settlement

G) Handle chargebacks

After the customer receives statement for credit card at the end of each month, the customer can file a dispute and request for chargeback regarding the fraudulent transactions found. The common reasons for a chargeback are: fraudulent transactions, credit not processes, items not received, or error occurred due to technical problems. After the cardholder files a chargeback, a provisional credit is provided to the cardholder and the chargeback is initiated and forwarded to the merchant's acquiring bank to check the validity. If the chargeback is found invalid, Merlion Bank will charge the cardholder on the chargeback. The customer's credit

may also be affected by the invalid chargeback. However, if the chargeback is valid, the merchant will be asked to provide needed document or proof to remedy the chargeback, or the chargeback amount will be provided to the customer.

3.4.3 System requirements analysis

Business assumptions

- Two types of debit cards are provided with same basic functions of cash deposit and withdraw, and cashback reward scheme. The only difference is that one card can make payment by VISA whereas the other card does by MasterCard.
- All types of transactions are involved in the debit card cashback scheme
- The cashback amount is automatically updated into customer's debit card account at the end of the month
- Two types of credit cards are provided with same basic functions but different credit card networks (VISA & MasterCard).
- Credit card account is provided for the credit cardholder. Customer can save money, make payment, and withdraw with a relatively high interest.
- The MasterCard and VISA card network are assumed to have the same clearing and settlement process. System simulates the clearing and settlement process of VISA card network.

To address the business requirements of Card Management System in the preliminary requirements specifications, a debit card module, a credit card module, and a card management module will be constructed. A merchant management module, an acquirer management module, and a card network management module in the system for the external parties involved are also constructed to facilitate the operation. These six modules are described as follows:

a) Debit card module

This module will primarily be used by staff in the debit card department to view and monitor the customer's' debit cards.

b) Credit card module

This module will primarily be used by staff in the credit card department to view and manage the customer's credit cards, evaluate customers information and respond to credit card applications. It will also facilitate the staff to deal with chargeback requests and update customer's credit report.

c) Card management module

This module will preliminary be used by customers to performance all the tasks related to debit and credit cards. The customers will be able to apply for new card, report lost card, monitor card information, make payment, make repayment, and request for chargebacks.

d) Merchant management module

This module will be built to simulate the processing of an EFTPOS terminal of the merchants. It is preliminary used for forwarding transaction authorization requests and do batching at the end of the day.

e) Acquirer management module

This module will be built to simulate the processing of the acquiring bank of the merchant. It is preliminary used for forwarding requests and information between merchants and card networks.

f) Card network management module

This module will be built to simulate the processing of the card network. It is preliminary used for routing requests and information to different acquiring banks and card issuing banks, and processing clearing and settlement at the end of the day.

System functionalities

Function Code	Name	Remark	AAU ID	
A.4 Card Management System				
A.4.1 Debit Card Module				
A.4.1.1	View debit card	Card manager views all debit card accounts.	4	
A.4.1.2	View card canceled	Card manager views all card canceled.		
A.4.2 Credit Card Module				
A.4.2.1	View credit card	Card manager views credit card accounts.	4	
A.4.2.2	View card canceled	Card manager views all card canceled.		
A.4.2.3	Manage lost card	Card manager acknowledges lost card and issue a new card for customer to replace the lost card.		
A.4.2.4	View credit report	Card manager views credit report of a customer.		
A.4.2.5	Approve credit card	Card manager evaluates applicant's profile and sets credit level for the card.		
A.4.2.6	Manage chargeback	Card manager takes action based on customer's chargeback request.		
A.4.2.7	Update credit report	Card manager edits customer's credit report based on customer's behavior.		
B.1 Card Management System				
B.1.1 Merchant Management System				
B.1.1.1	Forward authorization request	System forwards authorization request to the acquirer.	4	

B.1.1.2	Complete transaction	System acts upon approved or declined authorization and records approved transaction.	
B.1.1.3	Create batch	System updates all approved transactions on a batch and forwards it to the acquirer.	
B.1.1.4	Update settlement	System updates settlement status.	
B.1.2 Acquirer Management Module			
B.1.2.1	Forward authorization request	System forwards authorization request to the card network and forwards approved or declined authorization to the merchant.	4
B.1.2.2	Create batch	System forwards the merchant's batch to the card network for clearing.	
B.1.2.3	Update settlement	System updates settlement status.	
B.1.2.4	Credit merchant's account	System credits merchant's account.	
B.1.3 Card Network Management Module			
B.1.3.1	Forward authorization request	System forwards authorization request to the issuing bank and forwards approved or declined authorization to the acquirer.	4
B.1.3.2	Process clearing	System sends each approved transaction to the appropriate issuing bank	
B.1.3.3	Transfer to acquirer	System pays the acquirer.	
B.1.3.4	Update settlement	System updates settlement status.	

C.5 Card Management Module

C.5.1	Apply debit card	System verifies customer's information, approves or rejects the application, and generates debit card for the customer. System automatically generates internet banking account for the new customer.	4
C.5.2	Activate debit card	Customer uses the activation information received via email to activate their card.	
C.5.3	Cancel debit card	Customer decides to terminate the debit card.	
C.5.4	Apply credit card	Customer deletes existing payees.	
C.5.5	Activate credit card	Customer uses the activation information received via email to activate their card.	
C.5.6	Cancel credit card	Customer decides to terminate the credit card.	
C.5.7	Make repayment	Customer make repayment for the credit card.	
C.5.8	Request for chargeback	Customer requests for chargeback if there is a dispute regarding transaction.	
C.5.9	View outstanding balance	Customer views his/her outstanding balance for the credit card.	
C.5.10	View credit report	Customer view his/her credit report in pdf version.	
C.5.11	Report card loss	When customer report card loss, system locks the previous card, and issue a new card to the customer.	

C.5.12	Debit card payment	If customer makes payment by debit card, system charges customer deposit account upon successful transaction	
C.5.13	Credit card payment	If customer makes payment by credit card, system adds transaction to customer's bill for repayment.	

D.5 Card Management Module

D.5.1	Apply debit card	System verifies customer's information, approves or rejects the application, and generates debit card for the customer. System automatically generates internet banking account for the new customer.	4
D.5.2	Activate debit card	Customer uses the activation information received via email to activate their card.	
D.5.3	Cancel debit card	Customer decides to terminate the debit card.	
D.5.4	Apply credit card	Customer deletes existing payees.	
D.5.5	Activate credit card	Customer uses the activation information received via email to activate their card.	
D.5.6	Cancel credit card	Customer decides to terminate the credit card.	
D.5.7	Make repayment	Customer make repayment for the credit card.	
D.5.8	Request for chargeback	Customer requests for chargeback if there is a dispute regarding transaction.	
D.5.9	View outstanding balance	Customer views his/her outstanding balance for the credit card.	

D.5.10	View credit report	Customer view his/her credit report in pdf version.	
D.5.11	Report card loss	When customer report card loss, system locks the previous card, and issue a new card to the customer.	
D.5.12	Debit card payment	If customer makes payment by debit card, system charges customer deposit account upon successful transaction	
D.5.13	Credit card payment	If customer makes payment by credit card, system adds transaction to customer's bill for repayment.	

3.5 Loan Management System (AAU ID: 05)

3.5.1 Business Analysis

The Loan Management System (LMS) is to support the loan division in their operations to receive loan applications, process applications, manage loan repayment, manage mortgage redemption, and manage defaults on loans. It is a key function forming the backbone of Merlion Bank's core services, as it is the main earning stream. With the monthly installments and interest component of the payback, bank can earn a steady income in a fixed timeframe.

The LMS system provides a seamless application process for customers to easily submit and manage their loan application online. It also incorporates analytical functions to facilitate loan division staff, including loan managers and underwriting team, to access and decide on outcome of the applications. The repayment management module of LMS is responsible for the payback of borrowers. Different channels of installments, such as auto-deduction and manual repayment, will be supported so as to cater to different customers' preferences. When customers apply for a secured loan and have cleared the repayment, the mortgage redemption subsystem will be in charge of redeeming the collaterals for them. Lastly, when the borrower is not able to clear the loan, the bad debt management subsystem would take charge of the default and carry out measures to recover the loss.

Business Objectives

- Create and manage loan applications, including submission of documents, pre-process the documents to aid the loan managers to make decisions, and to store applicants' information into database.
- Provide digital channels for repayment
- Facilitate mortgage redemption when loans are cleared
- Compensate loss and support follow-up actions when there is default on loans
- Update status and information of loans when applicable

3.5.2 Business Processes

A) **Loan Application**

The LMS is in charge of receiving incoming application for both secured and unsecured loans. When the borrowers choose to apply for a specific loan on the Merlion Bank website, the system will prompt the customer to complete a series of questions, so as to collect necessary information about the applicant. These information include, NRIC, latest income tax notice of assessment, latest salary slip, latest one year CPF Contribution History Statement, employment history, choice of loan plan, information of collateral, and choice of repayment plan. Customers are required to take photos of the required documents as well as signatures if necessary, and upload it onto the website. The system will collect the data and store into database for loan managers to view and make decisions.

Scenario: Full-time salaried employee Amy apply for a home loan

1. Amy logs in to Merlion Bank website and clicks "My Account" tab
2. Amy clicks "Loans"
3. Amy clicks "Apply for a loan"
4. Amy indicates choice of loan as "home loan"
5. Amy fills in personal information appeared on her NRIC

6. Amy takes photo of her NRIC, contacts, latest income tax notice of assessment, latest salary slip, latest 1 year CPF Contribution History Statement and employment history.
7. Amy fills in information of her house as collateral.
8. Amy indicates preferred repayment plan by indicating auto-debit from her Merlion Bank debit card account.
9. Amy takes photo property ownership certificate as proof of collateral
10. LMS prompts Amy of success of application.
11. Amy can check status of her loan after successful application.

B) Process application data

The LMS is capable of pre-process the data before forwarding to loan managers and underwriting team. Such functions include calculating the Equated Monthly Installments(EMI), and highlighting the parts of the information that will increase the risk of granting the loan to the borrower, such as low credit score, history of bad debt, frequent change of jobs, etc.

Scenario: Loan officer process application of loan

1. Loan officer Ben view application from Amy
2. Loan officer Ben review and verify Amy's documents are valid
3. Loan officer Ben check Amy's documents are sufficient for evaluation
4. Loan officer Ben forward Amy's application to underwriting team for evaluation

After validation, loan officer will forward the necessary pre-processed documents to underwriting team for final decision of whether or not the loan will be offered to the borrower. The appraisal team will also be responsible for determining the value of asset and report result to the underwriting team.

Scenario: Underwriting team process application of loan

1. Underwriting team views application documents from Amy

2. Underwriting team determines whether the risk of lending loan to Amy is acceptable
3. Underwriting team determines amount and duration of loan issued
4. Underwriting approves the application
5. Underwriting team contacts Appraisal team to determine value of collateral

When the underwriting team process the applications, more information might be required for further evaluation under some circumstances. In this case, underwriting team will suspend the application and notify the applicant for resubmission of documents. The LMS will notify the borrowers via website notification, and electronic email.

Scenario: Amy is required to submit a more detailed property certificate

1. Amy receives an email from LMS stating that the submitted property statement is not sufficient for evaluation. A more detailed statement need to be supplied.
2. Amy logs in to Merlion Bank website.
3. Amy clicks “My Account” tab and then “Loans”
4. Amy clicks “Loan Application”
5. Amy clicks “Documents Submission”
6. Amy uploads a photo of her complete property statement.
7. LMS prompts Amy of success of submission.
8. Amy can check status of her loan after successful submission

C) Closing

After the approval of loan issuance, the relevant documents will be sent to borrower via electronic emails, postage and LSM portal. Borrower will be asked to sign the loan contract and exchange of title of property contract online. An application fee will be charged to both successful and rejected applicants. The loan amount will also be credited to borrower’s account.

The complete processing flow of loan application will be shown by the activity diagram below:

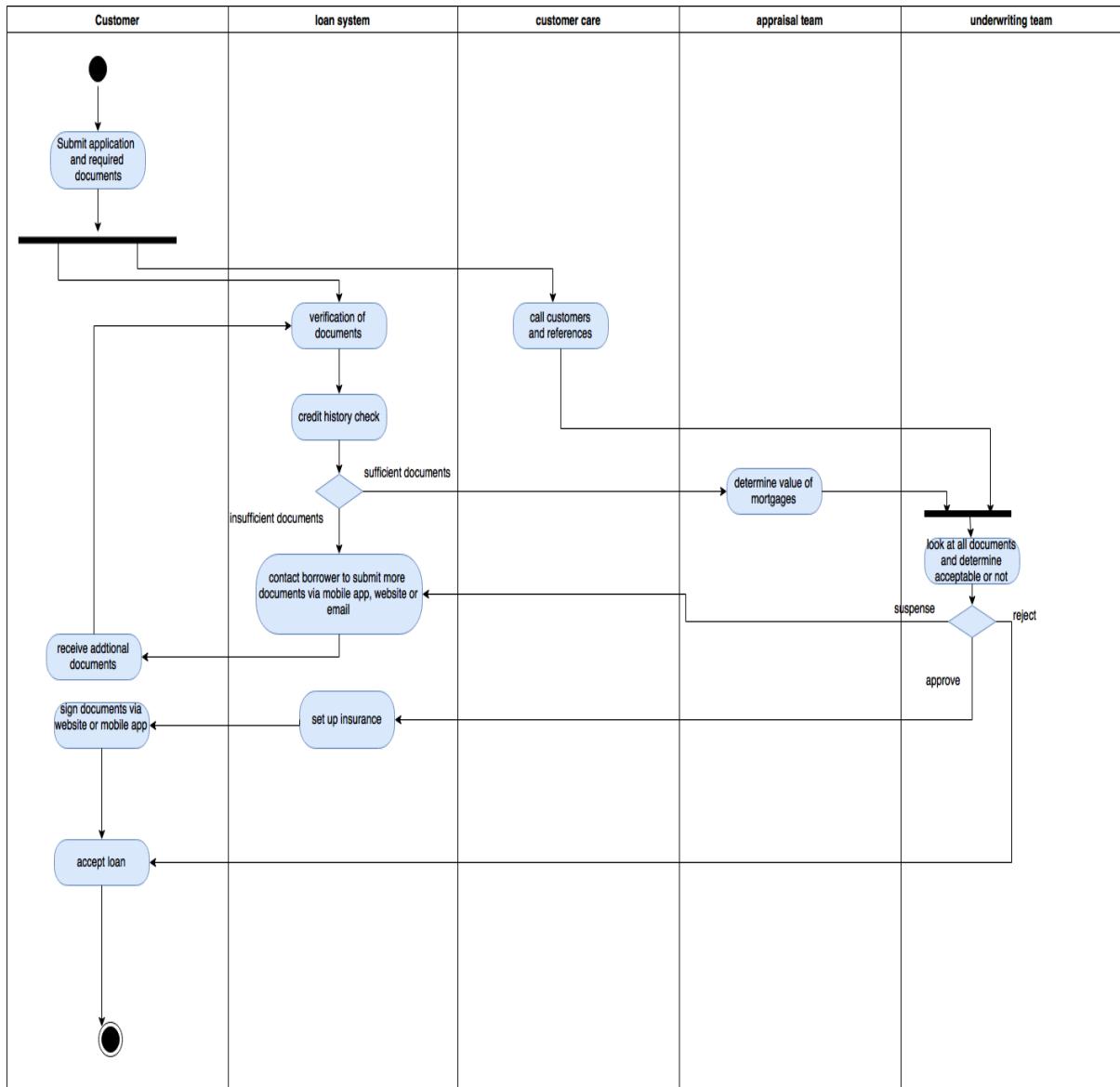


Figure 9: Activity Diagram - Loan Application

D) Repayment management

With the success of loan approval, the borrower will start to repay the loan at the predetermined time interval. Either automatic debiting assigned bank account, or voluntary online payment after each repayment period, can be chosen to repay the loan. When manually repaying borrower is late for installment, a late fee will be charged at either \$15 or 5% or the installment, whichever is greater. The late repayment will also be recorded in the repayment history by LSM. At the end of the installment, the loan balance will be shown to borrower. The borrower can also check the loan balance anytime during the repayment process.

