

System Proposal for Northwest Labs

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Executive Summary

The Dream Team at BYU has researched and developed recommendations for Northwest Labs's information system. The case for this solution follows.

Current System Overview and Analysis

Northwest Labs is a company burdened with aging hardware, a decentralized system, and no way to provide its clients with the desired responsiveness through its current information systems. After reviewing the current systems and strategic goals of Northwest Labs, we discovered the following problems the company must overcome to better meet its strategic objectives:

- Decentralized data storage
- Duplication of effort
- No accurate way to provide quotes
- Lack of data integrity
- Limited communications with clients
- Inability to forecast revenues from work orders
- Difficulty maintaining current systems
- Lack of uniformity of reports
- Inability to provide electronic results to clients
- Inability to produce ad-hoc reports

Proposed Solutions and Recommendations

After reviewing these concerns, we developed the following recommendations:

- Replace aging servers
- Create a new centralized database with the capacity to store all information about clients, work orders, assays, and employees
- Host the new database on Amazon Web Services (AWS) with a Relational Database Services (RDS) subscription
- Write an API to transfer the financial database to AWS
- Design and implement a new website including both client and employee portals
- Create a page in the employee portal of the website where employees can create reports
- Purchase an enterprise subscription to Tableau to aid with the creation of readable ad-hoc reports
- Modify existing business processes to place more importance on communication with the client

As an extension of this report, we have also created a website that includes several of the features that will be used in the new website we recommend. Screenshots and UI Diagrams of the website we have developed are included in the report.

Business Impact

We expect that our recommendations will assist Northwest Labs by creating a new system that will assist the company in more closely aligning itself with the following points of its business strategy:

- Improved quality, reliability, and consistency of data
- Improved speed and responsiveness
- Ability to produce quotes
- Increased efficiency
- Improved communication with customers
- Improved planning/reporting capabilities and scheduling

Estimated Schedule and Resources

We have estimated that it will take approximately 7 months to implement all of our recommendations.

The estimated resources that must be put towards the project are as follows:

Man hours	1,315
Initial investment	\$55,798
Yearly differential cost	\$14,503.80

The total net present cost of this project is \$1,219,271

With Northwest Labs's status as a cutting-edge pharmaceutical testing company, we consider Northwest Labs to be capable of investing in this project.

Because the Dream Team has considerable skills programming MVC applications, we consider the project to be technically feasible as well, though we have limited experience integrating websites with physical systems. In order to do so properly, we may need to spend slightly more time on the implementation process than a team that the project could be outsourced to.

We found that this project should be highly feasible organizationally. Though it will take time for the employees to become familiar with the new system, it should be much more user-friendly, reducing work time. For that reason, we don't anticipate an organizational rejection of the proposed system.

Current System Overview

Northwest Labs Pharmaceutical seeks to provide precise, well-documented test reports for clients through compound and assay testing. It runs all testing through its office in Singapore, and all

administrative processes are run in the main office in Seattle, Washington. Clients send work orders directly to Singapore and use Seattle sales reps as their main source of communication for work order statuses and reports.

Currently within its process, Northwest Labs uses the following software and equipment:

- Microsoft Excel
- Microsoft Access
- Mail server
- Print server
- Database server
- Server in Singapore
- Scientific testing equipment

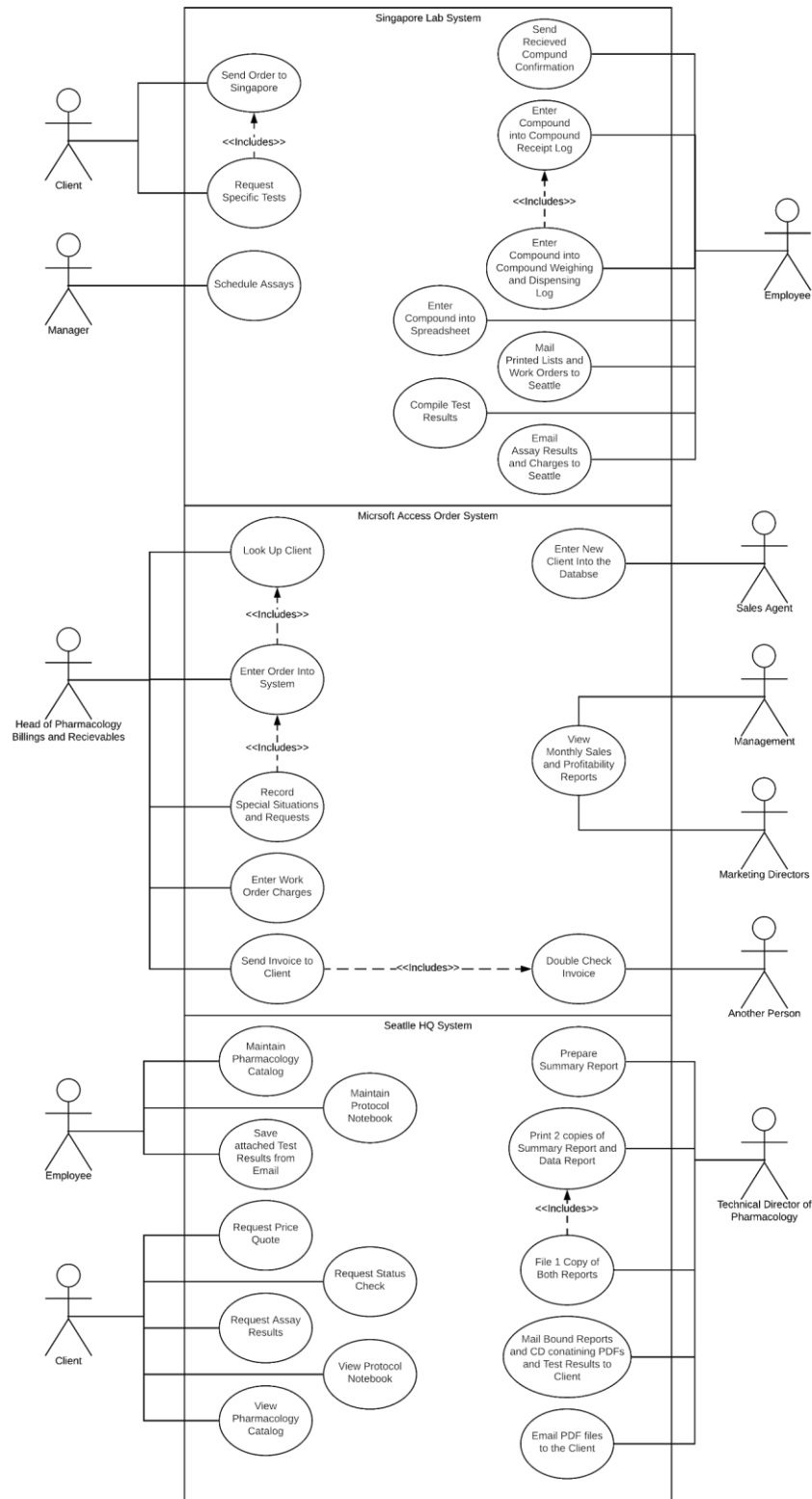
Northwest Labs has the following documents within its system (not all documents for the entire company are included):

- Pharmacology catalog
- Protocol notebook
- Financial database (Access)
- Work order database (Access)
- Order system (Access)
- Compound weighing and dispensing log (Excel)
- Compound receipt log (Excel)
- Dispensing log (Excel)
- Summary Report (PDF)
- Data Report (PDF)

Some of the people involved in their processes include

- Clients
- Sales representatives
- Managers
- Singapore employees
- Head of Pharmacology
- Marketing Directors
- Technical Director of Pharmacology

Based off our knowledge of the company as well as the information we've been given, we created the following use case diagram to roles and users within the system.



Assumptions

For this project and as employees in Northwest Labs, we have made the following assumptions:

Within recommended databases and processes, we are assuming that an assay is a batch of compounds that receive a series of tests.

While quote requests are common among new customers, due to the large number of returning customers who request less price quotes, Northwest Labs receives a small amount of quote requests on a daily basis (less than 20).

While there are many different roles within both the Seattle and the Singapore office, our analysis and recommendations will focus on the roles within each office as a whole, but not the individual roles of each office. As the project is approved and moves forward, we will look further into individual roles within the company.

Because the company already works with 4 servers and 125 computers between its two offices, we assume that Northwest Labs already has at least 7 IT support employees (1 in Singapore, 6 in Seattle).

We also assume that Northwest Labs currently employs a database administrator (DBA) and data analyst to monitor at least the financial database.

Current System Analysis

Northwest Labs identified several problems within their current system that it would like the Dream Team to address. These problems are

- Lack of data integrity
- No confirmation with customers of assays ordered and cost
- No easy ability to generate price quotes
- Delivery schedule not adequately communicated to customers
- No capability to forecast revenues/cash receipts from work orders
- High cost of processing back orders
- Difficulty communicating order status with customers
- Duplication of effort
- No purchasing replenishment system
- Lack of concurrent delivery of all results and invoicing
- Difficulty in maintaining current systems
- Lack of trained support personnel
- Lack of uniformity of reports
- Reports are not user friendly
- Inability to provide electronic results to clients for all data
- Inability to easily produce ad-hoc reports
- Lack of dated archival test protocols

In addition to these problems, we also identified some other pain points within the company that we would like to address for this project. They include

- Outdated Servers
- Use of data
- Poor integration

Outdated Servers

Northwest Labs has three servers in place in Seattle. Each server has issues that influence our recommendations for Northwest Labs.

The **mail server** is old and outdated. It currently can only host 40 users at a time, which will present a problem as Northwest continues to grow and progress. This server is also used for internet access at the Seattle office, which means that only 40 users may use the internet at a time while there are 115 desktops at the Seattle office. If a sales rep needs to communicate with employees in Singapore, he or she may be unable to if 40 users are already on the server. This creates more issues with communication between the offices.

The mail server computer is also on a system no longer supported by Microsoft. This presents issues for maintenance as well as security.

The **print server** runs on a Silicon Graphics system. While this server may have been cutting edge at the time it was purchased, Silicon Graphics declared bankruptcy and was sold to Rackable Systems in 2009. Assuming the server was purchased new in 2009, it is now ten years old, and will pose problems for future maintenance.¹

The **database server** is low on memory and only gives access to 50 users at a time. This creates low capability for database access and use.

The **server in Singapore** is also outdated, which will result in slower internet capability, thus creating more problems with communication and data integrity in Singapore.

Data Usage

Currently, Northwest Labs has years worth of test data archived. This data is hard to access and analyze. Without the capability to easily analyze this data, Northwest Labs risks having inaccurate pricing, efficiency, and data processes within the company.

Lack of Integration

Northwest Labs's system is scattered across many different servers and spreadsheet. This makes it difficult to access data and communicate across offices and to clients.

¹ (Mercury News 2009)

Proposed Solution and Recommendations

Our proposed solution will help to promote Northwest Labs's business strategy and will also boost client satisfaction and process productivity within the business.

Our solution involves several different recommendations for the following items:

- Servers
- Software
- Personnel
- Database
- Web Application
- Report System
- Servers
- API
- Business Processes
- Stock Replenishment

Servers

Our solution with servers will solve the following problems:

- Difficulty in maintaining current systems
- Lack of trained support personnel
- Risk of the malfunction of aging architecture
- Limited internet access in Seattle
- Critically low data storage capacity

In order to replace the aging hardware currently employed by Northwest Labs, we recommend that the company simplify its hardware architecture by using a single internet/mail server for both of their offices and by purchasing an RDS and EC2 corporate subscriptions to Amazon Web Services (AWS) where the database and print server functionality will be handled.