Scenario: Cat is late for repayment for 5 days

1. Cat logs in to Merlion Bank website
2. Cat clicks “My Account” tab
3. Cat clicks “Loans”
4. Cat clicks “Repayment” for her \$500 installment
5. LSM display a charge of \$525, including the installment and 5% late fee.
6. Cat types in her credit card information
7. LSM receive payment and display remaining loan balance.

E) Mortgage Redemption

For secured loan borrowers, when the loan is cleared, he/she is able to request for redemption of his/her collateral. The Title Deeds will be released back to the borrowers, together with the remaining title documents and re-assigned life policies. The LSM will delete reference to the redeemed mortgage at the Land Registry, and update the asset title on relevant documents.

When the borrower has installed more than the loan amount, an overpayment will occur and loan balance will be negative. As such, the system will credit the overpayment back to the paying account, then update the loan balance. A redemption fee will be applied to borrower after the process.

Scenario: Amy requests for redemption of her house

1. Amy logs in to Merlion Bank website
2. Amy clicks “My Account” tab
3. Amy clicks “Loans”
4. Amy clicks “Repayment”
5. Amy views her loan balance, which displays as “\$0.00”
6. Amy clicks “Request for Redemption”
7. Amy confirms her contacts and address

8. Amy signs on digital contracts of completion of loan repayment and gain of property ownership
9. LSM updates asset title and delete reference to the redeemed mortgage at the Land Registry
10. LSM displays outcome
11. Amy pays \$20.00 redemption fee via online credit card payment
12. Amy receive paper documents via mail

Scenario: Amy requests for redemption of her house

1. Amy logs in to Merlion Bank account
2. Amy clicks “My Account” tab
3. Amy clicks “Loans”
4. Amy clicks “Repayment”
5. Amy views her loan balance, which displays as “\$0.00”
6. Amy clicks “Request for Redemption”
7. Amy confirms her contacts and address
8. Amy signs on digital contracts of completion of loan repayment and gain of property ownership
9. LSM updates asset title and delete reference to the redeemed mortgage at the Land Registry
10. LSM displays outcome
11. Amy pays \$20.00 redemption fee via online credit card payment
12. Amy receive paper documents via mail

F) Bad Debt Management

When the borrower is not able to repay his/her loan, a default on loan is filed to Merlion Bank. A series of measures will be carried out to recover loss of the bank. The credit score of borrower will be deducted. A bad debt history will also be recorded in borrower's credit report. Subsequently, for the secured borrowers, the bank will exercise foreclosure, gain lien of property, and request to sell asset and retrieve less than full payment.

For unsecured loan borrowers, LSM will continue to add default fees and interest to their loan balance until they can repay back the full amount. Merlion Bank will turn over to a collection agency, and pursue legal actions such as request the court to garnish borrower's other income like wages or putting a lien on borrower's assets.

If the borrower has accounts in Merlion Bank, LSM will proceed to seize the remaining money for repayment. Paychecks which are transferred to borrower's account will also be garnished.

Under secured loans:

Scenario: Car loan borrower Don default on loan

1. Don logs in to Merlion Bank website and clicks “My Account” tab
2. Don clicks “Loans”
3. Don clicks “Repayment”
4. Don clicks “View Loan Balance”
5. Don clicks “File for Default”
6. Don receives warning of consequences, including affected credit report, garnished paycheck and loss of ownership of his car.
7. Don signs default on loan acknowledge form and the release of ownership contract for the mentioned car online.
8. LSM displays updated credit report of Don and remaining loan balance as “\$0.00”
9. LSM update loan status to “default”

Under unsecured loans:

Scenario: Personal loan borrower Evan default on loan

1. Evan logs in to Merlion Bank website and clicks “My Account” tab
2. Evan clicks “Loans”
3. Evan clicks “Repayment”
4. Evan clicks “View Loan Balance”
5. Evan clicks “File for Default”
6. Evan receives warning of consequences, including affected credit report, garnished paycheck, pressure faced by confronting collection agency and potential legal action if all the mentioned measures fail.

7. Evan signs default on loan acknowledge form.
8. LSM displays updated credit report of Evan and remaining loan balance.
9. LSM updates loan status to “default”

3.5.3 System Requirement Analysis

Business Assumptions

- Loan interests for all types of loans are higher than the rebate interest given to customers.
- The underwriting team and appraiser are insourced to internal underwriter team and appraisal team.
- The repayment plans are restricted to auto-deduction from assigned account, and manual online payment
- Decision of whether to issue a loan is dependent on loan officers on a case by case basis.
- Credit assessment is based on applicants' credit score, net income, TDSR, employment history and repayment history.
- Loan-to-value(LTV) ratio is calculated to measure lending risk of a loan.
- Insurance are not required for all types of loans as collaterals will guarantee prevention from loss.
- Merlion Bank have sufficient asset to meet any requested loan amount.
- Communication with borrowers are through Merlion Bank website and electronic mailing

To address the business requirements of the Loan Management function, a Loan Management Subsystem, a Loan Repayment Subsystem, a Mortgage Redemption Subsystem and a Bad Debt Management Subsystem will be constructed. These 4 subsystems are described as follows:

a) Loan Management Module

This subsystem will be used by the loan managers and underwriting teams from the Loan department at the Merlion Bank home branch. With the functions of processing all incoming loan applications, this module will draw on the applicant's data recorded from the LSM portal

to facilitate Loan managers and underwriting team to establish evaluation and develop final decision of acceptability of loan. It will also utilize data from Deposit Account Management System to issue loan, deduct repayment or credit overpayment. It will update the account balances of borrowers' accounts after each modification it brings about.

b) Loan Repayment Module

This subsystem will be used by loan managers from loan department to collect repayment. It will provide the platform to the borrowers to pay back their loan in fixed time intervals such as each month or each year. The system will also monitor whether there is a late repayment. When a repayment has not taken place after 30 days, a warning will automatically be delivered to the borrowers, and the system will prompt the loan managers to pay attention to the case. Data from Deposit Account Management System will also be drawn for auto-debit.

c) Mortgage Redemption Module

This subsystem will be used by loan managers to redeem secured loan borrowers' collaterals. The system will mainly be in charge of processing the exchange of titles of property. Documents including Title Deeds, reference to the property, life policy, etc, need to be updated in the process.

d) Bad Debt Management Module

This subsystem will be utilized by the loan managers. It is responsible for recovering financial loss from defaults on loans. These measures mainly include overtaking collaterals, garnishing paychecks and remaining sum in the borrower's accounts.

System functionalities

Functionality	Name	Remark	AAU
Code			ID
A.5 Loan Management System			
A.5.1 Loan Management Module			

A.5.1.1	Edit application information	Loan officer update application information such as applicant's contacts, income and credit history	5
A.5.1.2	View applicant's information	Loan officer & underwriter can view application information, such as applicant's credit history	
A.5.1.3	View application status	Loan officer & applicant can view status of loan applications	
A.5.1.4	Update application status	Underwriter can update loan application status	
A.5.1.5	View information of collateral	Mortgage appraiser can view information of collateral	
A.5.1.6	Edit information of collateral	Underwriter can update title of the collateral	
A.5.1.7	Update borrower account	Loan officer can credit/debit borrower's account	
A.5.2 Loan Repayment Module			
A.5.2.1	View payable account balance	Loan officer can view borrower's payable account balance	5
A.5.2.2	Update payable account balance	Loan officer can deduct repayment & late fee from payable account	
A.5.3 Mortgage Redemption Module			
A.5.3.1	View loan balance	Loan officer can view loan account balance	5
A.5.3.2	Update collateral information	Loan officer can return title of collateral	

A.5.3.3	Update payable account balance	Loan officer can return overpayment & deduct redemption fee at payable account	
A.5.4 Bad Debt Management Module			
A.5.4.1	View loan balance	Loan officer can view remaining loan balance	5
A.5.4.2	View collateral information	Loan officer can view asset's information	
A.5.4.3	Update collateral information	Loan officer can change title of property	
A.5.4.4	View borrower's credit history	Loan officer can view borrower's credit history	
A.5.4.5	Update borrower's credit history	Loan officer can update bad debt history on borrower's credit history	
C.3 Loan Management Module			
C.3.1	Request for loan	Customer submits loan request to Merlion Bank.	5
C.3.2	Submit supporting documents	Customer submits supporting documents for approval.	
C.3.3	View application status	Customer can view loan application status.	
C.3.4	View loan account balance	Customer can views loan account balance.	
D.3 Loan Management Module			
D.3.1	Request for loan	Customer submits loan request to Merlion Bank.	5

D.3.2	Submit supporting documents	Customer submits supporting documents for approval.	
D.3.3	View application status	Customer can view loan application status.	
D.3.4	View loan account balance	Customer can views loan account balance.	

3.6 Billing and Payment System (AAU ID: 06)

3.6.1 Business Analysis

The Billing and Payment function is the key service that Merlion Bank provides to its customers. Billing and Payment System (BPS) of Merlion Bank System (MBS) is dedicated to ensuring smooth transactions during ad-hoc and regular bill payment, as well as local and international fund transfer. While it is obvious that the digital transaction process requires little human intervention, multiple third parties are involved in the clearing and settlement process. The Automated Clearing House (ACH), MAS Electronic Payment System (MEPS) and other collaborator banks all play a role in the billing and payment service.

For the payment sector, the service can be segmented into local fund transfer and international fund transfer. For international fund transfer, SWIFT international fund transfer is provided. Within local fund transfer, it can be divided into intra-bank fund transfer and inter-bank transfer. While it is apparent that the intra-bank transfer commonly only concerns of direct debiting and crediting of payer and payee's accounts, inter-bank transfer is more complex than simple addition and subtraction. Merlion Bank's BPS essentially incorporate three inter-bank fund transfer measures, including Interbank GIRO system (IBG), Fast And Secure Transfers (FAST) system and exchanging cheque.

Though the end results are the same, IBG and FAST are essentially two different kinds of fund transfer, as IBG is an ACH transaction, and FAST is a wire transfer. The table below is to clarify the difference between these two electronic fund transfer:

	Working process	Charge	Waiting time
ACH Transactions	send patches of payment request to ACH as single transaction to be processed.	Free	Up to 3 working days
Wire Transfer	direct bank-to-bank collaboration	Processing fee	Immediate

Inter-bank GIRO System (IBG)

In IBG system, the initiator can be either payer or payee. When a payment request is sent to BPS, BPS will first view the credit limit of the originator, then send request for payment to ACH. ACH then generate net settlement amount and net clearing figures, which are essentially the changes of sum in the two involving banks, to MEPS. At the same time, ACH will forward the payment instruction to receiving bank for credit/debit of the second party's account. If the request is rejected by the recipient bank, ACH will forward the rejection message to Merlion Bank and readjust settlement amount. Upon approval of payment/collection, ACH will forward the approval message to Merlion Bank. A credit/debit statement is generated for the first party and second party respectively. The BPS will then debit/credit the originator's account accordingly and update payment status and transaction record.

Fast and Secured Transfer (FAST)

The newer FAST system allows local transfer of SGD amounts up to \$50,000 per transaction almost immediately. This system can only carry out among the participating banks, and it will not go through ACH clearing and settlement process every time so as to ensure faster transaction pace. However, processing fees will occur.

Cheque

Cheques are only allowed to transfer SGD fund within Singapore. The cheque processing path is very similar to that of GIRO. The deposit of cheque is only performed in our home branch at Raffles Place. After being presented a cheque, we will credit the payee's account provisionally, which means that the fund is "On Hold". Our staff will use a cheque reader to extract the MICR data (ECS data) and store into the system. Our staff will then send the cheque to ACH later in the day. BPS will forward the MICR information to ACH for clearance and settlement, followed by sending the net settlement amount to MEPS for broadcast and settlement. ACH will also forward the MICR data and physical cheque to the issuing bank for debit of the issuing person's account. If the request is rejected, the issuing bank will return the cheque to ACH, who will readjust the net figures and forward the cheque to Merlion Bank by 12:00 the next working day. Otherwise if the request is approved, no action is required. The payee will be able to withdraw the "On Hold" fund after 14:00 the second business day.

On the other hand, if Merlion Bank receive a collection request from ACH, BPS will check the remaining sum of the issuer's account balance. If there are enough fund, Merlion Bank will approve the request and debit and amount accordingly from the issuer's account. The whole process will take up to 2 working days.

Society for Worldwide Interbank Financial Telecommunications (SWIFT)

To achieve international fund transfer, Merlion Bank will collaborate with SWIFT, which is an interbank communication system rather than a fund transfer system. SWIFT is used to share financial information between financial institutions around the world. A SWIFT message can be sent from one bank to another bank via SWIFT network, to request for a transfer. A SWIFT code is uniquely assigned to each of the participating bank. To perform a transfer, a customer needs to provide a foreign account number, transfer amount and the destined bank's unique SWIFT code. A S\$25 processing fee per transaction is charged and the fund will be received after up to 5 days. The bank will also charge a premium for different currency transfer. The exchange rate we offer will be higher than the prevailing price, so as to ensure larger profit earned and to encourage same currency transfer.

Billing

As for the other integral of BPS, the billing system works in a similar way as payment system, except that payer needs to specify an corporate entity instead of an individual, as the payee.

There are two types of bill payment: ad-hoc bill payment and regular bill payment. For ad-hoc bill payment, the process assembles to fund transfer, except that payer need to specify the billing reference number. Payer has the choice to switch the billing to be recurrent. For regular bill payment, payer need to set up an IBG instruction. Payee will deduct fixed amount after every billing period on the specified day of month.

Business Objectives

- Ensure reliable transaction
- Ensure all transactions are secured and accessible only to higher rank staff in relevant divisions
- Minimize waiting time to provide responsive service
- Provide records for all transactions

3.6.2 Business Processes

A) Set up an IBG arrangement

As IBG can be initiated by both payer and payee, user need to specify the transaction is a payment or collection instruction. In most cases, individual customers will initiate a payment instruction, while corporate customers will initiate a collection instruction from their customers, which can also be categorized into the billing sector.

For GIRO payment within the same bank, the process is rather simple as the BPS only has to check the credit limit of the payer, and directly debit from payer's account and credit payee's account. However, as mentioned above, GIRO payment between different banks has a more tedious process. The following activity diagram depicts the process of GIRO transaction between different banks.

The setup of GIRO arrangements can be done via online BPS portal. A GIRO Application Form need to be filled.

Scenario: User Alan apply for GIRO payment through Merlion Bank online website

1. Alan logs in to Merlion Bank website
2. Alan clicks “Pay” tab
3. Alan clicks “GIRO Arrangement”
4. Alan clicks “Application”
5. Alan completes “Merlion Bank all-in-one GIRO form”
6. Alan types in phone number “12345678” and clicks “receive OTP”
7. Alan receives OTP and types in “kasdf134” in as OTP
8. Alan can view status of GIRO application

The recipient will indicate the outcome in the next bill of the Merlion Bank account used for regular deductions. Any new GIRO arrangements will take at least 21 days to take effect. Upon successful arrangement, customer will receive notification after each deduction via Merlion Bank website notification, electronic email and sms.

B) Receive payment via IBG

To receive payment via IBG, the payee and payer need to reach an agreement in advance. The payer need to put in place a IBG arrangement specifying the payee’s information. If the payer has insufficient funds in his/her bank account, no funds will be deducted from the payer’s account. Merlion Bank will inform payee about the unsuccessful GIRO collection via the same channels, so that payee can follow up with the payer.

The whole process of a GIRO transfer is shown below.

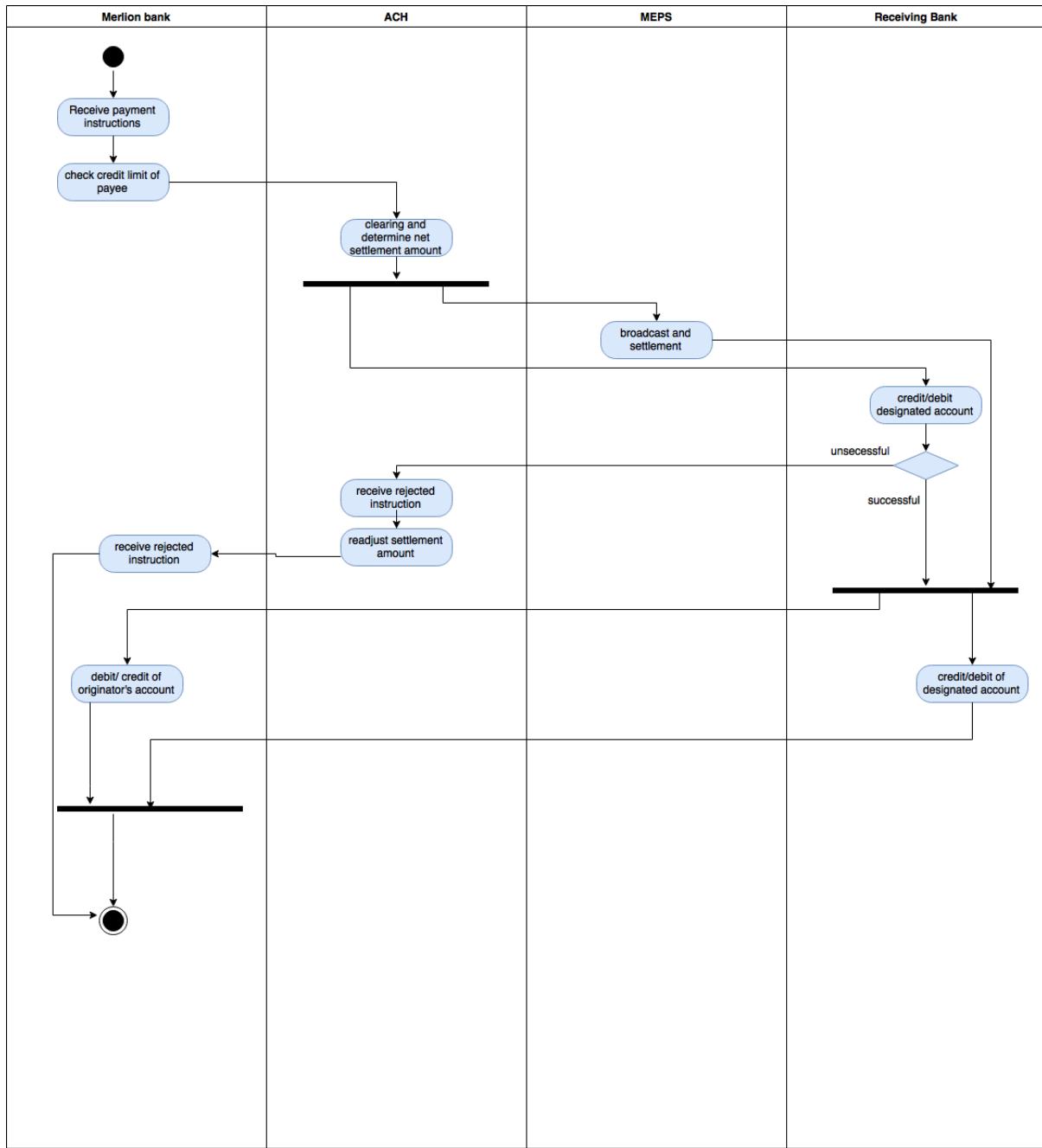


Figure 10: Activity Diagram - GIRO

C) Initiate FAST transfer

The process of FAST transfer is similar to that of simple account transfer. The user can simply send the payment instruction via BPS online portal. The beneficiary will receive the funds within five minutes after the payment has been made, upon a successful credit. Both parties will receive an email alert.

The information that the payer needs to provide are: beneficiary name, beneficiary bank account number, purpose code, beneficiary bank name and the amount. The debiting amount will also include a S\$5.00 transaction fee.

Scenario: Ben wants to transfer S\$10,000 to his friend Carol

1. Ben logs in to Merlion Bank website portal
2. Ben clicks “Transfer” tab
3. Ben clicks “To Other Bank”
4. Ben types in “Carol Wong” as beneficiary name
5. Ben types in “123-45678-9” as beneficiary account number
6. Ben choose “01” as purpose code
7. Ben types in “S\$10,000” as amount
8. BPS alerts Ben about the S\$5.00 transaction fees generated
9. Ben clicks “accept”
10. Ben types in phone number “12345678” and clicks “receive OTP”
11. Ben receives OTP and types in “kasdf134” in as OTP
12. Ben receives confirmation of payment via email and transaction history in his account center on Merlion Bank website after 1 minute.

D) Clearing a cheque

As the clearance of cheque takes place at our home branch, the main task of BPS is to store, forward and update the information of the cheques deposited.

Scenario: Don deposit a cheque with value of S\$50,000 from DBS

1. Don arrives at counter at Merlion Bank home branch
2. Don deposit the cheque into the cheque deposit box
3. BPS credit Don’s account with S\$50,000 on-hold fund
4. Don can check the cheque status from Merlion Bank websit, which shows “pending” at the time

5. BPS alert Don via email and notification box on Merlion Bank website about clearance of cheque
6. A S\$0.80 per cheque transaction fee is deducted from the cheque amount
7. Don can withdraw the S\$49,999.20 from his account

The backend workflow of clearing cheques is shown by the activity diagram.

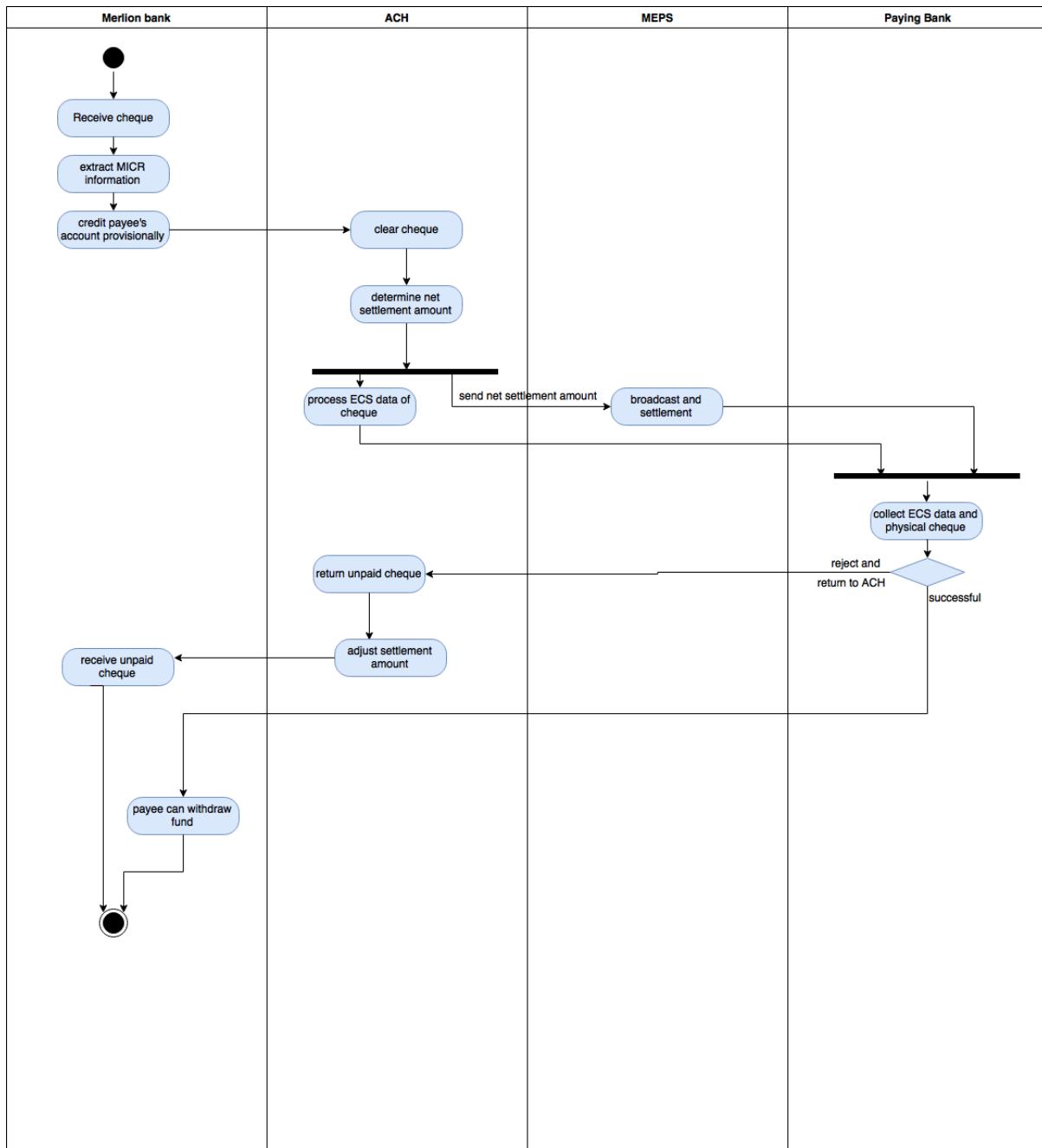


Figure 11: Activity Diagram - Cheque

E) Making a SWIFT transfer

The process of making a SWIFT transfer is very similar to that of making a FAST transaction, except that the payer need to provide the SWIFT code of the beneficiary's bank. The SWIFT code is uniquely assigned to each participating banks. For example, the Italian bank UniCredit Banca, headquartered in Milan, will have a SWIFT code of UNICRITMM. The payer need to

initiate a transfer by paying the bank an amount sufficient to cover the cost of the transfer as well as the amount to be sent, as the sender will be charged during the process. Moreover, if the remittance is subject to an exchange rate, the bank will charge a premium (\$10.00) and earn money on the exchange rate as well. Thus, users are encouraged to perform transfers that are sent and received in the same currency.

The customer can make a SWIFT transfer via walk-in or online payment.

Scenario: Ethan transfer USD\$10,000 to Frank in Italy

1. Ethan logs in to the Merlion Bank website
2. Ethan clicks “Transfer” tab
3. Ethan clicks “Overseas Transfer”
4. Ethan clicks “SWIFT transfer”
5. Ethan specifies “Frank Geller” as recipient name
6. Ethan specifies “123-55555-11” as account number
7. Ethan specifies “Italy” as destination country
8. Ethan specifies “UNICRITMM” as SWIFT code
9. Ethan specifies “USD” as receiving currency
10. BPS alert Ethan of S\$25.00 charge of processing fee
11. Ethan clicks accept
12. Ethan types in phone number “12345678” and clicks “receive OTP”
13. Ethan receives OTP and types in “kasdf134” in as OTP
14. Ethan can check transfer status on Merlion Bank portal, which shows “pending” at the time
15. Ethan receives email notice about successful transfer

The role of BPS in this service is rather simple. BPS is in charge of sending the SWIFT message to recipient's bank via SWIFT network, waiting for approval/rejection message from SWIFT network, and update the status of payment.

For receiving a SWIFT payment, BPS will credit money to recipient's account accordingly and send approval message to paying bank via SWIFT network.

F) Set up a billing arrangement

Since billing is essentially the same as fund transfer, the business process of billing is highly similar to that of GIRO transfer and FAST. To set up a regular bill payment, customer need to set up an IBG standing instruction. The billing organization will thus be able to deduct the bill at regular time frame. To initiate an ad-hoc bill payment, user need to go through the same process as FAST transfer, except that the billing reference number need to be specified. Use configure it to be recurrent during the process as well.

Scenario: Gina set up a billing arrangement to pay school fee annually to NUS

1. Gina logs in to Merlion Bank website
2. Gina selects “Pay” tab
3. Gina selects “Pay Bills”
4. Gina selects “Set up Regular Billing Arrangement”
5. Gina completes “All-in-one GIRO Application Form”, in which she indicate “National University of Singapore” as recipient name and check “Education Institutes” under recipient
6. Gina provides billing reference number
7. Gina types in phone number “12345678” and clicks “receive OTP”
8. Gina receives OTP and types in “kasdf134” in as OTP
9. Gina completes application and view status of GIRO application, which is stated as “pending”
10. Gina receives successful arrangement via email
11. Gina receives deduction notice every year after deduction of school fee

For ad-hoc bill payers, a simple transaction process will be performed by them.