We anticipate that an added benefit of simplifying the hardware systems utilized by Northwest Labs will be the reduction of responsibility for the current IT support professionals employed by the company. While they are currently overwhelmed and struggling to meet the company's needs, the IT support professionals in Seattle should have much less demand on their time once there is only a single internet server to service and troubleshoot.

New Servers in Seattle and Singapore

We recommend that Northwest Labs purchase the Dell PowerEdge R810 for both of its offices. This new server has 40 cores and should be able to process approximately 120 requests per second. With a new server, that should be plenty to give both offices all of the internet access they need.

Amazon Web Services

A corporate subscription to AWS services includes cloud printing capacity to network printers. This service would effectively replace the antiquated print server.

In addition, a Relational Database Services (RDS) subscription from AWS eliminates the need to purchase expensive database hardware, spend money installing security systems for the database, and employee a database maintenance team. In addition, AWS stores backups of all the data in case of catastrophic failure of their server warehouses.

An Elastic Compute Cloud (EC2) subscription would give Northwest Labs the capacity to host the new website, again, without the maintenance costs or concerns brought by hosting a website on local network hardware.

Software

We also recommend that Northwest Labs purchase a Tableau Creator subscription (\$70/mo.) for all its managers and the data analyst (approximately 15 people). A tableau subscription would assist in solving the following problems:

- No capability to forecast revenues/cash receipts from work orders
- Reports are not user friendly
- Inability to easily produce ad-hoc reports

With tableau access, managers would be able to generate much more user friendly reports to analyze financial data, efficiency, and other important business factors. In addition, it will facilitate the quick creation of high-quality ad-hoc reports. If a certain tableau report proves to be especially useful, it could even be hosted live on the website to a dashboard for managers to review.

Personnel

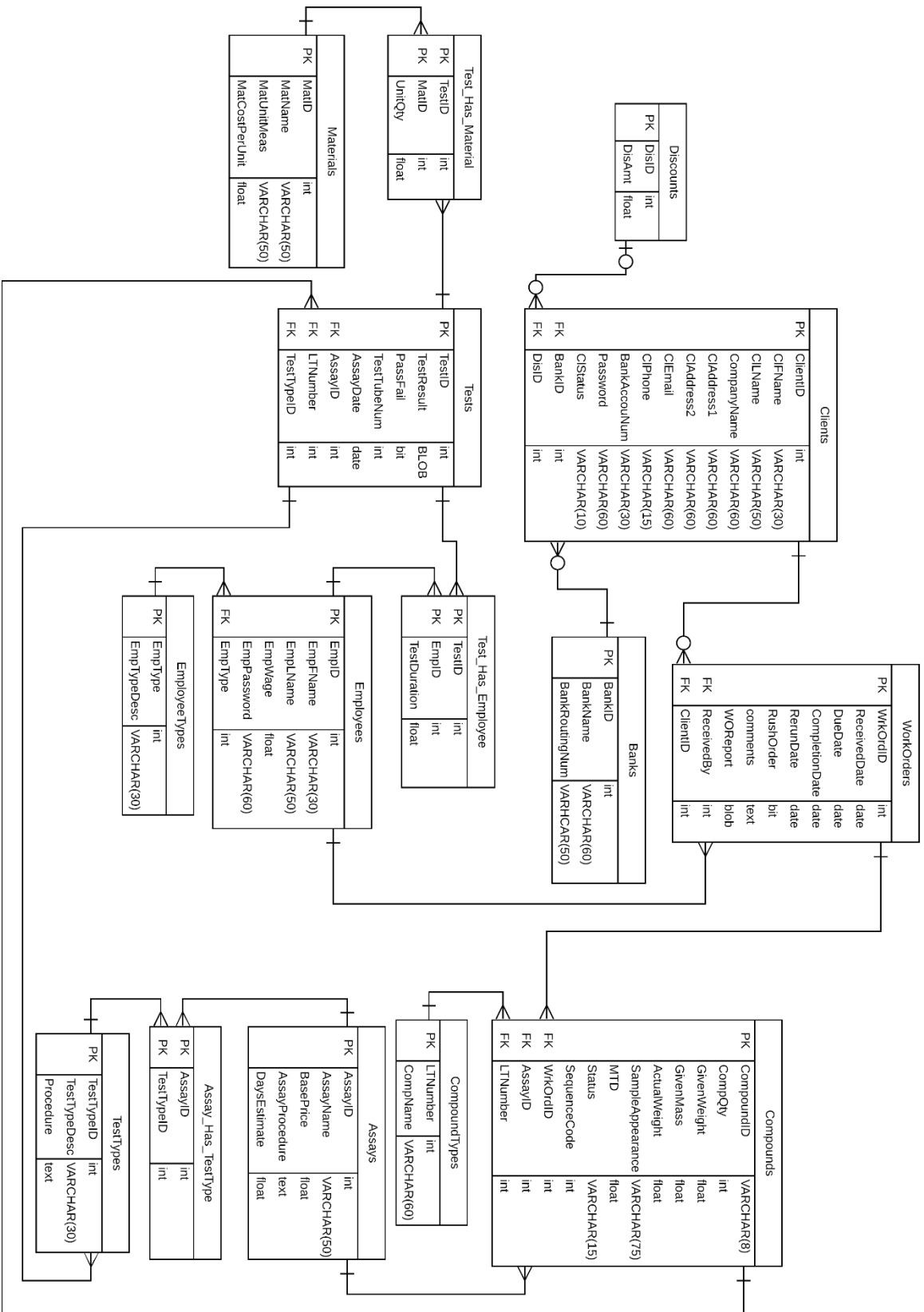
Assuming that we already have a database administrator, data analyst, and IT support professionals employed at Northwest Labs, we plan to train them to use the system to fulfill their respective roles. In the current system, these professionals are extremely occupied, however we anticipate a lighter load for the support staff through the simpler, more integrated system we are recommended. Because of this, we don't recommend hiring more personnel.

Database

In order to simplify the system further, we recommend the creation of the database outlined below. This new database will include relevant information about Work Orders, Assays, Clients, and Employees. This existing financial database will also be transferred to the AWS cloud. It will be integrated with the new database using a linking table as outlined below. These recommendations will help resolve the issues outlined below:

- Duplication of effort
- Lack of data integrity

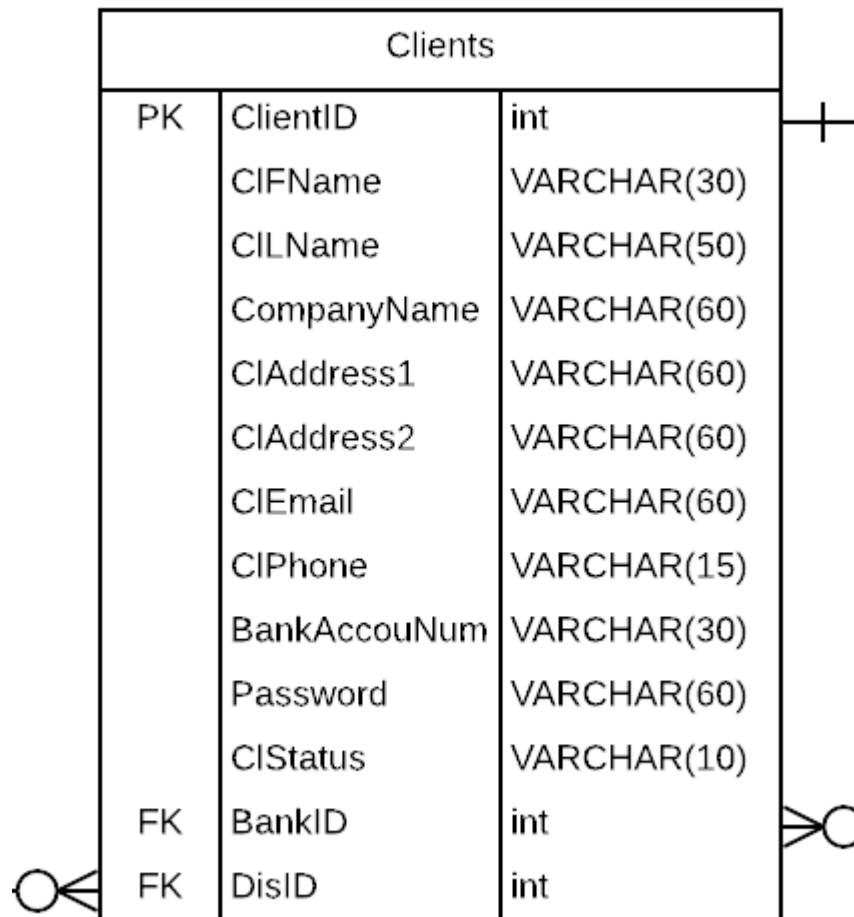
The structure of the proposed database is pictured in the ERD on the following page.



Clients Table

The Clients Table holds the client information necessary for work orders to be processed for each client as well as other relevant information about each client such as that client's discount rate, bank info, and login information for the new Client Portal.

The following image shows the Clients Table with all its fields and data types as it appears in the ERD:



An explanation of each field:

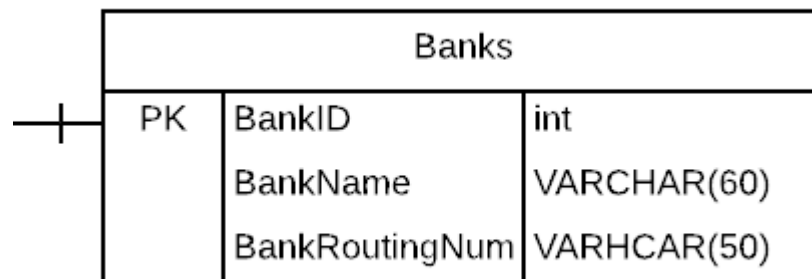
- ClientID: auto-incremented primary key assigned by the system when a client profile is created in the website (either by a new client or a sales representative on behalf of a client)
- ClFName: first name of a client
- ClLName: last name of a client
- CompanyName: Name of the company the client represents
- ClAddress1: First line of the address of the company the client represents
- ClAddress2: Second line of the address of the company the client represents

- CIEmail: Preferred business email where Northwest Labs can contact the client. Acts as the username for clients to log in to the Client Portal of the new website
- CIPhone: Preferred business phone number where Northwest Labs can contact the client
- BankAccouNum: Bank account number of the bank account that will pay for the client's work orders
- Password: Password associated with the Client Portal account of each client (set by client)
- CStatus: This status will be "registered" when a client first creates an account, but in order for a client to access the Client Portal, request a work order, or view work order progress, this status must be changed to "approved" by a sales representative.
- BankID: Foreign key from the Banks Table linking a client to the bank the client will use to make payments
- DisID: Foreign key from the Discounts. This key will associate a client with a discount that will automatically apply to the charges made to a client for a work order.

Banks Table

The Banks Table acts as a lookup table when a client is creating an account and specifying a bank. This will help preserve data integrity and reduce errors. In addition, it stores each bank's routing number for processing client's payments.

The following image shows the Banks Table with all of its fields and data types as it appears in the ERD:



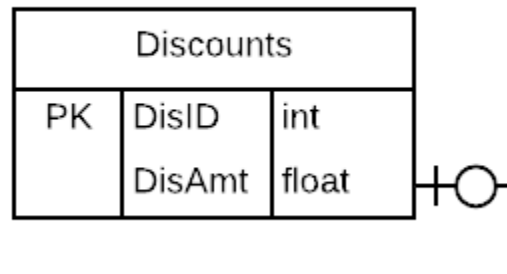
An explanation of each field:

- BankID: Auto-incremented primary key assigned by the system
- BankName: Full name of a bank
- BankRoutingNum: The routing number associated with the bank

Discounts Table

The Discounts Table stores the different discount amounts offered by the company to its clients.