Scenario: Helen pays her phone bill to Starhub

1. Helen logs in to Merlion Bank website
2. Helen selects “Pay” tab

3. Helen selects “Pay Bills”
4. Helen selects “Bill Payment”
5. Helen selects “Starhub” under billing companies
6. Helen provides billing reference number
7. Helen views bill outstanding balance of S\$40.00
8. Helen fills in S\$40.00 as paying amount
9. Helen types in phone number “12345678” and clicks “receive OTP”
10. Helen receives OTP and types in “kasdf134” in as OTP
11. Helen provides Merlion Bank deposit account number and PIN
12. Helen completes ad-hoc bill payment

3.6.3 System Requirements Analysis

Business Assumptions

- Cheque clearance is done at the counter by counter-teller. An MICR check reader will be used.
- Merlion Bank has already joined the FAST payment system, IBG system and SWIFT system.
- Connection with ACH is already established.
- Merlion Bank issue cheques by counter pickup or mailing. A cheque writer machine can be used to write a cheque.

To address the business requirements of the billing and payment functions, 5 subsystems are categorized based on the different payment channels that BPS supports, which are GIRO Transfer subsystem, FAST Fund Transfer subsystem, Cheque Management subsystem, SWIFT International Transfer subsystem and the Billing Management subsystem. All of the subsystems will be used by the staff in Payment Department under Consumer Banking Division. In addition, the third parties who are responsible for clearing and settlement will also be simulated in the system.

a) GIRO Transfer Module

This subsystem will be used to facilitate all GIRO transactions payment and collection requests. It is responsible for actual debit and credit of users' accounts, sending/ receiving instructions to/from ACH, update the users' account balances and update transfer status. As the main functions are done mostly by the algorithms in the system, the staff in Payment Department are mostly in charge of maintenance of the system, assessing data and transaction history when necessary and editing data.

b) FAST Fund Transfer Module

This subsystem will be responsible for the incoming and outgoing FAST transfer requests. As there is no third party involved besides the paying/receiving bank and Merlion Bank, this module will only be dealing with the partnering banks. It will provide the means for users to apply for FAST Fund Transfer payment and collection, allow users to view transfer status and account balance, as well as debit and credit of user's account. The staff in Payment Department will conduct maintenance of system, assessment and editing of data.

c) Cheque Management Module

This subsystem is used by the Payment Department and the counter tellers to store and process the cheque data. The module will acquire inputs including the MICR information of the received cheques from the MICR cheque reader machines at the counter, and also from manual editing of counter tellers and Payment Department staff. The module will store and forward the MICR cheque information to ACH and second party bank, provide status check, and update the cheque user's account balances.

d) SWIFT International Transfer Module

The SWIFT International Transfer Subsystem is the only channel Merlion Bank provides for overseas fund transfer. The system will perform simple functions like forwarding and receiving SWIFT messages, checking credit limit of payers' accounts, crediting and debiting, and updating transfer status as well as account balances.

e) Billing Management Module

The Billing Management Subsystem performs the similar functions as the GIRO Transfer Subsystem, except that all transfers are designating corporates as recipients.

f) ACH Module

This module will be built to simulate the clearing, settlement and forwarding of payment instructions. It acts as a bridge between the receiving bank, MEPS, and the paying bank. It is also in charge of clearing of cheques.

g) MEPS Module

This module is established to simulate the processing of clearing and settlement results from ACH. It is essentially in charge of storing the net settlement results and broadcasting it to the originating and receiving banks.

h) SWIFT Module

This subsystem is to simulate the international payment network. It primarily act as a bridge between the paying and receiving banks by receiving, processing and forwarding the instructions and responses from them.

System functionalities

Functionality	Name	Remark	AAU
Code			ID
A.6 Billing and Payment System			
A.6.1 FAST Fund Transfer Module			
A.6.1.1	View account balance	System displays account balance	6

A.6.1.2	Edit transfer request	System updates information of transfer, such as amount and receiving account	
A.6.1.3	Update account balance	System edits account balance after transfer	
A.6.1.4	View transfer request	System displays transfer request	
A.6.1.5	View status of transfer	System displays transfer status	
A.6.2 GIRO Transfer Module			
A.6.2.1	View account balance	System displays account balance	6
A.6.2.2	View transfer request	System displays transfer request	
A.6.2.3	Edit transfer request	System updates information of transfer, such as amount and receiving account.	
A.6.2.4	Process transfer request	System sends transfer request to ACH	
A.6.2.5	Update account balance	System credits/ debits account balance.	
A.6.3 Billing Management Module			
A.6.3.1	View account balance	System displays account balance	6
A.6.3.2	Edit billing information	System updates billing information, such as recipient corporate's account, reference number, billing amount, billing period	
A.6.3.3	Update account balance	System debits payer's account	

A.6.3.4	Update billing status	System edits billing status		
A.6.4 Cheque Management Module				
A.6.4.1	View cheque information	System displays cheque information, such as amount, MICR information	6	
A.6.4.2	Update account balance	System edits payer/payee's account balance		
A.6.4.3	Update cheque status	System edits cheque processing status		
A.6.4.4	Process cheque request	System forwards cheque information to ACH		
A.6.5 SWIFT International Transfer Module				
A.6.5.1	View account balance	System displays account balance	6	
A.6.5.2	Update account balance	System credits/debits payer/payee's account balance		
A.6.5.3	View SWIFT transfer request	System views information of SWIFT transfer such as SWIFT code		
A.6.5.4	Process SWIFT transfer message	System forwards SWIFT transfer request to SWIFT network		
A.6.5.5	Update SWIFT transfer request status	System edits SWIFT transfer request status		
B.2 Billing and Payment System				
B.2.1 ACH Module				

B.2.1.1	Process clearing	ACH determines net settlement amount of originating bank and recipient bank.	6
B.2.1.2	Cheque clearing	ACH processes MICR information and clears them.	
B.2.1.3	Forward clearing figures	ACH sends net clearing figures of originating and recipient bank to MEPS.	
B.2.1.4	Forward payment instruction	ACH forwards payment information to the receiving bank for credit/debit of instructed account.	
B.2.1.5	Update settlement	ACH update settlement amount of originating bank and receiving bank.	
B.2.1.6	Forward rejected payment instruction	If the payment instruction is rejected, receiving bank will return the rejected instruction to ACH, who will then forward the instruction to originating bank.	
B.2.2 MEPS Module			
B.2.2.1	Update settlement	MEPS updates settlement amount of originating bank and recipient bank.	6
B.2.2.2	Broadcast settlement	MEPS sends net settlement figures to originating bank and recipient bank.	
B.2.3 SWIFT Module			
B.2.3.1	Process payment instruction	SWIFT system processes incoming payment request.	6
B.2.3.2	Forward payment instruction	SWIFT system sends payment request to instructed receiving bank based on SWIFT code.	

B.2.3.3	Send outcome	SWIFT system sends transfer outcome (successful/rejected) to originating bank.	
C.4 Billing and Payment Module			
C.4.1	Online transfer	Customer transfers Singapore Dollar funds through FAST.	6
C.4.2	View transfer status	Customer views transfer status.	
C.4.3	View Cheque Status	Customer views cheque processing status	
D.4 Billing and Payment Module			
D.4.1	Online transfer	Customer transfers Singapore Dollar funds through FAST.	6
D.4.2	View transfer status	Customer views transfer status.	
D.4.3	View Cheque Status	Customer views cheque processing status	

3.7 Wealth Management System (AAU ID: 07)

3.7.1 Business Analysis

The Wealth Management System is to facilitate client relationship teams to make decisions on recommending wealth management proposals and plans to Merlion Bank's customers. It is a key function that supports Merlion Bank's main approach to make profits.

The system must be able to advise relationship managers on different wealth management proposals and plans that are suitable for a customer based on analysis of his family information, financial goals, risk profile, and other advanced information. A knowledge management system

featuring a knowledge repository which contains wealth planning case studies will be incorporated into Wealth Management System to provide computerized decision support for relationship managers.

The system is also linked to Portfolio Management System which manages all the portfolios of customers. The system must be able to generate a weekly portfolio performance report for customers to track their portfolio performance and decide on whether or not to perform asset reallocation.

The Wealth Management System will be able to provide personalized wealth management plans for customers and facilitate relationship managers to make informed decision.

Business Objectives

- Create customer's advanced profile which includes family information and financial goals of the customer
- Provide an online test for customers to do risk tolerance test and create customer's risk profile
- Fetch wealth management planning case studies from database to provide decision support for relationship managers
- Allow customers to view their portfolio performance report on internet banking website or on mobile phones
- Allow relationship managers & sales department manager to view their customers' portfolio performance report

3.7.2 Business Processes

A) Assign relationship manager to customer

After customer contacts Merlion Bank for wealth management services, system will search for customer's profile in database. If the customer is an existing customer who has already been assigned a relationship manager, the customer will be directed to his relationship manager. If the customer has never requested for Merlion Bank's wealth management service before, the

sales department manager will assign a relationship manager to the customer using Merlion Bank Internal System.

Scenario: Assign relationship manager to customer

1. Customer Tom contacts Merlion Bank over internet banking website and requests for wealth management services
2. System checks if the customer has been assigned a relationship manager
3. If Tom has not been assigned a relationship manager, system will send a notification to sales department manager and create an entry in “Assign Relationship Manager” page. The default status for the entry is “pending”
4. Sales department manager John logs in to Merlion Bank Internal System and noticed the notification sent by system.
5. John clicks the “Assign Relationship Manager” tab and sees all the pending entries.
6. John assigns a relationship manager to a customer by choosing name of the RM (Mike) from a drop-down menu.
7. John clicks the “confirm” button
8. System updates the status of the entry to “completed”
9. System sends a notification to the relationship manager Mike about the customer assignment done by John

B) Create Advanced Profile of Customer

After relationship manager approaches customer, relationship manager will collect advanced information from customer such as family information, income, and financial goals. Besides, relationship manager will also help customer do a online risk tolerance test to create customer’s risk profile.

Scenario: Relationship manager creates advanced profile of customer

1. Relationship manager Mike logs in to Merlion Bank Internal System
2. Mike clicks “Create Advanced Profile” button

3. System displays the “Advanced Profile” page
4. Mike input the following information of the customer Tom
 - Family information
 - Monthly income
 - Financial goals
5. Mike clicks “Next” and inputs Tom’s answer to the questions designed for customer risk tolerance test
6. Mike clicks “Save” button
7. System displays the summary of Tom’s advanced profile which includes the mark gained for customer risk tolerance test and indicates that the advanced profile has been successfully saved into database

C) View Proposed Wealth Management Proposals

After the advanced profile of a customer has been created, relationship manager can make use of Wealth Management System to recommend investment plans to customers.

Scenario: View proposed wealth management proposals

1. Relationship Manager Mike selects customer Tom’s advanced profile
2. Mike clicks “View Proposed Plans” button
3. System generates and displays several wealth management proposals

D) Send Proposed Plans to Customer

Relationship manager makes the decision on choosing proper investment plans based on the wealth management proposals recommended by the system. After choosing the proposed plans, relationship manager will then send the plans to customer’s mailbox on Customer Internet Banking Website in order to obtain approval from customer

Scenario: Send proposed plans to customer

1. Relationship manager Mike chooses wealth management plans from plans recommended by the system
2. Mike clicks the “Send” button
3. System sends an email which contains the wealth management plan Mike has chosen to customer Tom’s mailbox
4. System sends a notification to Tom

E) Approve Proposed Plans

After viewing the proposed plans from relationship manager, customer will then indicate if he/she approves/rejects the plan. If customer approves the plan, relationship manager will then prepare the contract. If customer rejects the plan, relationship manager has to revise the plan and send it to customer again.

Scenario: Approve proposed plans

1. Customer Tom logs in to Internet Banking Website of Merlion Bank
2. Tom opens the file of wealth management plan proposed by relationship manager Mike
3. Tom views the plan and ticks the “Approve”/“Reject” checkbox at the bottom of the file
4. Tom sends the file back to Mike
5. System will sends a notification to Mike

F) Sign Contract with Customer

After the customer approves the wealth management plan, relationship manager has to prepare a contract. The contract can be either sent to customer via email or be signed by customer on a hard copy.

After the customer signs the contract, relationship manager will create a new portfolio for the customer and start monitoring the portfolio performance.

The above business processes can be shown in an activity diagram as follow:

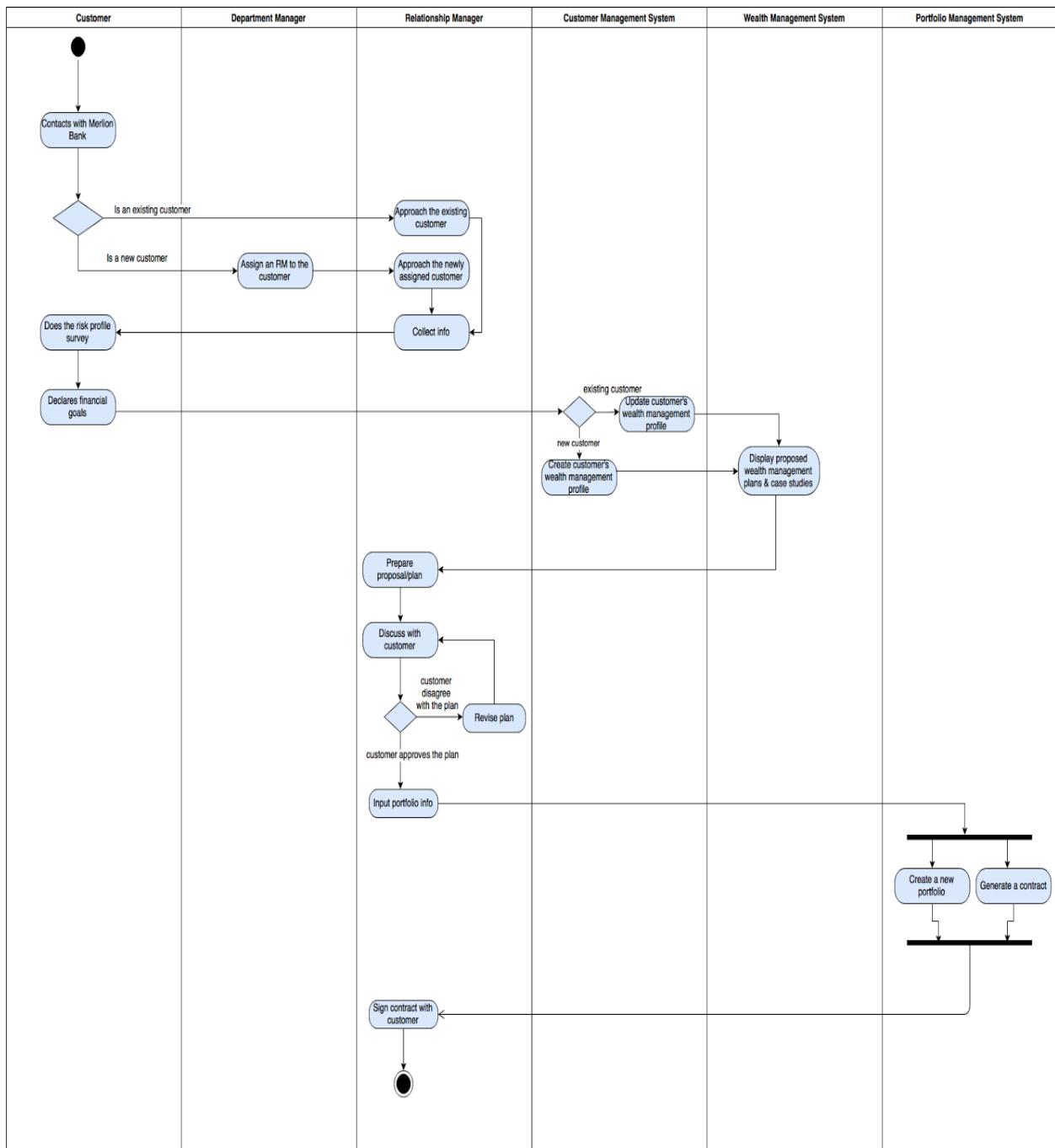


Figure 12: Activity Diagram - Wealth Management Process

G) View Portfolio Report

Every week system will send a portfolio performance report to customer's mailbox. Customer can log in to Internet Banking Website to view the weekly report. Besides, relationship manager of the customer will also be able to view the weekly portfolio performance report of his customer via Merlion Bank Internal System.

Scenario A: View portfolio report (customer)

1. System sends weekly portfolio performance report to customer Tom on the last day of each month
2. Tom logs in to Internet Banking Website
3. Tom clicks “View Portfolio Performance Report” button
4. System displays the weekly report using charts and tables

Scenario B: View portfolio report (relationship manager)

1. Relationship manager Mike logs in to Merlion Bank Internal System
2. Mike selects customer Tom from the customer list
3. Mike clicks “View Portfolio Performance Report” button
4. System displays the weekly report using charts and tables

H) Portfolio Performance Reviewing

Every half year relationship manager will arrange a meeting with customer to review customer's portfolio performance. Customer can choose to revise wealth management plan or stick to the original plan after reviewing the portfolio performance. Besides, customer can also request to terminate the wealth management plan and sign termination agreement with Merlion Bank. After the agreement is signed, the remaining credit of the portfolio will be transferred to customer's account.

The portfolio performance reviewing process can be shown in an activity diagram as follow:

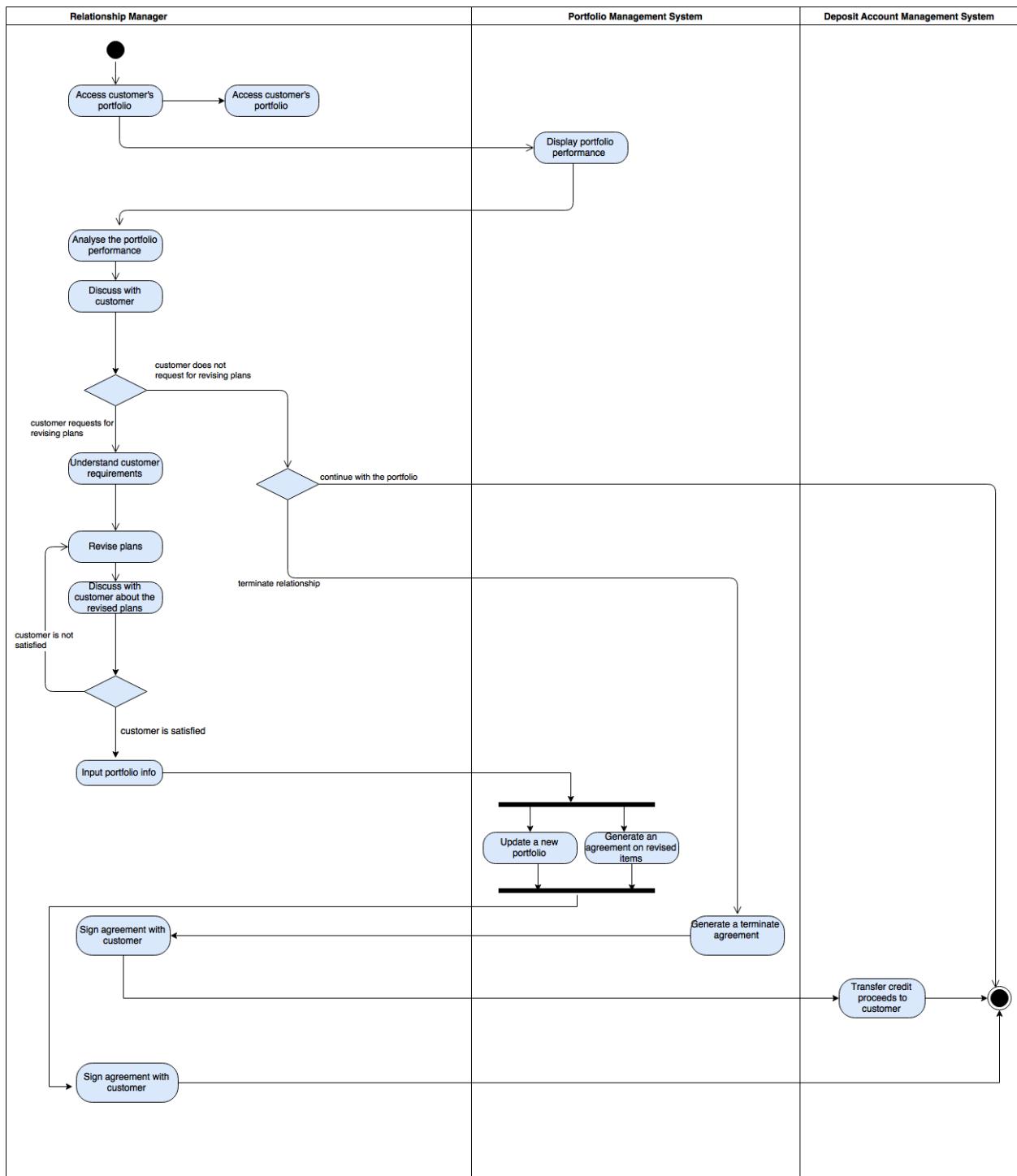


Figure 13: Activity Diagram - Portfolio Performance Review

3.7.3 System Requirements Analysis

Business Assumptions

- The financial goals and information about risk tolerance test are input by relationship managers using Merlion Bank Internal System
- Once the financial goal has been created and customer has chosen his preferred wealth management plan, the financial goal cannot be modified by customers or staff of Merlion Bank
- The proposed wealth management proposals and plans are generated mainly based on customer's financial goals and risk profile
- The actual trade related activities are performed offline in a separated trading system
- Relationship manager can only view portfolios of his own customers
- Customer can decide on whether or not to revise current wealth management plan only when he meets his relationship manager for the portfolio performance reviewing meeting which happens once every half year.

To address the business requirements of the Wealth Management System in the preliminary requirements specifications, a Wealth Management Planning Module and a Portfolio Performance Reviewing Module will be constructed for Merlion Bank Internal System. These two modules are described as follows:

a) Wealth Management Planning Module

This module will primarily be used by staff from sales department to make informed decision on recommending wealth management proposals for customers. It will also provide a platform for relationship managers to input customer's advanced information such as financial goals, and risk tolerance information, as well as family information. The system will analyze the information in customer's advanced profile such as financial goals and risk tolerance, and provide recommended wealth management proposals to facilitate relationship managers during the decision making process.

b) Portfolio Performance Reviewing Module

This module will be used by Staff from sales department to view customer's portfolio performance report using Merlion Bank Internal System.

A Wealth Management Module will be constructed for Internet Banking Website and Mobile Web Application. The module is described as follows:

c) Wealth Management Module

This module will be primarily used by customers to review their portfolios and their performance, as well as monitor their financial goals using Internet Banking Website or mobile web application.

System Functionalities

Functionality	Name	Remark	AAU
Code			ID
A.7 Wealth Management System			
A.7.1 Wealth Management Planning Module			
A.7.1.1	View Advanced Profile	Relationship manager & Sales department manager view financial goals and risk profile of customer	
A.7.1.2	View Proposed Plan	Relationship manager & Department manager can view proposed wealth management plan	7
A.7.1.3	Create Advanced Profile	Relationship manager can create the advanced profile of his customer	
A.7.2 Portfolio Performance Reviewing Module			
A.7.2.1	View Portfolio Report	Relationship manager & Department manager can view the weekly portfolio performance report	7
C.6 Wealth Management Module			

C.6.1	View Advanced Customer Information	Customer can view his/her advanced customer information on internet banking website	7
C.6.2	View Portfolio Report	Customer can view report about portfolio performance over a certain period on internet banking website	
D.6 Wealth Management Module			
D.6.1	View Advanced Customer Information	Customer can view his/her advanced customer information on internet banking website	7
D.6.2	View Portfolio Report	Customer can view report about portfolio performance over a certain period on internet banking website	

3.8 Portfolio Management System (AAU ID: 08)

3.8.1 Business Analysis

The Portfolio Management System(PMS) is to support the staff from sales department to maintain and manage the portfolios of customers. Once customer has signed contract with Merlion Bank, relationship manager must create a portfolio of the customer. After the portfolio is created, relationship manager must keep monitoring performance of the portfolio and re-allocate the assets based on the valuation of the portfolio provided by the PMS system.

In order to ease relationship manager's daily job, there should be an easy-to-use user interface for relationship manager to input and maintain customer's portfolio. Therefore, PMS system must provide intuitive monitoring tools such as charts and tables for relationship managers to reflect the performance and valuation of the portfolio. Besides, it must enable relationship manager to create a new portfolio, and modify the portfolio to reflect the asset re-allocation and balancing.

In order to provide more accurate valuation information to reflect the net worth of customer's portfolio, PMS system must make use of appropriate valuation methodologies and criteria to evaluate different financial instruments such as real estate properties and private equities.

Business Objectives

- Create and maintain customer's portfolio
- Provide portfolio monitoring tools such as charts and tables
- Provide portfolio valuation report for relationship manager
- Update and modify customer's portfolio to reflect asset re-allocation and balancing

3.8.2 Business Processes

A) Create a New Portfolio

After customer has signed contract with Merlion Bank about his wealth management plan, relationship manager will log in to Merlion Bank Internal System and review the contract. Once the contract is confirmed, relationship manager will select the customer and create a new portfolio for the customer.

Scenario: Create a new portfolio

1. Customer Tom chooses wealth management plan A and signs contract with Merlion Bank
2. Relationship Manager Mike logs in to Merlion Bank Internal System
3. Mike confirms that there is no problem with the contract
4. Mike selects Tom in PMS system and clicks "Create A Portfolio" button
5. System displays "portfolio" page of customer Tom
6. Mike clicks "Add New Product" button in "Portfolio" page and inputs the following information:
 - Product name
 - Number of unit purchased

- | | |
|----|---|
| 7. | Mike repeated step 5 until all the products Tom has chosen are added to the portfolio |
| 8. | Mike clicks “Confirm” button to confirm the information input |
| 9. | System saves the portfolio and displays the notification saying that “A portfolio has been successfully created!” |

B) View the Portfolio Valuation and Performance

PMS system is able to provide intuitive portfolio monitoring tools to reflect the portfolio performance. Relationship manager can log in to Merlion Bank Internal System to view the portfolio valuation which is shown using various charts and tables.

C) Re-allocate assets

After viewing the portfolio valuation, relationship manager can modify customer's portfolio. Relationship manager can add a new product, remove a product, edit the unit price, and edit number of units purchased to reflect assets re-allocation and balancing.

3.8.3 System Requirements Analysis

Business Assumptions

- The actual trade related activities are performed offline in a separated trading system
- Relationship manager can only view portfolios of his own customers
- Daily operations of the portfolio is decided by relationship manager, and customer cannot view the daily operations performed by his relationship manager

To address the business requirements of the Portfolio Management System in the preliminary requirements specifications, a Portfolio Creation and Updating Module and a Portfolio Valuation Module will be constructed. These two modules are described as follows:

a) Portfolio Creation and Updating Module

This module will be used by relationship manager from sales department of Merlion Bank. It enables relationship manager to create a new portfolio for his customer, and modify the

portfolio based on the portfolio performance and valuation to reflect assets diversification and changes happened during assets re-allocation process.

b) Portfolio Valuation Module

This module will be used by relationship manager from sales department of Merlion Bank. It provides portfolio valuation using charts and tables as monitoring tools for relationship manager to track the performance of the portfolio. Relationship manager will view the portfolio valuation, and then modify the portfolio accordingly based on his professional knowledge with the support of portfolio creation and updating module.

System Functionalities

Functionality	Name	Remark	AAU
Code			ID
A.8 Portfolio Management System			
A.8.1 Portfolio Creation and Updating Module			
A.8.1.1	Add a new portfolio	Relationship manager & Department manager can add a new portfolio	8
A.8.1.2	Update a portfolio	Relationship manager & Department manager can update a portfolio	
A.8.2 Portfolio Valuation Module			
A.8.2.1	View Portfolio Valuation	Relationship manager & Department manager can view portfolio valuation shown in charts and tables	8

3.9 Customer Analytics & Business Intelligence System (AAU ID: 09)

3.9.1 Business Analysis

The Customer Analytics & Business Intelligence System is(CABIS) to help high-level management of Merlion Bank with decision making, cutting cost, and identifying business opportunities. For high-level management who make strategic business decisions including placing priorities, setting goals and directions of Merlion Bank, CABIS system provides business insights based on data analysis results to facilitate management to make more informed decisions.

CABIS system makes use of various analytics tools, techniques, and metrics to enable CEO and department managers to have an overview of the performance of Merlion Bank. For instance, It identifies and differentiates customers to apply customized marketing strategy to different customer segments. It also evaluates Merlion Bank's performance based on customer acquisition and attrition rate over a certain period. Besides, CABIS system calculates the estimated cost of retaining customers from different segments, and therefore helps high-level management of Merlion Bank to apply the insights gained to make business strategies for retaining existing customers.