The following image shows the Discounts Table with all of its fields and data types as it appears in the ERD:



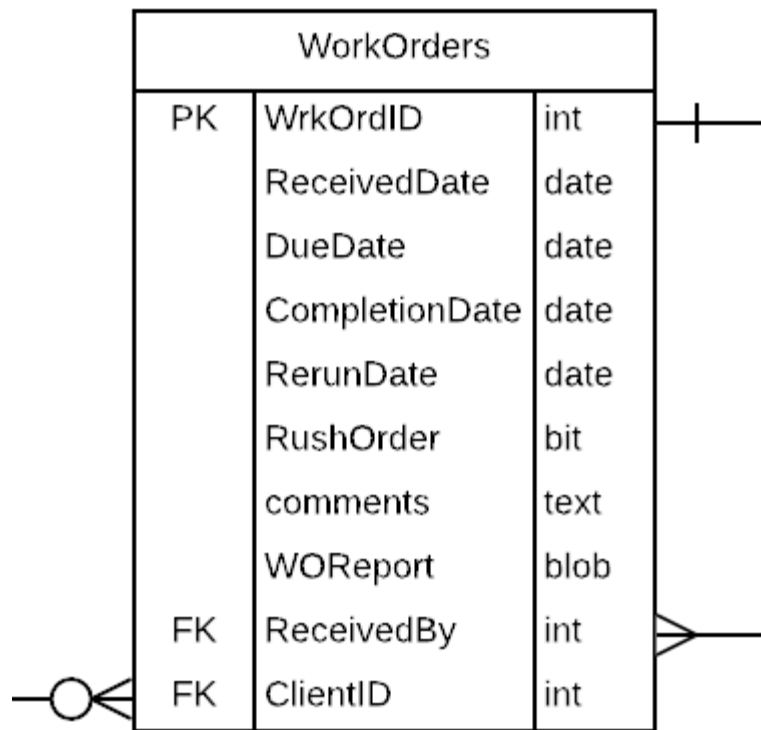
An explanation of each field:

- DisID: Auto-incremented primary key assigned by the system
- DisAmt: The decimal amount of each discount (i.e. 0.20)

WorkOrders Table

The WorkOrders Table stores the information relevant to each work order as well as the information to link each work order with the client who made it and the employee who received it and added it to the database.

The image on the following page shows the WorkOrders Table with all of its fields and data types as it appears in the ERD:



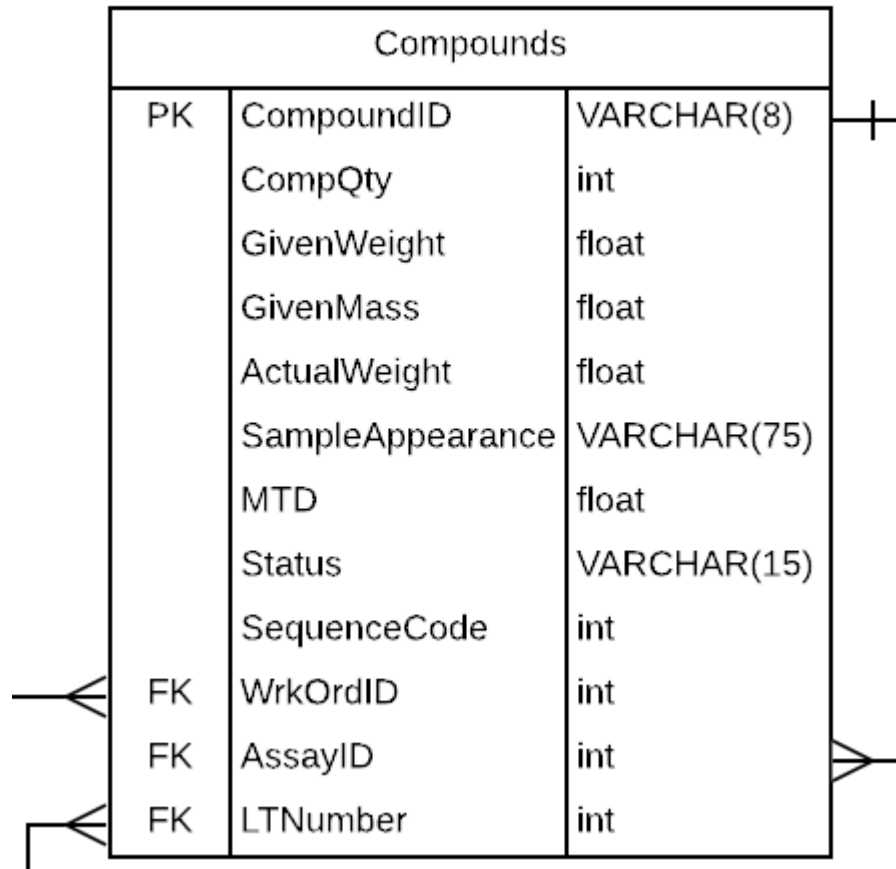
An explanation of each field:

- WrkOrdID: Auto-incremented primary key assigned by the system
- ReceivedDate: Date the shipped samples of compounds for a work order arrive in Singapore from the client
- DueDate: Date the completed report is scheduled to be submitted to the client
- CompletionDate: Date the report is actually completed
- RerunDate: Date that a work order is processed again (if needed)
- RushOrder: True if the customer has requested that the order be rushed, false otherwise. A value of true also increases the price of the work order
- Comments: Text explaining any relevant information about a work order such as significant delays.
- WOReport: File containing the raw data from the assay tests for the work order
- ReceivedBy: Foreign key linking the work order with the employee in the employee table who received it
- ClientID: Foreign key linking the work order with the client in the client table who sent it in

Compounds Table

The Compounds Table contains all the information about each sample of a compound in a work order.

The following image shows the Compounds Table with all of its fields and data types as it appears in the ERD:



An explanation of each field:

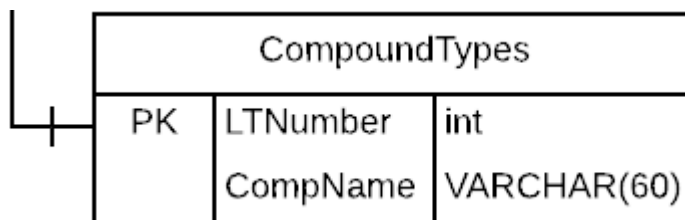
- CompoundID: Composite primary key. It is the six-digit LTNumber of the compound concatenated with the two-digit SequenceCode associated with the particular sample in question
- CompQuantity: Quantity (in milligrams) of the compound sample sent in
- GivenWeight: Weight (in oz) of the compound sample reported by the client
- GivenMass: Molecular mass of the compound sample reported by the client
- ActualWeight: Weight (in oz) of the compound sample recorded by the Lab Specialist in Singapore. Only recorded if the given weight seems inaccurate
- SampleAppearance: Text description of the physical appearance of the sample

- MTD: Maximum tolerated dose for animal tests
- Status: Text description of the status of the assay on the compound sample
- SequenceCode: two-digit code associated with the compound sample (i.e. if it is the 5th sample of the compound, the code would be “05”)
- WrkOrdID: Foreign key linking the particular compound sample in the Compounds Table to the appropriate work order in the Work Orders Table
- AssayID: Foreign key linking the particular compound sample in the Compounds Table to the requested assay in the Assays Table
- LTNumber: Foreign key linking the particular compound sample in the Compounds Table to the compound information in the Compound Types Table

CompoundTypes Table

The CompoundTypes Table is a lookup table containing a list of the names of all the compounds that have ever been tested by Northwest Labs. It will be used in the web application as a searchable list to help preserve data integrity and reduce the occurrence of misspellings.

The following image shows the CompoundTypes Table with all of its fields and data types as it appears in the ERD:



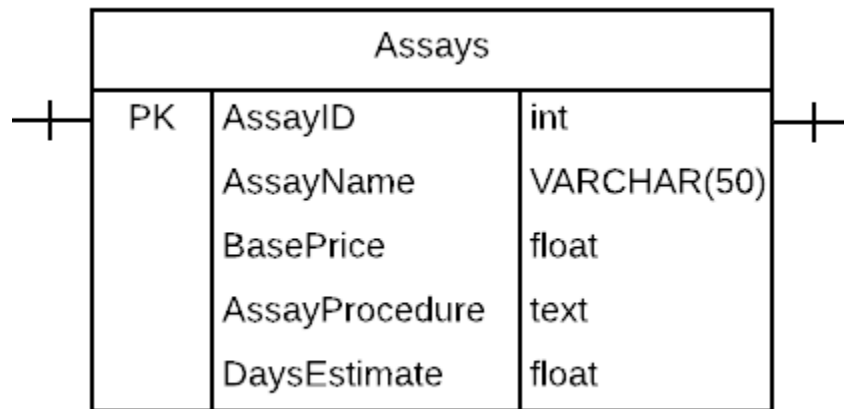
An explanation of each field:

- LTNumber: Primary key. Unique 6-digit identifier assigned to each compound the first time that compound is sent by a client to Northwest Labs
- CompName: Name of the compound as provided by the client

Assays Table

The Assays Table contains all information related to each kind of assay performed by Northwest Labs.

The following image shows the Assays Table with all of its fields and data types as it appears in the ERD:



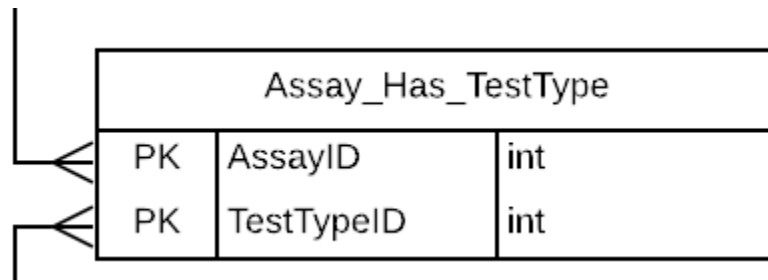
An explanation of each field:

- AssayID: Auto-incremented primary key assigned by the system
- AssayName: Name of the assay
- BasePrice: Lowest estimated price of each assay based on historical data
- AssayProcedure: Text description of the protocols and procedures of completing each assay
- DaysEstimate: Average time required to complete the assay based on historical data

Assay_Has_TestType Table

The Assay_Has_TestType Table is a linking table between the Assay Table and the Test Type Table. This table is necessary because each assay is associated with many tests and each test could potentially be associated with at least one assay.

The following image shows the Assay_Has_TestType Table with all of its fields and data types as it appears in the ERD:



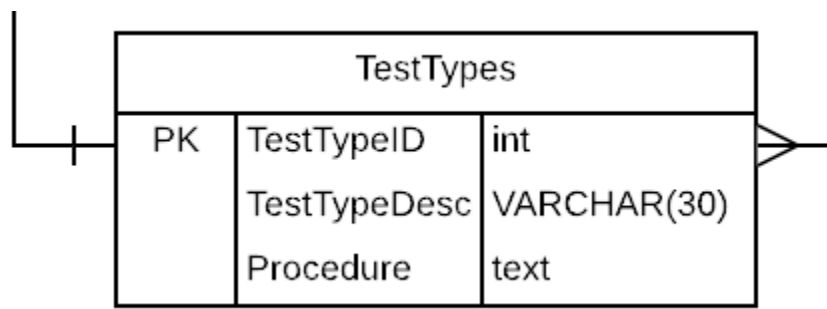
An explanation of each field:

- AssayID: Primary key from the Assays Table. Acts as part of the composite key in this table
- TestTypeID: Primary key from the TestType Table. Acts as part of the composite key in this table

TestTypes Table

The TestTypes Table stores the information about every kind of test Northwest Labs performs.