CABIS system is also in charge of supporting business activities in other systems using data analysis and algorithms. It analyzes financial goals and risk profile of the customer and return the analysis results to Wealth Management System to facilitate relationship managers to make decision on choosing wealth management proposals and plans for his customer. CABIS system also provides support for loan managers during the decision making process to approve a loan application through analyzing customer's credit score, credit history, debt and income, as well as collaterals.

Business Objectives

- Help in segmentation of customers through Customer Lifetime Value(CLV) or Recency, Frequency, and Monetary(RFM) analysis to better target different customer segments with different marketing strategies

- Provide business intelligence dashboard for management to gain insights from product sales performance, customer attrition rate, and customer acquisition rate
- Generate opportunity list of potential customers for wealth management services based on the analysis of customer cashflow statement and net worth statement
- Calculate estimated customer retention cost for different customer segments and help management make decision on retaining customers
- Analyze financial goals, risk profile, and other financial information of customer, and recommend wealth management plans and proposals to help relationship manager in decision making process
- Help loan managers during decision making process to approve a loan application

3.9.2 Business Processes

A) View Opportunity List

Sales department manager can log in to Merlion Bank Internal System to view a list of potential customers for wealth management services. Manager can filter the opportunity list by only viewing potential customers whose net worth is within certain range.

Scenario: View opportunity list
<ol style="list-style-type: none"> 1. Sales Department manager Jeff logs in to Merlion Bank Internal System 2. Jeff clicks “Business Intelligence” tab 3. System displays customer analytics and business intelligence section with BI dashboard shown as the first page 4. Jeff clicks “Opportunity List” tab 5. System displays a list of customers who may be target customers of sales department 6. Jeff selects the “net worth: >\$1,000,000” checkbox from system filter 7. The opportunity list will be filtered according to net worth of customer, and system will only display customers whose net worth is more \$1,000,000 8. Jeff selects customer “John” from opportunity list 9. System will display detailed information about John which includes: <ul style="list-style-type: none"> • Net worth range

- Contact number
- Recommended financial instruments

B) View Product Sales Performance

Sales department manager can view product sales performance report to review the overall performance of different products over a certain period. For instance, system can show the top 10 product by sales with their respective revenue shown in a bar chart. Besides, the percentage of various products sold will also be displayed in a pie chart to reflect the product sales performance. In order to view the overall tendency of wealth management products sales of Merlion Bank, sales department manager can choose either weekly view or monthly view of the total revenue gained from product sales.

C) View Customer Acquisition & Attrition Rate

In order to have a sense of Merlion Bank's overall performance, CEO can make use of BI dashboard to view the weekly or monthly customer acquisition rate and customer attrition rate through intuitive line chart. Additionally, when customer decides to terminate relationship with Merlion, a questionnaire will pop up to ask customer about the reason. While viewing customer attrition rate in BI dashboard, CEO can also get to know the main reasons why customers terminate relationship with Merlion Bank through a pie chart showing the percentage of different reasons.

D) View Estimated Customer Retention Cost

While deciding on business strategies about retaining customers of Merlion Bank, CEO can make use of BI dashboard to view estimated customer retention cost. It facilitates the decision making process of CEO by specifying customer retention cost for various customer segments. After executing the business strategies, CEO can examine the effectiveness of the strategy to retain customers by looking at the customer attrition rate which is also shown in BI dashboard.

E) View Customer Lifetime Value

CEO can view the Customer Lifetime Value(CLV) of Merlion bank using BI dashboard. System calculates customer's value by RFM analysis and displays the percentage of different CLV ranges with pie chart.

F) View Customer Segments

CEO of Merlion Bank can view percentage of different customer segments which are categorized based on analysis of customer's net worth statement, cashflow statement and customer lifetime value. System displays percentage of different customer segments (high-value customer, medium-value customer, and low-value customer) with pie chart.

3.9.3 System Requirements Analysis

Business Assumptions

- Only CEO and department managers of Merlion Bank can view business intelligence dashboard
- Department managers can only view information that is related to their respective departments
- Customers are segmented based on Customer Lifetime Value(CLV) and Recency, Frequency, and Monetary(RFM) analysis

To address the business requirements of Customer Analytics & Business Intelligence System in the preliminary requirements specifications, a Customer Segment Analysis Module, a Dashboard Module, and a Customer Insights Module will be constructed. These three modules are described as follows:

a) Customer Segment Analysis Module

This module will be used by CEO of Merlion Bank. It enables CEO to have an overview of Merlion Bank's customer with intuitive visual presentation of different customer segments.

b) Dashboard Module

This module will be used by CEO and department managers of Merlion Bank. It facilitates CEO in making decisions about business strategies by monitoring the overall performance of Merlion Bank from various aspects such as wealth management product sales performance, customer acquisition rate, as well as customer attrition rate. Sales department manager can also make use of this module to gain insights about potential customers for wealth management services.

c) **Customer Insights Module**

This module will be used by CEO of Merlion Bank. CEO can view estimated retention cost and customer lifetime value for different customer segments, and therefore obtain insights about how to retain customers of Merlion Bank in a more cost-effective way.

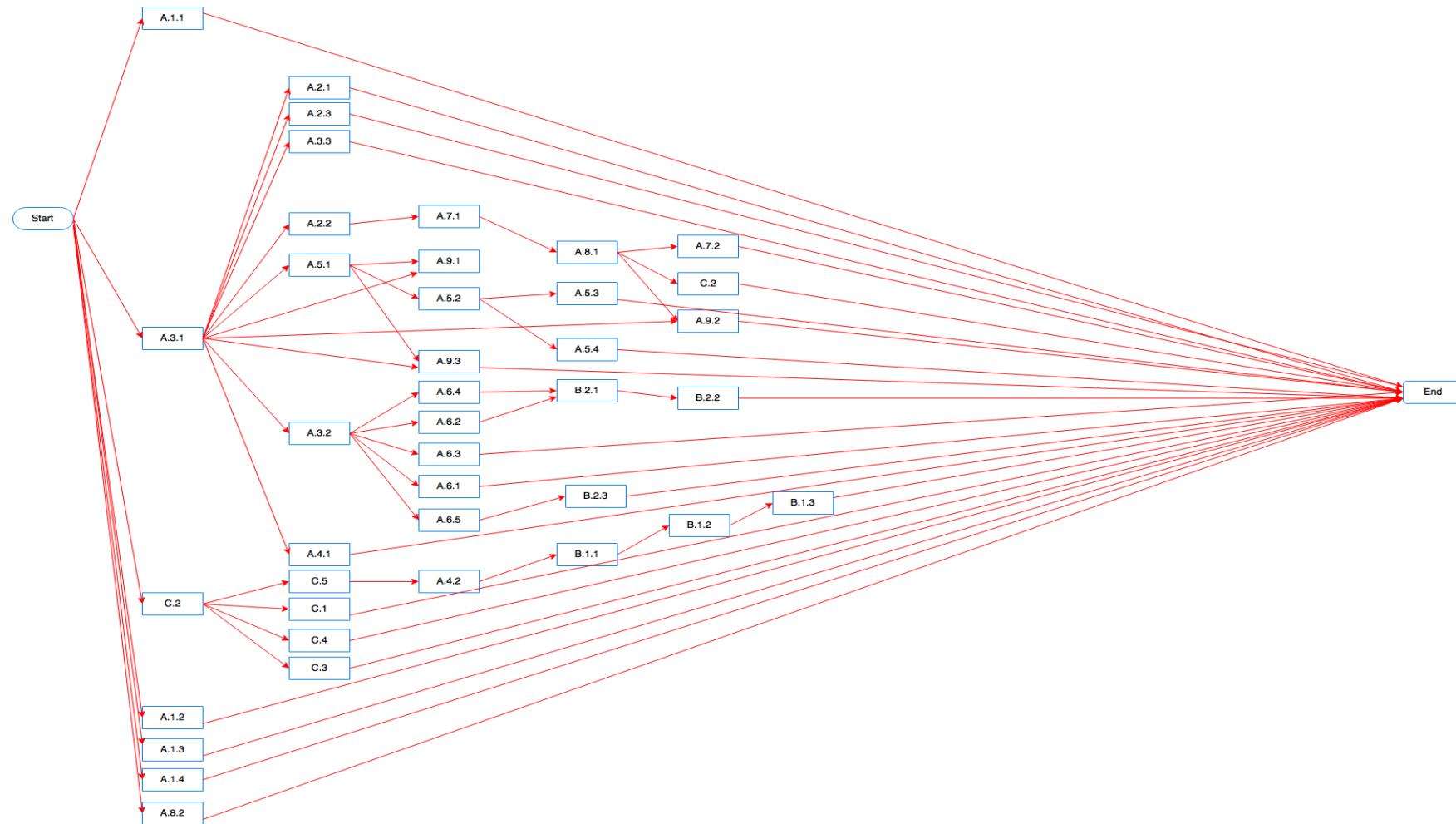
System Functionalities

Functionality Code	Name	Remark	AAU ID
A.9 Customer Analytics and Business Intelligence System			
A.9.1 Customer Segment Analysis Module			
A.9.1.1	View customer segment	CEO can view customers from different segments such as high-value customers, medium-value customers, and low-value customers	9
A.9.2 Dashboard Module			
A.9.2.1	View opportunity list	Sales department managers can view opportunity list of potential customers for wealth management	9
A.9.2.2	View product sales performance	CEO and sales department managers can view performance of different product sales	

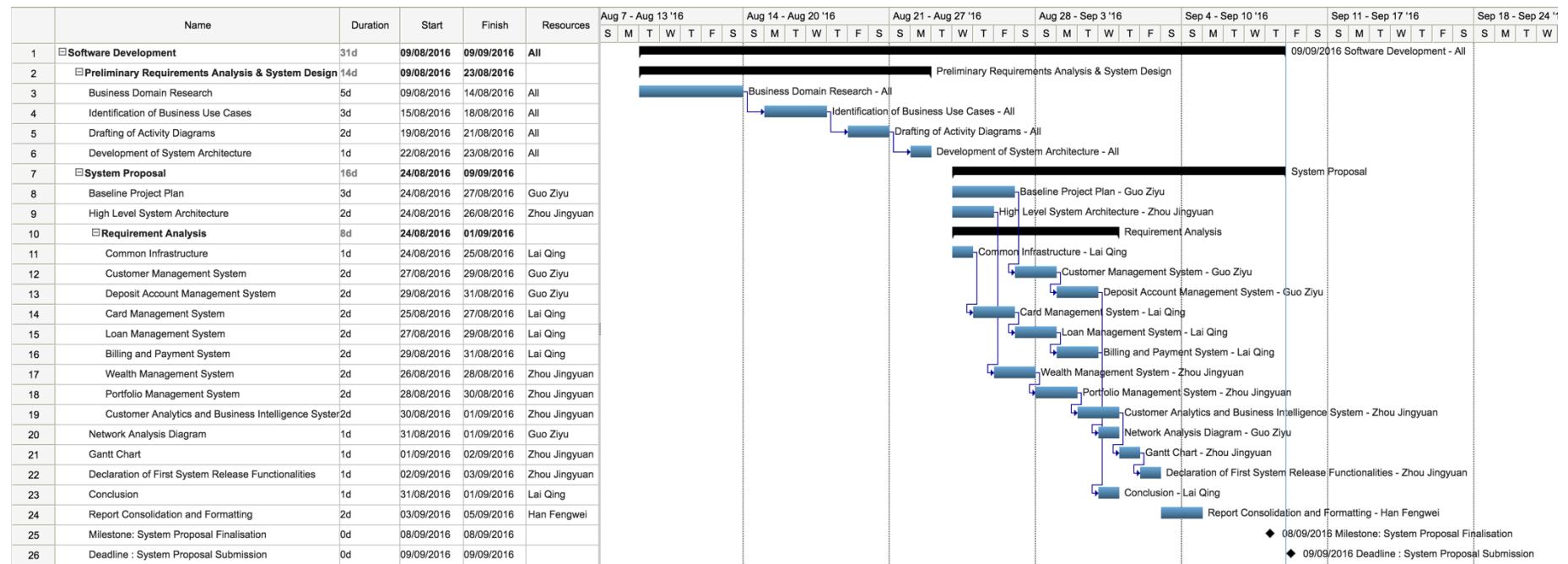
A.9.2.3	View customer attrition rate	CEO can view customer attrition rate	
A.9.2.4	View customer acquisition rate	CEO can view customer acquisition rate	
A.9.3 Customer Insights Module			
A.9.3.1	View estimated customer retention cost for different customer segments	CEO can view estimated customer retention cost for different customer segments(high-value, medium value, low-value)	9
A.9.3.2	View customer lifetime value of customers from different segments	CEO can view customer lifetime value of customers from different segments(high-value, medium value, low-value)	

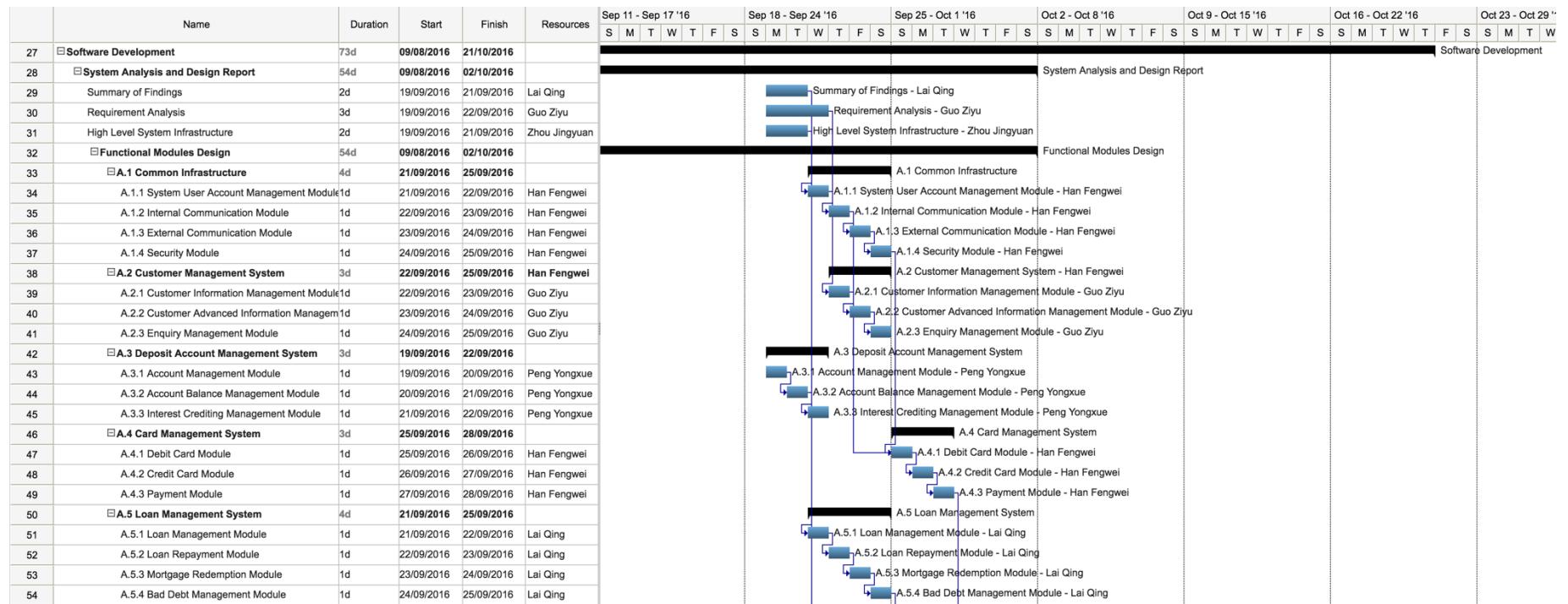
4. Project Management Plan

4.1 Network Analysis



4.2 Gantt Chart





	Name	Duration	Start	Finish	Resources	Sep 11 - Sep 17 '16						Sep 18 - Sep 24 '16						Sep 25 - Oct 1 '16						Oct 2 - Oct 8 '16						Oct 9 - Oct 15 '16						Oct 16 - Oct 22 '16					
						S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
55	■ A.6 Billing and Payment System	5d	19/09/2016	24/09/2016																																					
56	A.6.1 FAST Fund Transfer Module	1d	19/09/2016	20/09/2016	Yang Shuanghe																																				
57	A.6.2 GIRO Transfer Module	1d	20/09/2016	21/09/2016	Yang Shuanghe																																				
58	A.6.3 Billing Management Module	1d	21/09/2016	22/09/2016	Yang Shuanghe																																				
59	A.6.4 Cheque Management Module	1d	22/09/2016	23/09/2016	Yang Shuanghe																																				
60	A.6.5 SWIFT International Transfer Module	1d	23/09/2016	24/09/2016	Yang Shuanghe																																				
61	■ A.7 Wealth Management System	2d	21/09/2016	23/09/2016																																					
62	A.7.1 Wealth Management Planning Module	1d	21/09/2016	22/09/2016	Zhou Jingyuan																																				
63	A.7.2 Portfolio Performance Reviewing Module	1d	22/09/2016	23/09/2016	Zhou Jingyuan																																				
64	■ A.8 Portfolio Management System	2d	24/09/2016	26/09/2016																																					
65	A.8.1 Portfolio Creation and Updating Module	1d	24/09/2016	25/09/2016	Yang Shuanghe																																				
66	A.8.2 Portfolio Valuation Module	1d	25/09/2016	26/09/2016	Yang Shuanghe																																				
67	■ A.9 Customer Analytics and Business Intelligence System	3d	23/09/2016	26/09/2016																																					
68	A.9.1 Customer Segment Analytics Module	1d	23/09/2016	24/09/2016	Zhou Jingyuan																																				
69	A.9.2 Dashboard Module	1d	24/09/2016	25/09/2016	Zhou Jingyuan																																				
70	A.9.3 Customer Insights Module	1d	25/09/2016	26/09/2016	Zhou Jingyuan																																				
71	■ B. External Parties System	6d	25/09/2016	01/10/2016																																					
72	■ B.1 Card Management System	3d	28/09/2016	01/10/2016																																					
73	Merchant Management Module	1d	28/09/2016	29/09/2016	Han Fengwei																																				
74	Acquirer Management Module	1d	29/09/2016	30/09/2016	Han Fengwei																																				
75	Card Network Module	1d	30/09/2016	01/10/2016	Han Fengwei																																				
76	■ B.2 Billing and Payment System	3d	25/09/2016	28/09/2016																																					
77	ACH Module	1d	25/09/2016	26/09/2016	Lai Qing																																				
78	MEPS Module	1d	26/09/2016	27/09/2016	Lai Qing																																				
79	SWIFT Module	1d	27/09/2016	28/09/2016	Lai Qing																																				

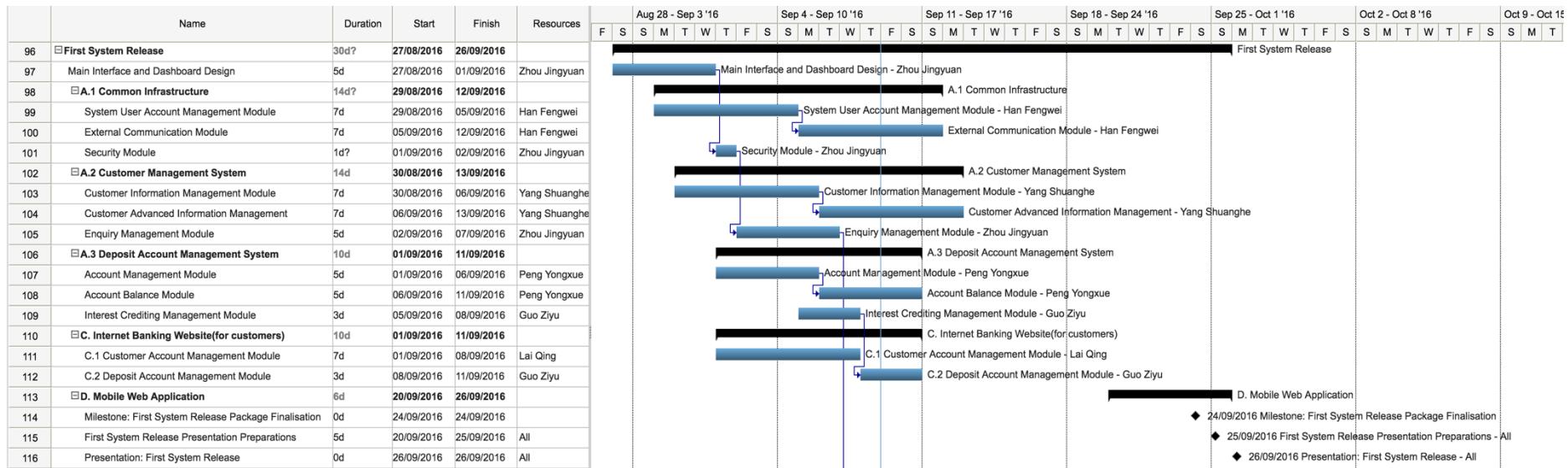
	Name	Duration	Start	Finish	Resources	Sep 25 - Oct 1 '16						Oct 2 - Oct 8 '16						Oct 9 - Oct 15 '16						Oct 16 - Oct 22 '16						Oct 23 - Oct 29 '16						Oct 30 - Nov 5 '16					
						S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	
80	▣ C. Internet Banking Website(for customers)	6d	26/09/2016	02/10/2016																																					
81	C.1 Customer Account Management Module	1d	26/09/2016	27/09/2016	Yang Shuanghe																																				
82	C.2 Deposit Account management Module	1d	27/09/2016	28/09/2016	Yang Shuanghe																																				
83	C.3 Loan Management Module	1d	28/09/2016	29/09/2016	Yang Shuanghe																																				
84	C.4 Billing and Payment Module	1d	29/09/2016	30/09/2016	Yang Shuanghe																																				
85	C.5 Card Management Module	1d	30/09/2016	01/10/2016	Yang Shuanghe																																				
86	C.6 Wealth Management Module	1d	01/10/2016	02/10/2016	Yang Shuanghe																																				
87	D. Mobile Web Application(for customers)	0d	09/08/2016	09/08/2016																																					
88	User Interface Design	1d	28/09/2016	29/09/2016	Lai Qing																																				
89	Naming and Package Conventions Used	1d	01/10/2016	02/10/2016	Han Fengwei																																				
90	Declaration of Open-source and/or Third Party Codes	1d	02/10/2016	03/10/2016	Han Fengwei																																				
91	Integration and Unit Testing Plan	1d	26/09/2016	27/09/2016	Zhou Jingyuan																																				
92	Project Management Plan	1d	27/09/2016	28/09/2016	Zhou Jingyuan																																				
93	Report Consolidation and Formatting	3d	15/10/2016	18/10/2016	Peng Yongxue																																				
94	Milestone: System Analysis and Design Report Finalisation	0d	20/10/2016	20/10/2016																																					
95	Deadline: System Analysis and Design Report Submission	0d	21/10/2016	21/10/2016																																					

The Gantt chart illustrates the project timeline across several phases:

- Phase 1: Sep 25 - Oct 1 '16** (6 days): Includes tasks C.1 through C.6 (Customer Account Management, Deposit Account management, Loan Management, Billing and Payment, Card Management, and Wealth Management) and D. Mobile Web Application.
- Phase 2: Oct 2 - Oct 8 '16** (7 days): Includes tasks User Interface Design, Naming and Package Conventions Used, Declaration of Open-source and/or Third Party Codes, Integration and Unit Testing Plan, and Project Management Plan.
- Phase 3: Oct 9 - Oct 15 '16** (7 days): Includes tasks C.1 through C.6.
- Phase 4: Oct 16 - Oct 22 '16** (7 days): Includes task Report Consolidation and Formatting.
- Phase 5: Oct 23 - Oct 29 '16** (7 days): Includes milestones: 20/10/2016 Milestone: System Analysis and Design Report Finalisation and 21/10/2016 Deadline: System Analysis and Design Report Submission.
- Phase 6: Oct 30 - Nov 5 '16** (6 days): No tasks are shown.

Key milestones and deadlines are explicitly marked:

- 20/10/2016 Milestone: System Analysis and Design Report Finalisation
- 21/10/2016 Deadline: System Analysis and Design Report Submission



	Name	Duration	Start	Finish	Resources	Sep 25 - Oct 1 '16					Oct 2 - Oct 8 '16					Oct 9 - Oct 15 '16					Oct 16 - Oct 22 '16					Oct 23 - Oct 29 '16					Oct 30 - Nov 5 '16				
						S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S		
117	Second System Release	27d	27/09/2016	24/10/2016																															
118	A.1 Common Infrastructure	1d	28/09/2016	29/09/2016																															
119	Internal Communication Module	1d	28/09/2016	29/09/2016	Zhou Jingyuan																														
120	A.4 Card Management System	4d	28/09/2016	02/10/2016																															
121	Debit Card Module	1d	28/09/2016	29/09/2016	Lai Qing																														
122	Credit Card Module	2d	29/09/2016	01/10/2016	Lai Qing																														
123	Payment Module	1d	01/10/2016	02/10/2016	Lai Qing																														
124	A.5 Loan Management System	4d	28/09/2016	02/10/2016																															
125	Loan Management Module	3d	28/09/2016	01/10/2016	Yang Shuanghe																														
126	Loan Repayment Module	1d	01/10/2016	02/10/2016	Yang Shuanghe																														
127	Mortgage Redemption Module	1d	29/09/2016	30/09/2016	Zhou Jingyuan																														
128	Bad Debt Management Module	2d	30/09/2016	02/10/2016	Zhou Jingyuan																														
129	A.6 Billing and Payment System	9d	27/09/2016	06/10/2016																															
130	FAST Fund Transfer Module	2d	27/09/2016	29/09/2016	Peng Yongxue																														
131	GIRO Transfer Module	3d	29/09/2016	02/10/2016	Peng Yongxue																														
132	Billing Management Module	3d	28/09/2016	01/10/2016	Guo Ziyu																														
133	Cheque Management Module	3d	01/10/2016	04/10/2016	Guo Ziyu																														
134	SWIFT International Transfer Module	2d	04/10/2016	06/10/2016	Guo Ziyu																														
135	B. Simulated External Parties System	7d	28/09/2016	05/10/2016																															
136	B.1 Card Management System	7d	28/09/2016	05/10/2016																															
137	Merchant Management Module	2d	28/09/2016	30/09/2016	Han Fengwei																														
138	Acquirer Management Module	2d	30/09/2016	02/10/2016	Han Fengwei																														
139	Card Network Management Module	3d	02/10/2016	05/10/2016	Han Fengwei																														
140	B.2 Billing and Payment System	3d	02/10/2016	05/10/2016																															
141	ACH Module	3d	02/10/2016	05/10/2016	Yang Shuanghe																														
142	MEPS Module	1d	02/10/2016	03/10/2016	Zhou Jingyuan																														
143	SWIFT Module	2d	03/10/2016	05/10/2016	Zhou Jingyuan																														

Name	Duration	Start	Finish	Resources	Oct 2 - Oct 8 '16	Oct 9 - Oct 15 '16	Oct 16 - Oct 22 '16	Oct 23 - Oct 29 '16	Oct 30 - Nov 5 '16	Nov 6 - Nov 12 '16	Nov 13 - Nov 19 '16	Nov 20 - Nov 26 '16	
					S S M T W T F S	S S M T W T F S	S S M T W T F S	S S M T W T F S	S S M T W T F S	S S M T W T F S	S S M T W T F S	S S M T W T F S	
□ C. Internet Banking System(for customers)	9d	02/10/2016	11/10/2016					C. Internet Banking System(for customers)					
C.3 Loan Management Module	1d	02/10/2016	03/10/2016	Lai Qing		C.3 Loan Management Module - Lai Qing							
C.4 Billing and Payment Module	2d	02/10/2016	04/10/2016	Peng Yongxue		C.4 Billing and Payment Module - Peng Yongxue							
C.5 Card Management Module	5d	06/10/2016	11/10/2016	Guo Ziyu			C.5 Card Management Module - Guo Ziyu						
□ D. Mobile Web Application(for customers)	18d	06/10/2016	24/10/2016					D. Mobile Web Application(for customers)					
Second System Release UI Integration	2d	06/10/2016	08/10/2016	Zhou Jingyuan				Second System Release UI Integration - Zhou Jingyuan					
Presentation: Second System Release	0d	24/10/2016	24/10/2016	All					◆ 24/10/2016 Presentation: Second System Release - All				
□ Final System Release	19d	26/10/2016	14/11/2016							Final System Release			
□ A.7 Wealth Management System	5d	26/10/2016	31/10/2016					A.7 Wealth Management System					
Wealth Management Planning Module	3d	26/10/2016	29/10/2016	Yang Shuanghe			Yang Shuanghe		◆ 26/10/2016 Wealth Management Planning Module - Yang Shuanghe				
Portfolio Performance Reviewing Module	2d	29/10/2016	31/10/2016	Yang Shuanghe			Yang Shuanghe			Portfolio Performance Reviewing Module - Yang Shuanghe			
□ A.8 Portfolio Management System	4d	26/10/2016	30/10/2016					A.8 Portfolio Management System					
Portfolio Creation and Updating Module	2d	26/10/2016	28/10/2016	Zhou Jingyuan			Zhou Jingyuan		◆ 26/10/2016 Portfolio Creation and Updating Module - Zhou Jingyuan				
Portfolio Valuation Module	2d	28/10/2016	30/10/2016	Zhou Jingyuan			Zhou Jingyuan			Portfolio Valuation Module - Zhou Jingyuan			
□ A.9 Customer Analytics and Business Intelligence System	3d	26/10/2016	29/10/2016					A.9 Customer Analytics and Business Intelligence System					
Customer Segment Module	2d	27/10/2016	29/10/2016	Guo Ziyu			Guo Ziyu		◆ 26/10/2016 Customer Segment Module - Guo Ziyu				
Dashboard Module	2d	26/10/2016	28/10/2016	Han Fengwei			Han Fengwei			Dashboard Module - Han Fengwei			
Customer Insights Module	2d	26/10/2016	28/10/2016	Peng Yongxue			Peng Yongxue			Customer Insights Module - Peng Yongxue			
□ C. Internet Banking System(for customers)	1d	30/10/2016	31/10/2016					C. Internet Banking System(for customers)					
C.2 Wealth Management Module	1d	30/10/2016	31/10/2016	Lai Qing			Lai Qing		◆ 30/10/2016 C.2 Wealth Management Module - Lai Qing				
□ D. Mobile Web Application(for customers)	9d	05/11/2016	14/11/2016					D. Mobile Web Application(for customers)					
Milestone: Final System Release Package Finalisation	0d	09/11/2016	09/11/2016						◆ 09/11/2016 Milestone: Final System Release Package Finalisation				
Final System Release Presentation Preparations	5d	05/11/2016	10/11/2016	All					Final System Release Presentation Preparations - All				
Deadline: Final System Release Submission	0d	10/11/2016	10/11/2016						◆ 10/11/2016 Deadline: Final System Release Submission				
Presentation: Final System Release(Rehearsal)	3d	10/11/2016	13/11/2016	All					Presentation: Final System Release(Rehearsal) - All				
Presentation: Final System Release	0d	14/11/2016	14/11/2016	All					◆ 14/11/2016 Presentation: Final System Release - All				