The following image shows the TestTypes Table with all of its fields and data types as it appears in the ERD:



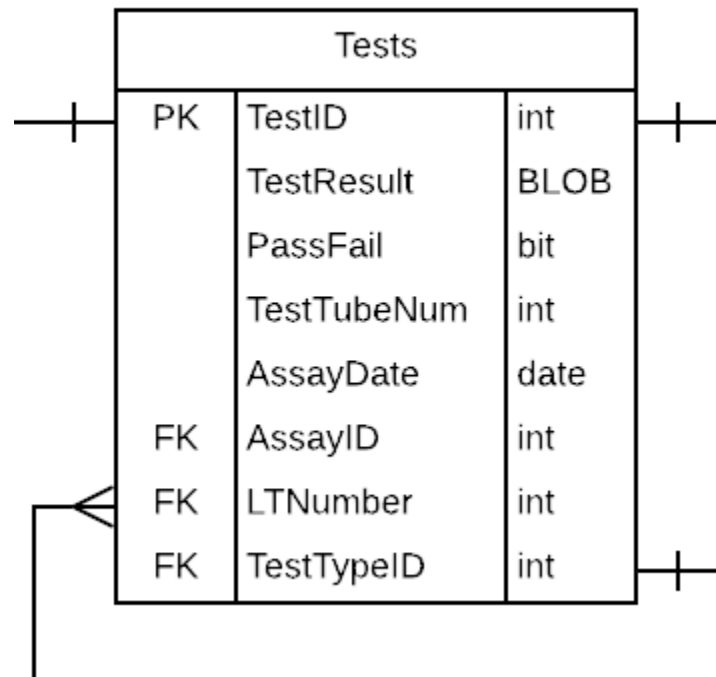
An explanation of each field:

- TestTypeID: Auto-incremented primary key assigned by the system
- TestTypeDesc: Brief text description of the Test
- Procedure: Detailed text description of the procedure for executing the test

Tests Table

This table holds resulting test data from each test that is performed on a compound sent in by a client.

The following image shows the Tests Table with all of its fields and data types as it appears in the ERD:



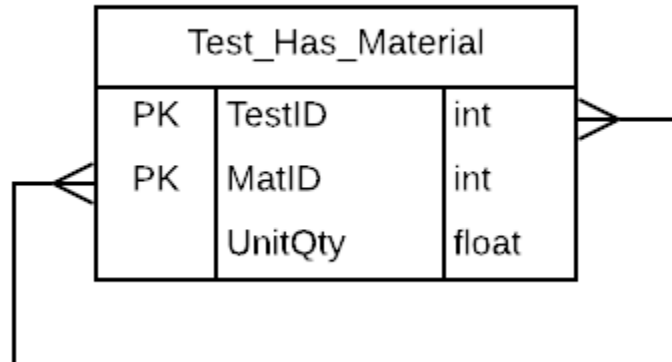
An explanation of each field:

- TestID: Auto-incremented primary key assigned by the system for every test performed
- TestResult: Raw data results generated by the test
- PassFail: True or False values assigned depending on the results of the test
- TestTubeNum: Number on the test tube with the sample of the compound involved in the test
- AssayDate: Date this particular test was completed
- AssayID: Foreign key linking this test to the Assay in the Assays table that the test is associated with
- LTNumber: Foreign key linking this test to the compound tested in the CompoundTypes Table
- TestTypeID: Foreign key linking this test to the type of test it is in the TestTypes table

Test_Has_Material Table

This linking table connects the Tests Table to the Materials Table. In addition, it holds the quantity of each material that is used in each test.

The following image shows the Test_Has_Material Table with all of its fields and data types as it appears in the ERD:



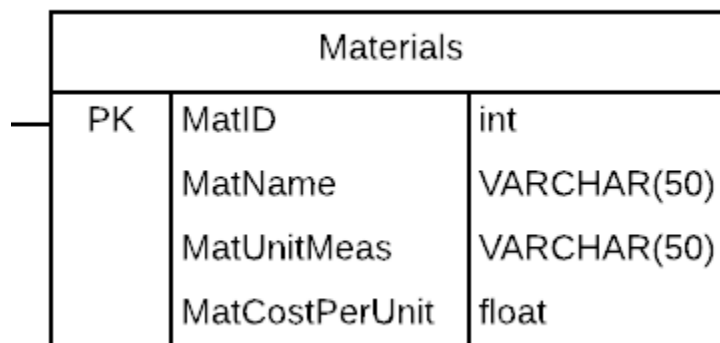
An explanation of each field:

- TestID: Primary key from Tests Table. Acts as a composite key in this table
- MatID: Primary key from the Materials Table. Acts as a composite key in this table
- UnitQty: The quantity of a given material that is used in a test

Materials Table

This table stores the data about every material that Northwest Labs uses in all of the assays it performs.

The following image shows the Materials Table with all of its fields and data types as it appears in the ERD:



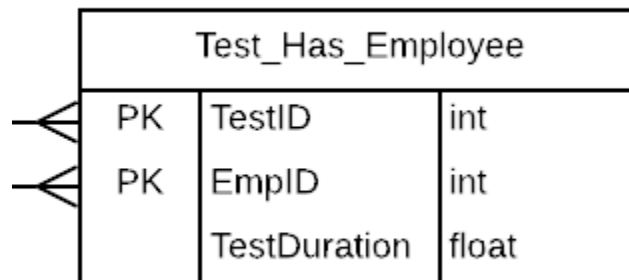
An explanation of each field:

- MatID: Auto-incremented primary key assigned to each record by the system
- MatName: Name of the material
- MatUnitMeas: Unit of measure used for the material
- MatCostPerUnit: Cost per unit of the material

Test_Has_Employee Table

This is a linking table between the Tests Table and the Employees Table. It also includes the test duration which is a measure of time an employee spends on a particular test; this value is used to calculate the price of each test for the invoice.

The following image shows the Test_Has_Employee Table with all of its fields and data types as it appears in the ERD:



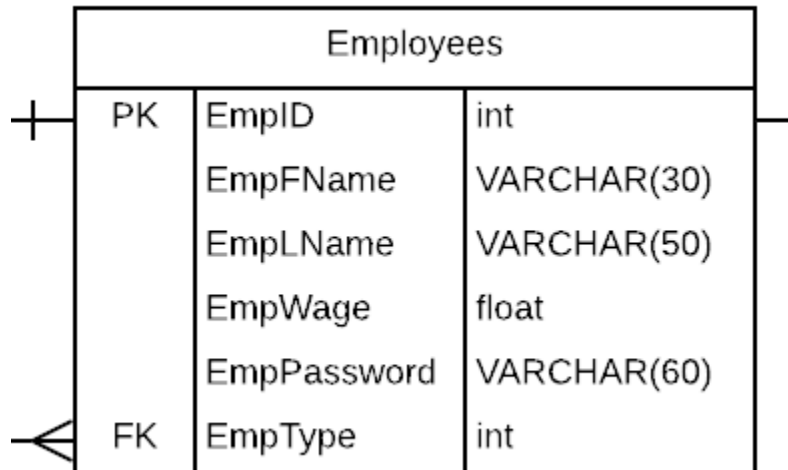
An explanation of each field:

- TestID: Primary key from the Tests Table. Acts as a composite key in this table
- EmpID: Primary key from the Employees Table. Acts as a composite key in this table
- TestDuration: Time spent by an employee on the specific test

Employees Table

This table stores all information about employees of Northwest Labs

The following image shows the Employees Table with all of its fields and data types as it appears in the ERD:



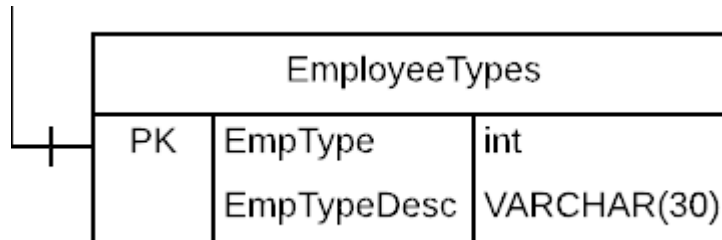
An explanation of each field:

- EmpID: Auto-incremented primary key assigned to each record by the system (doubles as employee username for the Employee Portal of the website)
- EmpFName: First name of an employee
- EmpLName: Last name of an employee
- EmpWage: Hourly wage of an employee
- EmpPassword: Password used by an employee to enter the Employee Portal of the new website
- EmpType: Foreign key from the EmployeeTypes Table. Associates each employee with his or her title

EmployeeTypes Table

This is a lookup table that stores the list of all employee positions in Northwest Labs.

The following image shows the EmployeeTypes Table with all of its fields and data types as it appears in the ERD:



An explanation of each field:

- EmpType: Auto-incremented primary key assigned to each record by the system
- EmpTypeDesc: Name of the employee position

Database Integration

The database that we are including does not include detailed financial information. As part of our solution, we recommend keeping the current financial database and linking it to our new database through a linking table. We will look further into the database to get exact fields, but a potential table for the linking table could look like this:

Financials_To_Main		
PK	TransactionNum	int
PK	WorkOrderID	int

This table would take the Work Order ID from the main database and link it to the transaction number from the financial database. The work order is attached to clients, thus linking transactions to clients. Through this linking table, Northwest Labs will be able to use both tables to access financials as well as client and work order data.

Benefits

The proposed database would benefit Northwest Labs by avoiding unnecessary duplication of tasks and reducing the risk of the introduction of errors into company data. These changes would help increase business efficiency.

Web Application

We recommend building an MVC website to interact with a centralized database. This recommendation will help to solve the following problems within Northwest Labs:

- No confirmation with customers of assay costs and orders
- High cost of processing back orders
- Inability to provide electronic results to clients for all data
- No ability to easily generate price quotes
- No way to easily display and sort assays for scheduling
- No easy process to notify clients of delays

The MVC website we recommend building will provide the following capabilities for clients:

- Create a work order
- View work orders and progress
- View and download current and previous work order reports
- Change client information
- Create a client profile

More details are provided regarding the process of creating a client profile and creating a client's first work order in the new business processes section.

Potential clients will also be able to create a client profile, which will later be reviewed and confirmed by sales representatives in Seattle.

The website will provide the following capabilities for employees in the Seattle office:

- Create a client profile
- Confirm a client profile
- Update client information
- Create a work order
- Update a work order
- Delete a work order
- View work orders and progress
- View and download current and previous work order reports
- Create reports
- View assays
- Create assays
- Update assays
- Delete assays
- View tests
- Update tests

- Delete tests
- Create tests

Employees in the Singapore office will be able to do the following through the website:

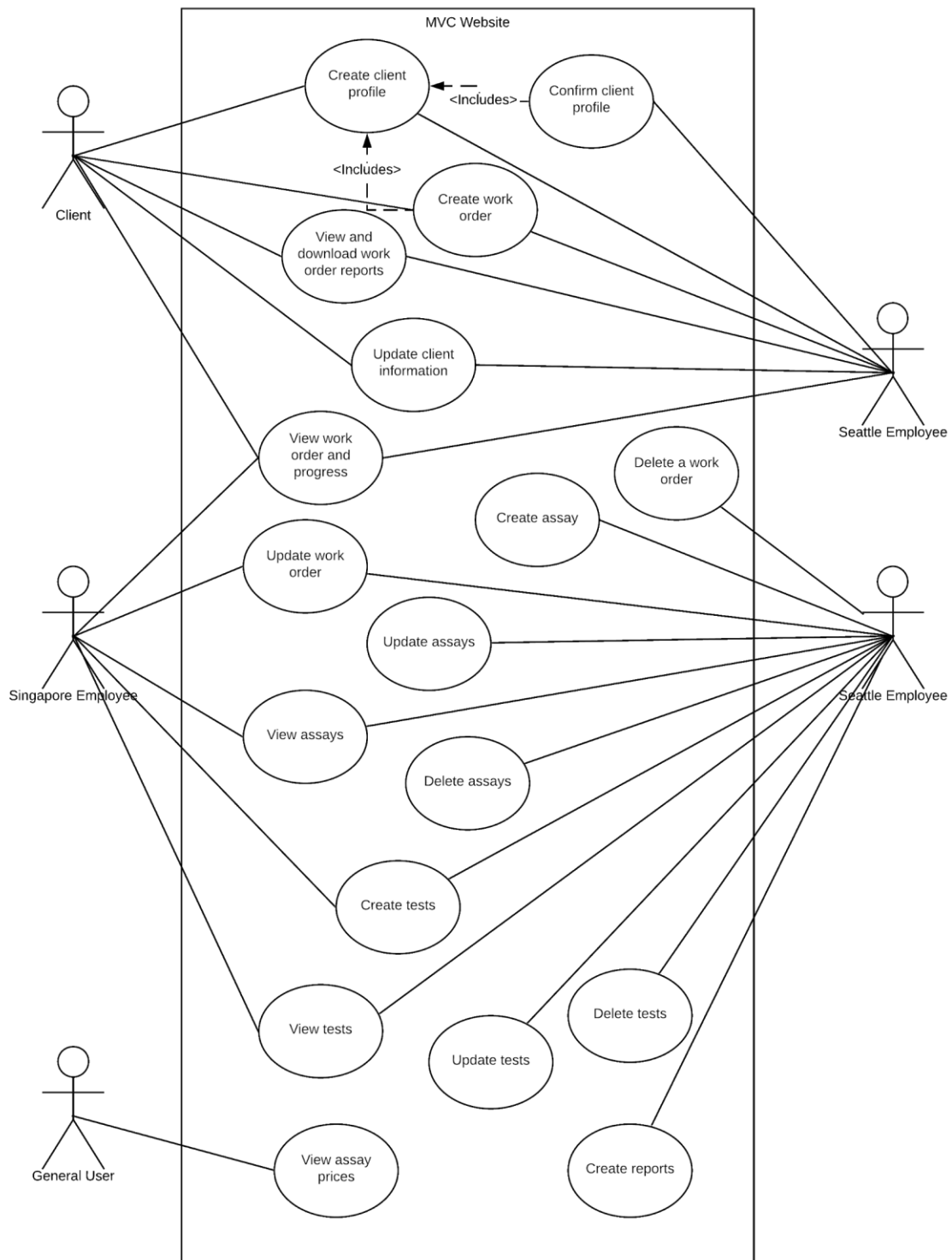
- View work orders
- Update work orders
- View assays
- View tests
- Update tests
- Create tests

Any general users of the website will be able to access a price quotes section of the website to view a price quote prediction based off of previous data.

Please note that we use the term “employees” very loosely here. As we move forward with this project, we will need to consider more specific roles for different use cases within the Seattle and Singapore offices in order to maintain security and mitigate risk within the company.

If changes are ever made to work orders, assays, or tests, the related parties will be sent an email notification regarding changes and necessary next steps.

The use case diagram on the following page shows the different capabilities for each user within the system. For this diagram, we separated the Seattle employee icon into two different users to enhance readability. This has no correlation to different roles within the Seattle office.



Through these different use cases, clients will be able to see assay costs and orders as well as receive and download electronic test results. Users at the Singapore office will be able to see work

orders that have received rush orders and will also receive email notifications regarding these orders.

Additionally, general users will be able to see assay base prices to get a basic price quote for work orders. More details about price quoting will be provided in the new business process section.

Sending Invoices Concurrently

The website will also offer capabilities to send invoices concurrently.

After the Technical Director of Pharmacology adds her summary comments to each work order, the system will automatically grab all the relevant data to dynamically create the new Client Report. At the same time, it will pull the actual costs for all assays associated with the work order and dynamically generate an invoice as well. Both the invoice and the Client Report will be emailed to the client by the system. (The physical copies will continue to be printed and mailed with a CD of the reports as in the current business process).

Scheduling

An essential characteristic of the proposed system is its ability to assist lab professionals in the process of scheduling tests. The scheduling page in the Singapore Interface of the new system will, by default, display all of the tests to be completed in the next week. Lab professionals will be able to sort and filter the relevant tests by assay type, rush order status, compound type, and any other relevant attributes.

The scheduling page will also include the capability to download the currently displayed data as a csv file for the convenience of the lab professionals assigned to scheduling. Once the employee has sorted and filtered the week's tests to his or her satisfaction, by clicking the "Download Data" button, he or she can access, format, and print the data for more convenient use.

In addition to being downloadable, this page will also provide the ability to notify clients of unforeseen delays with assays. In order to do so, the lab professional can either select specific assays one by one or filter the assays so only the affected ones are showing and then press "Select All." After that, the client will click "Post Message" and be prompted to write a message explaining the testing delay. Once the message is submitted, the system will post it to the "Comments" section of every affected work order for clients to view and an automated email (See Below) will be sent to each affected client notifying them that there has been a delay in their work order and to check the "Client Portal" for more information.

Schedule View Mockup

Schedule

Filter By ▼

Sort By ▼

Record Delay

Download

☐ Select All

	Assay Name	Due Date	Compound Count	▼
<input type="checkbox"/>	Assay 1	12/15/19	5	▼
<input type="checkbox"/>	Assay 2	12/23/19	2	▼
<input type="checkbox"/>	Assay 5	12/23/19	2	▼
<input type="checkbox"/>	Assay 3	12/27/19	1	▼
<input type="checkbox"/>	Assay 6	01/02/20	4	▼
<input type="checkbox"/>	Assay 4	01/03/20	3	▼
<input type="checkbox"/>	Assay 7	01/04/20	5	▼
<input type="checkbox"/>	Assay 9	01/04/20	7	▼
<input type="checkbox"/>	Assay 8	01/06/20	2	▼

This is a mockup of the opening scheduling page.

Expanded Schedule View Mockup

Schedule

Filter By ▼

Sort By ▼

Record Delay

Download

☐ Select All

	Assay Name	Due Date	Compound Count	▼																								
<input type="checkbox"/>	Assay 1	12/15/19	5	▼																								
<input type="checkbox"/>	<table><thead><tr><th></th><th>Work Order No.</th><th>Compound</th><th>Due Date</th></tr></thead><tbody><tr><td><input type="checkbox"/></td><td>36</td><td>Compound 1</td><td>12/15/19</td></tr><tr><td><input type="checkbox"/></td><td>27</td><td>Compound 2</td><td>12/21/19</td></tr><tr><td><input type="checkbox"/></td><td>32</td><td>Compound 4</td><td>12/28/19</td></tr><tr><td><input type="checkbox"/></td><td>41</td><td>Compound 1</td><td>12/28/19</td></tr><tr><td><input type="checkbox"/></td><td>37</td><td>Compound 3</td><td>01/02/20</td></tr></tbody></table>				Work Order No.	Compound	Due Date	<input type="checkbox"/>	36	Compound 1	12/15/19	<input type="checkbox"/>	27	Compound 2	12/21/19	<input type="checkbox"/>	32	Compound 4	12/28/19	<input type="checkbox"/>	41	Compound 1	12/28/19	<input type="checkbox"/>	37	Compound 3	01/02/20	
	Work Order No.	Compound	Due Date																									
<input type="checkbox"/>	36	Compound 1	12/15/19																									
<input type="checkbox"/>	27	Compound 2	12/21/19																									
<input type="checkbox"/>	32	Compound 4	12/28/19																									
<input type="checkbox"/>	41	Compound 1	12/28/19																									
<input type="checkbox"/>	37	Compound 3	01/02/20																									
<input type="checkbox"/>	Assay 7	01/04/20	5	▼																								
<input type="checkbox"/>	Assay 9	01/04/20	7	▼																								
<input type="checkbox"/>	Assay 8	01/06/20	2	▼																								

This is a mockup of the expanded view of a specific assay in the scheduling system.

Delayed Work Order Email

Dear Client,

There has been a delay with your work order [insert Work Order ID]. Please check the Work Order Status screen in the Client Portal for more information.

Sincerely,

Northwest Labs|

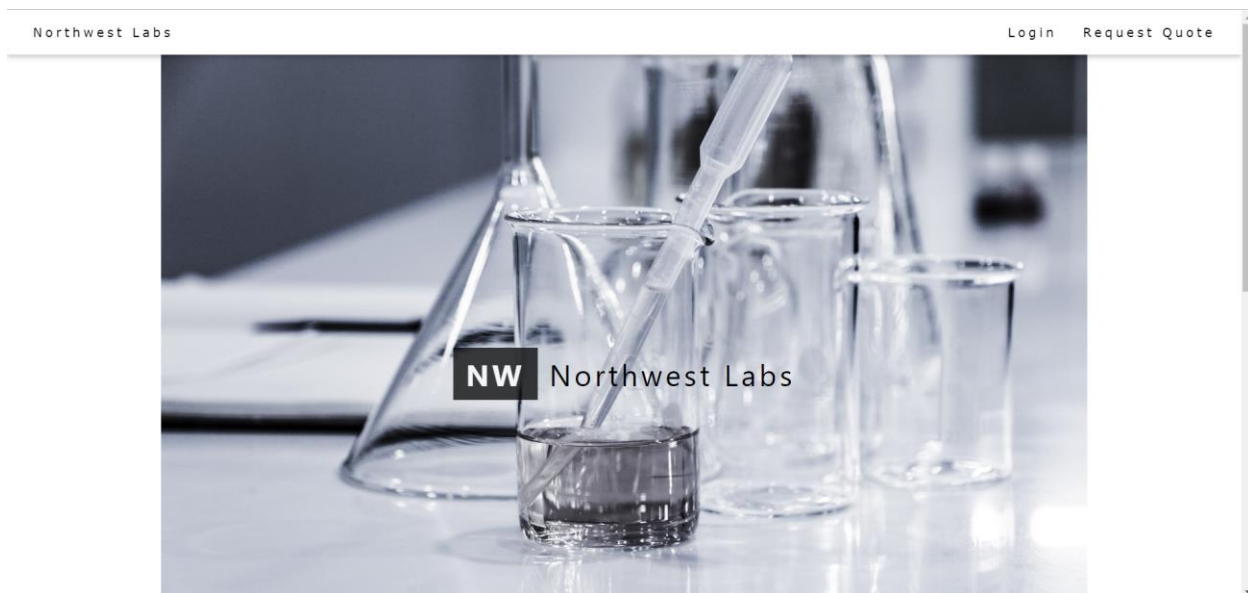
This is a draft of the automated email that will be sent for the delayed work order emails.

MVC Example

To help illustrate Dream Team's potential with this project, we have built a database and MVC project with a few of these features. The screenshots below show some of these features. Please keep in mind that this website is not a finished product, but simply a preview of what the Dream Team will be able to provide for Northwest Labs.

Overall, the prototype MVC project was created to demonstrate how basic functions of the website will simplify and solve communication, client interaction, and data flow problems in the business. While full functionality will take more time to develop, the prototype effectively demonstrates how a fully implemented final product will function in the future.

Five views are accessible to all users when they first view the website. They are the main home page, login page, create an account page, pricing information page, and a price quote page. The home page shows some basic information about the company as well as links to the other four pages. It was created to be aesthetically pleasing and easy for an unfamiliar user to navigate.



About

Here at Northwest Labs we strive to get the precise, well documented, and accurately reported results that you need. We process every order like it is our only order because we believe that our customers deserve the highest quality results. Our commitment is to our clients.