Name	Duration	Start	Finish	Aug 13 '16		Aug 14 - Aug 20 '16		Aug 21 - Aug 27 '16		Aug 28 - Sep 3 '16		Sep 4 - Sep 10 '16		Sep 11 - Sep 17 '16		Sep 18 - Sep 24 '16		Sep 25 - Oct 1 '16		Oct 2 - Oct 8 '16								
				T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F
Course Module Administration Deadlines	103d?	09/08/2016	20/11/2016																									
Peer Review 01	0d	05/09/2016	05/09/2016																									
Peer Review 02	0d	10/10/2016	10/10/2016																									
Peer Review 03	0d	14/11/2016	14/11/2016																									
Deadline: Project Log(Week 1)	0d	14/08/2016	14/08/2016																									
Deadline: Project Log(Week 2)	0d	21/08/2016	21/08/2016																									
Deadline: Project Log(Week 3)	0d	28/08/2016	28/08/2016																									
Deadline: Project Log(Week 4)	0d	04/09/2016	04/09/2016																									
Deadline: Project Log(Week 5)	0d	11/09/2016	11/09/2016																									
Deadline: Project Log(Week 6)	0d	18/09/2016	18/09/2016																									
Deadline: Project Log(Recess Week)	0d	25/09/2016	25/09/2016																									
Deadline: Project Log(Week 7)	0d	02/10/2016	02/10/2016																									
Deadline: Project Log(Week 8)	0d	09/10/2016	09/10/2016																									
Deadline: Project Log(Week 9)	0d	16/10/2016	16/10/2016																									
Deadline: Project Log(Week 10)	0d	23/10/2016	23/10/2016																									
Deadline: Project Log(Week 11)	0d	30/10/2016	30/10/2016																									
Deadline: Project Log(Week 12)	0d	06/11/2016	06/11/2016																									
Deadline: Project Log(Week 13)	0d	13/11/2016	13/11/2016																									
Deadline: Project Log(Reading week)	0d	20/11/2016	20/11/2016																									

	Oct 9 - Oct 15 '16	Oct 16 - Oct 22 '16	Oct 23 - Oct 29 '16	Oct 30 - Nov 5 '16	Nov 6 - Nov 12 '16	Nov 13 - Nov 19 '16	Nov 20 - Nov 26 '16	Nov 27 - Dec 3 '16																							
	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S
Course Module Administration Deadlines																															

◆ 10/10/2016 Peer Review 02

◆ 14/11/2016 Peer Review 03

◆ 09/10/2016 Deadline: Project Log(Week 7)

◆ 09/10/2016 Deadline: Project Log(Week 8)

◆ 16/10/2016 Deadline: Project Log(Week 9)

◆ 23/10/2016 Deadline: Project Log(Week 10)

◆ 30/10/2016 Deadline: Project Log(Week 11)

◆ 06/11/2016 Deadline: Project Log(Week12)

◆ 13/11/2016 Deadline: Project Log(Week13)

◆ 20/11/2016 Deadline: Project Log(Reading week)

5. Declaration of First System Release Functionalities

In the first system release, the team will show a prototype featuring some of the important features of the Merlion Banking System(MBS). The features for first system release will constitute around 30% of all the system functionalities. The exhaustive list is as follows:

Function Name	Remark	AAU ID
Code		
A. Merlion Bank Internal System		
A.1 Common Infrastructure		
A.1.1 System User Account Management Module		
A.1.1.1	Create staff account	System administrator creates new staff account
A.1.1.2	View staff accounts	System administrator views all the staff accounts, and associated roles and permissions
A.1.1.3	Update staff account	System administrator updates staff account information
A.1.1.4	Delete staff account	System administrator deletes staff account
A.1.1.5	Reset account password	Staff resets password of his user account
A.1.1.6	View role	System administrator views all roles assigned to a staff
A.1.1.7	Assign role	System administrator gives staff certain access right by assigning them a new role
A.1.1.8	Delete role	System administrator deletes a role of staff, and the access right attached to the role deleted will be canceled
A.1.1.9	Log in	Staff logs in to Merlion Bank Internal System
A.1.1.10	Log out	Staff logs out from Merlion Bank Internal System

A.1.1.11	Forget password	Staff retrieves lost password through email verification	
A.1.3 External Communication Module			
A.1.3.1	Send notifications to customer's mailbox	System sends notifications to customer's mailbox on Internet banking Website	1
A.1.3.2	Send email to customer's personal email account	System sends email to customer's personal email account	
A.1.4 Security Module			
A.1.4.1	Session inactivity logout	Session will automatically logout after 15 minutes of inactivity	1
A.1.4.2	Logging	System traces all the users' financially material transactions and sensitive user actions	
A.1.4.3	Hash Password	System uses hashing to protect password	
A.1.4.4	Encrypt sensitive data at transport layer	System uses Secure Socket Layer(SSL) to encrypt sensitive data for transport layer security	
A.1.4.5	Account lock out	If customer inputs password wrongly for three times at login page, system will send one-time password (OTP) to customer's phone number. The OTP is required for customer to login again to his/her online banking account.	
A.1.4.6	Captcha mechanism	If customer inputs password wrongly for three times at login page, system will require customer to pass the simple test before login to protect website against bots	
A.1.4.7	Second factor authentication	System sends SMS to customer's phone number to facilitate authentication if customer requests for any service on the online banking system	
A.2 Customer Management System			

A.2.1 Customer Information Management Module			
A.2.1.1	Edit basic customer information	Teller updates basic customer information such as, contact information and address.	2
A.2.1.2	View basic customer information	Teller views basic customer information.	
A.2.2 Customer Advanced Information Management Module			
A.2.2.1	Edit advanced customer information	RM updates advanced customer information mainly used in wealth management such as, individual risk profile and financial goals.	2
A.2.2.2	View advanced customer information	RM or customer views advanced customer information.	
A.2.2.3	Search customer	RM searches customer information through dynamic filters and searching criteria.	
A.2.3 Enquiry Management Module			
A.2.3.1	Create enquiry case	Customer-fronting employee adds a new case to customer enquiry with detailed description of the problem. A case can consist of one or many issues.	2
A.2.3.2	Update enquiry status	Customer service employee updates enquiry status.	
A.2.3.3	Forward enquiry to specialist	According to its category, system routes enquiry to relevant customer service employee for resolution.	
A.2.3.4	Add follow-up questions	If the resolution does not address customer's concern, customer may add follow-up questions.	
A.2.3.5	Search enquiry	Customer-fronting employees and RM search case by its case ID.	
A.2.3.6	View enquiry	Customer-fronting employees and RM view a list of customer enquiries with corresponding status.	
A.3 Deposit Account Management System			

A.3.1 Account Management Module			
A.3.1.1	Add a New Account	Teller helps customer to create a new account.	3
A.3.1.2	Delete a Account	Teller helps customer to closes his/her bank account.	
A.3.1.3	View Transaction History	Staff views customer transaction history.	
A.3.1.4	View Information of All Accounts	Staff views all customer account information including account number, account type, etc.	
A.3.1.5	View Bank e-Statement	Teller may view and print bank statement for customer.	
A.3.2 Account Balance Management Module			
A.3.2.1	Fund Transfer	Teller performs bank internal fund transfer.	3
A.3.2.2	Cash Deposit	Teller collects cash from customer and helps to deposit cash.	
A.3.2.3	Cash Withdraw	Teller withdraws cash and hand over to customer.	
A.3.3 Interest Crediting Management Module			
A.3.3.1	Accrue Interest	System calculates the interest accrued on the end-day balance of each account.	
A.3.3.2	Credit Interest	System credits interest for saving accounts monthly.	
C. Internet Banking Website(for customers)			
C.1 Customer Account Management Module			
C.1.1	Delete account	Customer chooses to delete his/her account for Merlion Online Banking	1
C.1.2	Change password	Customer replaces old password with a new password	
C.1.3	Forget password	Customer retrieves lost password through email verification	

C.1.4	Log in	Customer logins to their account by user account number and password	
C.1.5	Log out	Customer logs out of their account	
C.1.6	View accounts	Customer views his/her own account information	
C.1.7	Update accounts	Customer updates his/her basic information such as, contact number, home address, etc	
C.1.8	Submit enquiry	Customer submits enquiry by briefly describe the problem encountered	2
C.1.9	View enquiry	Customer views the status of the enquiry submitted, whether it is solved by an employee or not	
C.1.10	Add follow-up questions	If the resolution does not address customer's concern, customer may add follow-up questions	

C.2 Deposit Account Management Module

C.2.1	Open an account	Customer creates a new deposit account.	
C.2.2	Delete an account	Customer closes his/her deposit account.	
C.2.3	View transaction history	Customer views his/her transaction history of a particular account.	
C.2.4	View account balance	Customer views his/her account balance.	3
C.2.5	View account information	Customer views the account related information, including account number, account type, etc.	
C.2.6	View e-statement	Customer views his/her bank statement in pdf version.	
C.2.7	Intra-bank fund transfer	Customer transfers money to an account which is also under Merlion Bank	

C.2.8	Add Payee	Customer adds a payee for internal bank fund transfer.	
C.2.9	Delete Payee	Customer deletes existing payees.	
D. Mobile Web Application(for customers)			
D.1 Customer Account Management Module			
D.1.1	Delete account	Customer chooses to delete his/her account for Merlion Online Banking	1
D.1.2	Change password	Customer replaces old password with a new password	
D.1.3	Forget password	Customer retrieves lost password through email verification	
D.1.4	Log in	Customer logins to their account by user account number and password	
D.1.5	Log out	Customer logs out of their account	
D.1.6	View accounts	Customer views his/her own account information	
D.1.7	Update accounts	Customer updates his/her basic information such as, contact number, home address, etc	
D.1.8	Submit enquiry	Customer submits enquiry by briefly describe the problem encountered	
D.1.9	View enquiry	Customer views the status of the enquiry submitted, whether it is solved by an employee or not	
D.1.10	Add follow-up questions	If the resolution does not address customer's concern, customer may add follow-up questions	
D.2 Deposit Account Management Module			
D.2.1	Open an account	Customer creates a new deposit account.	

D.2.2	Delete an account	Customer closes his/her deposit account.	
D.2.3	View transaction history	Customer views his/her transaction history of a particular account.	
D.2.4	View account balance	Customer views his/her account balance.	3
D.2.5	View account information	Customer views the account related information, including account number, account type, etc.	
D.2.6	View e-statement	Customer views his/her bank statement in pdf version.	
D.2.7	Intra-bank fund transfer	Customer transfers money to an account which is also under Merlion Bank	
D.2.8	Add Payee	Customer adds a payee for internal bank fund transfer.	
D.2.9	Delete Payee	Customer deletes existing payees.	

[**6. Conclusion**](#)

Merlion Bank is an ambitious enterprise which aims to stand out from the major players in Singapore's financial industry with its direct bank services as competitive advantages. Kent Ridge Technology is honored to be on Merlion Bank's side as we analyze, construct, and deliver Merlion Banking System(MBS) which is composed of four main subsystems serving both internal and external users' needs.

After rigorous and comprehensive analysis of Merlion Banks's operations and business requirements, our team has designed MBS from the ground up. With the successful implementation of MBS, we are confident that the main concerns of Merlion Bank highlighted during meeting will be addressed through:

Accessibility & Automation

The MBS system enables data synchronization and flow across all business divisions, allowing staff to access real time information. The automation granted for components such as sending bank statement and reports, sending notifications help to reduce the amount of manual labour involved and corresponding manpower cost incurred.

Data Analytics & Business Intelligence

The adoption and usage of various metrics, analytics tools, and techniques tailored for the banking context ensures the accuracy and reliability of the data analytics results. It enables upper management of Merlion Bank to be always informed of the bank's overall performance, and therefore gain insights into developing effective business growth strategies.

Scalability & Sustainability

The proposed MBS system is incredibly scalable and sustainable. The exhaustive functionalities tailored for various business processes and adoption of advanced algorithms empower it to support the long-term usage of Merlion Bank as well as its global expansion in the future.

We at Kent Ridge Technology are excited to be a part of this momentous project. We are confident that Kent Ridge Technology's promise of excellence and outstanding track record makes us an ideal partner of Merlion Bank for this project, and we believe that the Merlion Banking System will be the solid foundation for the establishment, growth and expansion of Merlion Bank in Singapore and globally in the future.

7. References

Deutsche Bank. (2015). *Digitalisation and the Future of Commercial Banking*. Retrieved from <http://cib.db.com/insights-and-initiatives/flow/35583.htm>

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Tan, C. (2005). *Financial Markets and Institutions in Singapore*. Singapore University Press. Retrieved from <https://books.google.com.sg/books?id=lAChksdNj0MC>