Gary Anderson
CEO & Founder

Create New Profile



Dallin Fairbanks
Singapore Operations

See Pricing



Bonnie McDougal
Sales Director

Request Price Quote



Mason Brockbank
Pharmaceutical Director

Login

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Security is a top priority in developing a new website and system. Each user must have a verified profile in order to view any part of the website past the before mentioned pages. The login and create profile pages allow the user to be verified before they are allowed to view further parts of the website. The prototype MVC website allows for users to log in to a pre-created Employee profile or a user created Client Profile. Employee profiles are created separately by an Employee in the Seattle office when new Employees are hired (This will be shown and described in the Seattle Interface later). In the prototype MVC website employees are classified as belonging to the Singapore or Seattle offices but in the future development, roles would be created to restrict what employees can do based on their needed access rights. Also further security would be added to prevent various malicious attacks to the database and website features.

The final open access pages are the pricing information and price quote pages. In these pages a user is able to view basic price estimates for the most common tests that are performed and then request price quotes on more specific assays that they might need tests for. Having a general pricing page for the most popular tests allows our clients to be more informed from the moment they view our website. By allowing them to request more specific price quotes we will be able to reach out to solve more of our clients individualized needs. Having a feature which utilizes the system to fill out a quote request form increases communication between the Client to Seattle and from Seattle and Singapore, increasing the efficiency of the overall process.

Basic Tests Pricing

Test	Description	Estimated Price	Days
Biochemical Pharmacology (BP)	Test for biochemical products.	\$1200 - \$1800	5 - 10 Days
Discovery Screen (DS)	Understand chemical reactions	\$1000 - \$1500	9 - 14 Days
ImmunoScreen (IS)	Discover immunities	\$1800 - \$2400	4 - 8 Days
Profiling Screen (PF)	Details all compounds	\$1100 - \$1600	3 - 6 Days
PharmaScreen (PS)	Indicates use in pharmaceutical products.	\$2000 - \$2400	6 - 10 Days
Custom Screen (CS)	Add additional custom tests	\$3000+ (varies)	10 - 12 Days

Request quote for more detailed information.

[Request Price Quote](#)

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Request a Quote

Email

Full Name

Biochemical
Pharmacology
(BP) ☐

DiscoveryScreen
(DS) ☐

ImmunoScreen
(IS) ☐

ProfilingScreen
(PF) ☐

PharmaScreen
(PS) ☐

CustomScreen
(CS) ☐

Custom Tests

Comments

[Send Quote](#)

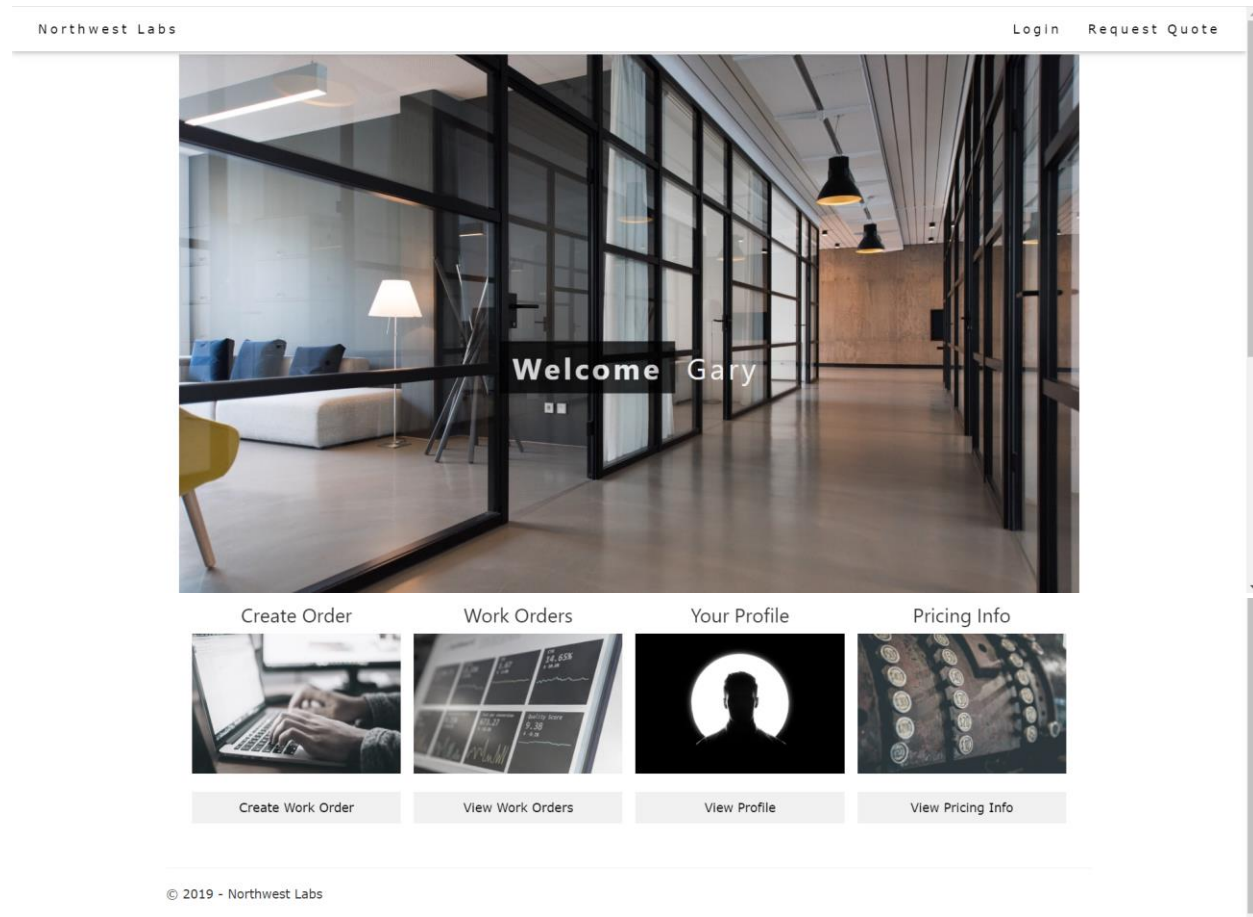
[Back to Home](#)

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Client Interface

Once logged in the client will see the home screen displayed below. The design is similar to home page that they are already familiar with. Clients are able to access four features from their profile. Those features are the ability to create a work order, view work orders, view their profile information, and again view pricing information.

The link to the pricing information stays on this page for the convenience of the client. They can continue to easily get general estimates as well as request specific quotes on their personalized requests. The ability to view and edit the information on their profile is also included in this section of the website so the client has control over their personal info.



The main focus of the Client's views is to be able to create and view their work orders. In this MVC prototype all of the specific outcomes of the assays and individual tests are represented by being able to view the work order information. In future development the results a summary of each assay will be provided in a client view and more detailed individual test results will be made available at the request of the client. By being able to create a work order directly from their online client profile the overall process becomes more efficient and also becomes more convenient for the client.

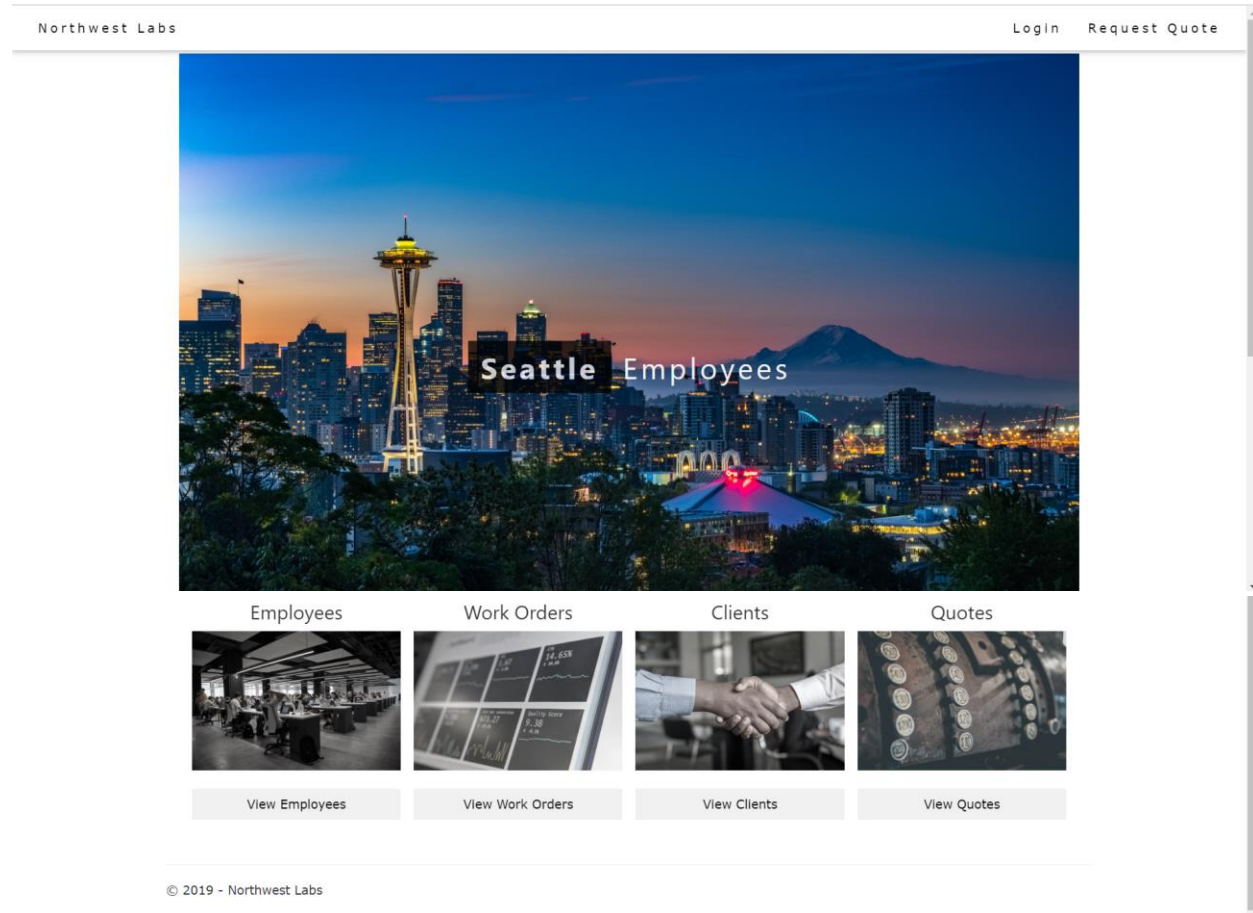
My Orders

Date Due	Rush Order	Comments	Work Order Report	Current Status
12/14/2019 12:00:00 AM	<input type="checkbox"/>	Test those little rascals!		Work Order Received Details
12/28/2019 12:00:00 AM	<input type="checkbox"/>	This is my Comment		Work Order Received Details
12/5/2019 12:00:00 AM	<input type="checkbox"/>	Hurry with this one!		Tests In Progress Details

[Create New Order](#) [Back to Client Home](#)

Seattle Interface

The Seattle Employees will have some of the most administrative responsibilities when it comes to this new system. All of these views will not be available to every employee but as mentioned earlier, in later development, functions will be divided by each employees specific roles. The features that Seattle workers will have access to include the ability to create, read, update and delete Client records, Employee records, and work orders.



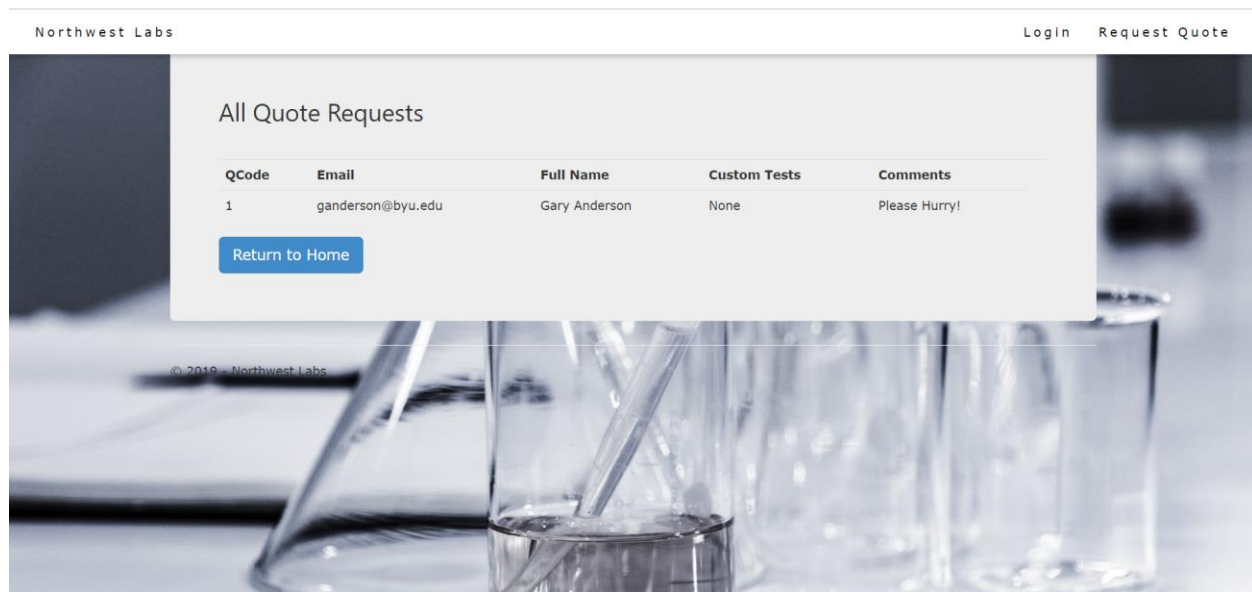
The work order feature looks and operates in a similar manner to what was described previously in the client section only with the ability to also update and delete orders as well. The functionality of the Clients and Employee views is also very similar. Employees with proper authorization can create client records as well as confirm the records that were made previously by clients online. They can view all of the clients in a list like the one displayed below. They also have the ability to edit, view more details, and delete the clients in the database. The functionality is very similar when dealing with records of the employees.

All Clients

First Name	Last Name	Company Name	Email	Phone Number	Client Status			
TESTer	test	Test Company	Test@email.com	2222222222	New Client	Edit	Details	Delete
TEST2	test2	Test Company2	Test2@email.com	3333333333		Edit	Details	Delete
Chris	McLeod	MyCompany	Chris@email.com	8013554567	New	Edit	Details	Delete
tester	TESTER	The test company	thetest@email.com	9999999999	New	Edit	Details	Delete
Christopher	McLeod	MyCompany	Chris@email.com	1231231234	New	Edit	Details	Delete
TEST	test	Test Company	tester@email.com	4444444444	New Client	Edit	Details	Delete
Chris	McLeod	sdgadg	chris1@email.com	1111111111	New Client	Edit	Details	Delete
Bill	asdgasdg	aasdgasdg	what@what.what	1111111111	New Client	Edit	Details	Delete
Gary	Anderson	InformationSystems	ganderson@byu.edu	8018675309	New Client	Edit	Details	Delete

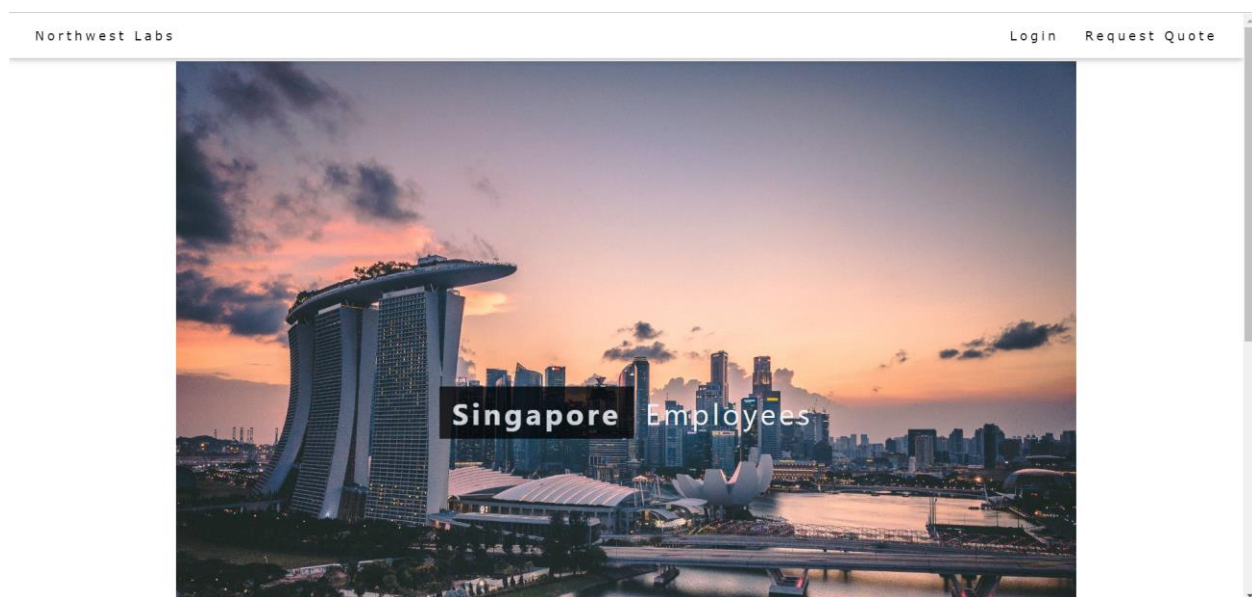
[Return to Home](#)[Create New Client](#)

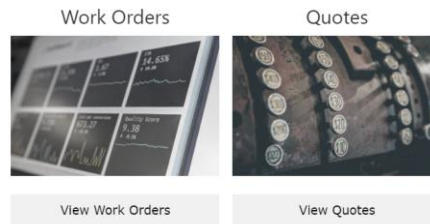
The final view associated with employees in the Seattle office deals with the quotes that clients request. After the quote is submitted it is sent to Singapore to receive an accurate price estimate. Once the estimate is attached to the quote record then the Employees in the Seattle office can view those quotes. This allows them to field questions about the quotes and make sure that there is proper follow up with the client who requested the quote.



Singapore Interface

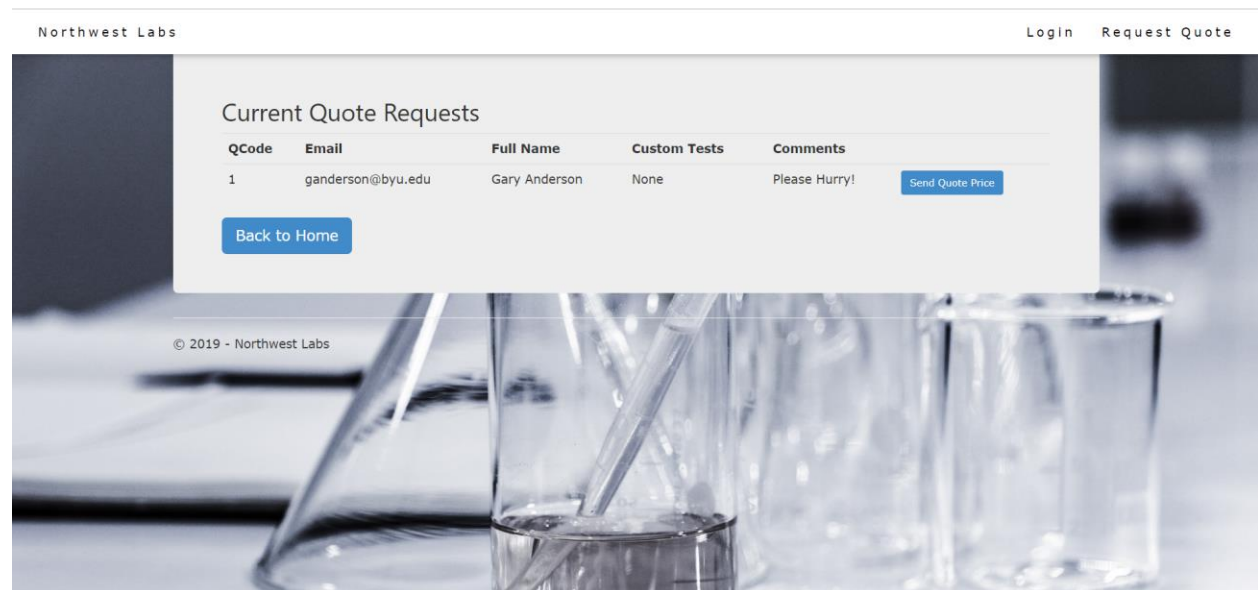
The final section of our website is the interface for the Singapore Employees. Their access is very simple since they are occupied with the work of actually performing the tests. Their interactions with the system are limited to viewing and editing work orders, and quote requests. They will update the work orders with progress and result reports. This will allow the Director Pharmacology to easily process the results of tests as soon as they are finished in Singapore. The progress reports also increase communication with the clients by allowing them to view the progress of their requested work orders whenever they desire.





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The other responsibility of an employee in Singapore is to view the quote requests that are sent to them directly from the clients. This allows them to respond to quote requests in a much faster and efficient way. In the prototype MVC when the employee submits the quote request it updates it in the database as well as sends an email to the clients email address on their profile. The email includes the requested quote information and estimated time to complete the requested assay.



Benefits

By implementing this website, people in the Seattle and Singapore office as well as clients would receive live updates for test data and work orders. This will minimize the necessity for phone calls or video call communication to receive updates.

Additionally, the website will provide access to a page that provides quotes for assays based on historical data. With the massive amounts of data provided in the archives, these quotes should be fairly accurate with minor alterations in the final price. It will also increase efficiency between offices by providing live updates and requests for work orders.

Customers will be able to view updates to their work orders as well as progress of the work orders and reports from past work orders through their user interface on the website. This will help promote customer satisfaction.

Report System

As part of our proposal, we recommend a more simplified client report and a new report generator and user interface within Northwest Labs. We recommend these changes to help address the following problems:

- Lack of uniformity between reports for the clients
- Non-user-friendly reports for clients and business functions

Simplified Client Report

To increase uniformity between reports for the clients and make the reports more user friendly, we recommend only providing basic data in reports. More detailed test data may be provided on request. We recommend this because

- Most clients are only interested in the success or failure of the compounds
- Simpler reports are easier to make uniform across different assays

We have provided a sample of the new report format (now called “Client “Report”) on the following page.

	Work Order _____
	Order Date _____
	Completion Date _____
Customer Name _____	
Assay _____	Result _____
LT Number _____	
Compound _____	Result _____
Sequence Code _____	
Compound _____	Result _____
Sequence Code _____	
Compound _____	Result _____
Sequence Code _____	
Compound _____	Result _____
Sequence Code _____	
Comments and Correlations	
Assay _____	Result _____
LT Number _____	
Compound _____	Result _____
Sequence Code _____	
Compound _____	Result _____
Sequence Code _____	
Compound _____	Result _____
Sequence Code _____	
Compound _____	Result _____
Sequence Code _____	
Comments and Correlations	

As mentioned before, if the client wants a more detailed report, he or she can request one from the client. These additional requested reports will be what we currently are distributing as “Data Reports” to customers.

The client report will be generated upon completion of the work order, and will be available for download on the client portal as well as emailed to the client.

New Report Generator and User Interface

In an effort to make report building more efficient, we recommend building an interface to interact with the proposed database as well as the financial database. This interface will include a quick reports section where managers within the company can generate sales, profitability, and efficiency reports based on sales agents, customers, and assays. It will also include a section to download CSV files and open Tableau desktop.

A mockup of the user interface is pictured below.

The mockup shows a user interface with two main sections: 'Quick Reports' and 'Tableau Reporting'.

Quick Reports

- Report Type**: Three buttons labeled 'Sales', 'Profitability', and 'Efficiency'.
- Grouping By**: Three buttons labeled 'Sales Agent', 'Customer', and 'Assay'.
- Using Dates**: Two date pickers, both showing '1 Jan 2019' and '31 Jan 2019'.
- Generate**: A large button at the bottom.

Tableau Reporting

- Select Table**: A dropdown menu showing 'Work Orders'.
- Using Dates**: Two date pickers, both showing '1 Jan 2019' and '31 Jan 2019'.
- Generate CSV**: A button.
- Open Tableau**: A button.

Benefits

By boosting these elements through our recommendations, Northwest will present more professional reports to both clients and internal managers, thus improving client satisfaction.

API

One of Northwest Labs's current problems is the lack of dated archival test protocols. The data from previous years' tests would be highly useful in Northwest Labs's business strategy. Because of this, we recommend developing an API to pass the archived data to the existing database.

Currently, we do not have enough information about the archived data structure to know how to pull the data, but part of this project would involve building simple routes in an API to quickly transfer the data to the newly-designed database.

This API would be simple, and only needed for the initial transfer of data, so the API would not require upkeep costs.

We also recommend developing an API to move the information passed on the website to the new database on the server. This API would be more complex and would also require more upkeep costs as changes are made to the website and interface over time.

Benefits

The API to recover the archived data will help the data collected throughout the lifetime of the company to be more easily accessible for reports and analyses and will be generated to update the database will help to keep the database up-to-date and of good quality. This API will also help keep the data updated live so that updates on projects and work orders are communicated quickly through the views and email notifications on the website.

An active API between the website and database will help increase efficiency in the processes across the two business locations and help clients to see more accurate and up-to-date notifications for their work orders.

Overall, both API's will provide more accessible and recent data to help with report scheduling.

New Business Processes

Problems addressed by these changes:

- Difficulty of offering price quotes
- Communicating work order status with clients

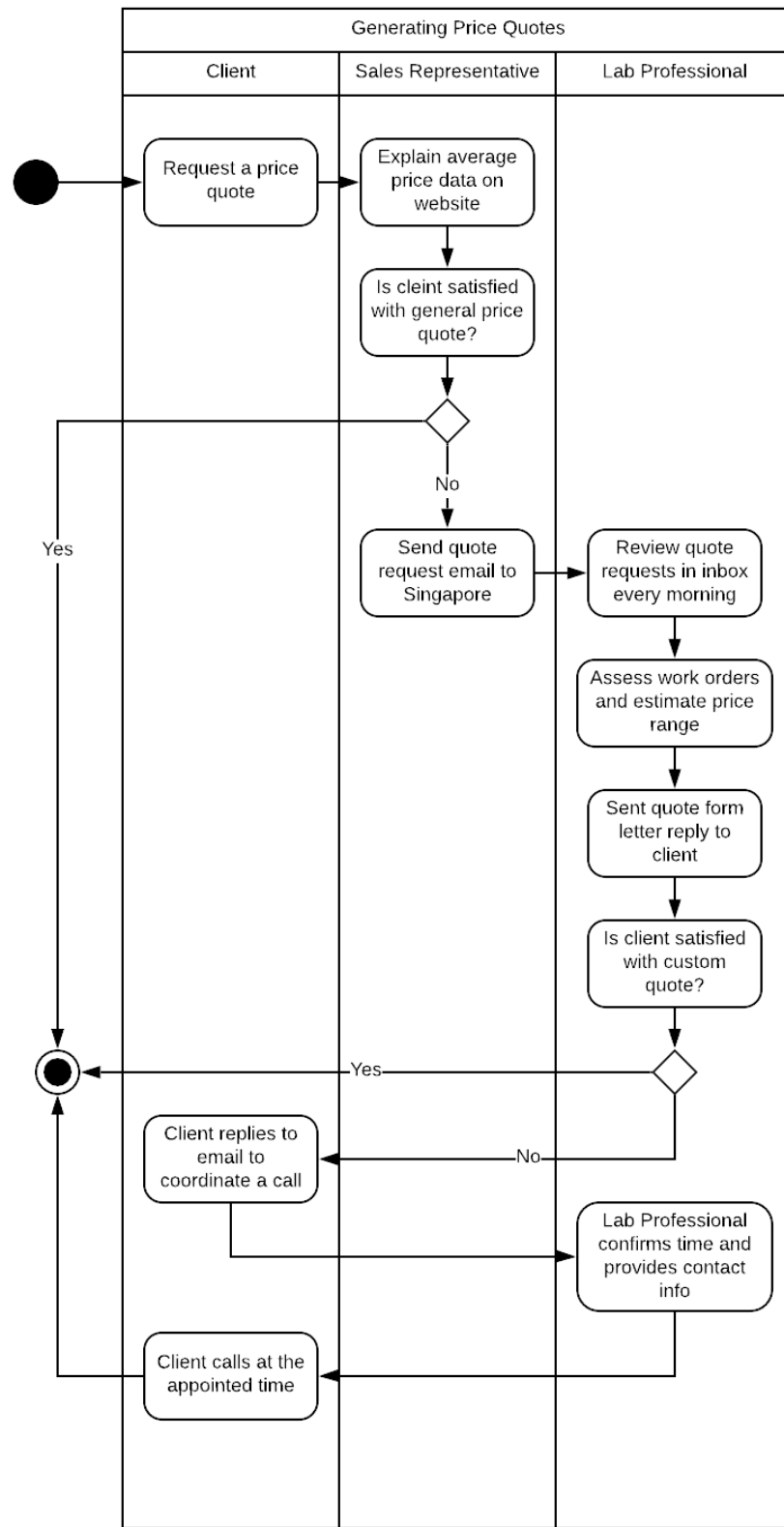
To address these problems, we recommend new business processes for obtaining price quotes and communicating order status.

Price Quotes

The time-differences between Singapore and Seattle provide a barrier between instant communication of price quote information between the two offices that even a new, sophisticated mail server or communication system cannot bridge. For that reason, after reviewing historical costs with sales agents, if a client requests a more customized quote from a lab specialist in Singapore, we recommend that the following process be followed:

1. A client requests a price quote for a particular work order
2. A sales representative shows the client where that information is located on the web page and explains the average cost of the required tests and the average cost of all the optional tests to establish a possible price range for each requested assay. Afterwards, the sales representative explains that a lab professional should be consulted for a more accurate quote.
3. If the customer requests a customized quote:
 - a. The sales representative immediately sends a request email including all relevant work order information and the client's email to the Singapore office
 - b. In Singapore a lab professional checks the inbox for quote requests every morning and, using his or her lab experience, fills a form letter (see below) an email with a more customized quote considering each compound, its characteristics, and the requested assays. The lab professional will then send the email with the more customized price estimate directly back to the client
4. If the customer is not satisfied with the customized report:
 - a. They may reply to the customized quote email requesting a call
 - b. In this case, the client and lab professional will coordinate a time and the lab professional will provide contact information
 - c. End

Full Activity Diagram:



Customized Price Quote Form Letter:

Dear Client,

After reviewing the assays you have requested I have estimated the following price ranges:

Compound Name:
Requested Assay:
Minimum Estimated Price:
Maximum Estimated Price:
Comments:

Compound Name:
Requested Assay:
Minimum Estimated Price:
Maximum Estimated Price:
Comments:

Compound Name:
Requested Assay:
Minimum Estimated Price:
Maximum Estimated Price:
Comments:

If you have any further questions, feel free to respond to this email and we can arrange a time for a call to discuss these prices in more detail.

Thank you for your business,

[Lab Professional Name]
Northwest Labs

Communicating Order Status

While the proposed database and client portal will provide clients with live updates on the progress of their work orders, unexpected delays are not accounted for in the regular updates and will require that special notifications be sent to clients. Using the new website and its scheduling capabilities, Singapore employees should follow the following process in order to notify clients of delays:

1. Singapore employees notice that there will be a delay for certain assays and work orders
2. Using the new assay scheduling/sorting page, employees will select the affected assays and click the “Send delay notification” option.
 - a. The system will prompt the employee to write a brief message explaining the delay. This brief message will include relevant information such as the expected duration of the delay

- b. The system will then post this comment to the work order status screens for all affected clients
 - c. The system will also automatically send a form email (pictured below) to all affected clients, notifying them of the delay and requesting that they review the work order status screen in the Customer Portal for more information.
3. End

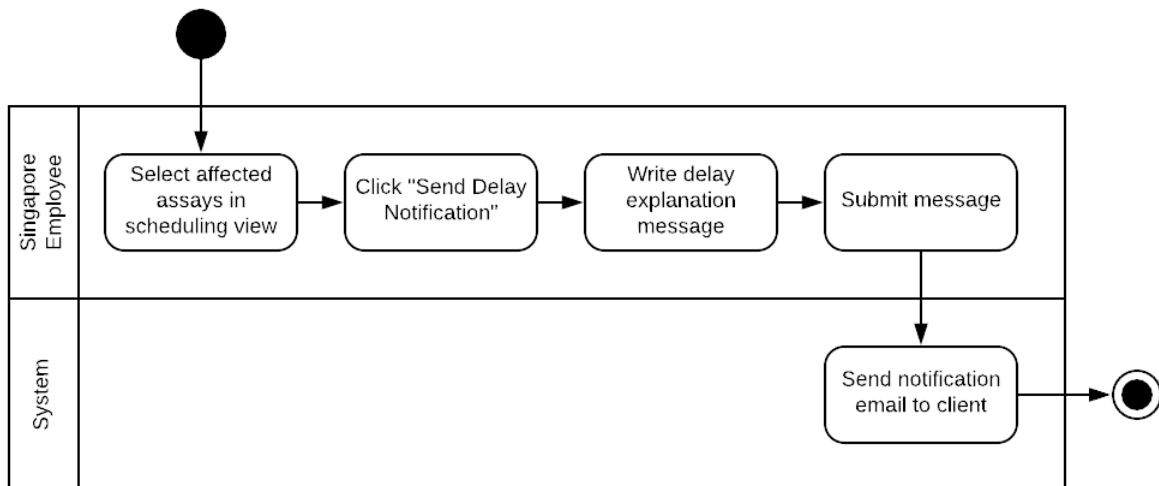
Dear Client,

There has been a delay with your work order [insert Work Order ID]. Please check the Work Order Status screen in the Client Portal for more information.

Sincerely,

Northwest Labs

This process is depicted in the activity diagram below.



Stock Replenishment System

We have not created a system solution to the problem of tracking and replenishing stock; According to the specifications we were given: “maintaining inventory of items used in Singapore is outside of the scope of this project.”

Business Impact

We designed our recommendations to promote elements of Northwest Labs's business strategy. Below is a table depicting each of Northwest Labs's business strategy elements with the recommendations that help boost those elements.

Business Strategy Element	Recommendation(s) that supports the strategy
Improved quality, reliability, and consistency of reports/data	Server Software Database Report system API
Improved speed and responsiveness	Server Database Web application API
Ability to produce quotes	Database Web application API Business processes
Increased efficiency	Server Database Web application API
Improved communication with customers	Web application Report system API Business processes
Improved planning/reporting capabilities and scheduling	Software Database Web application API

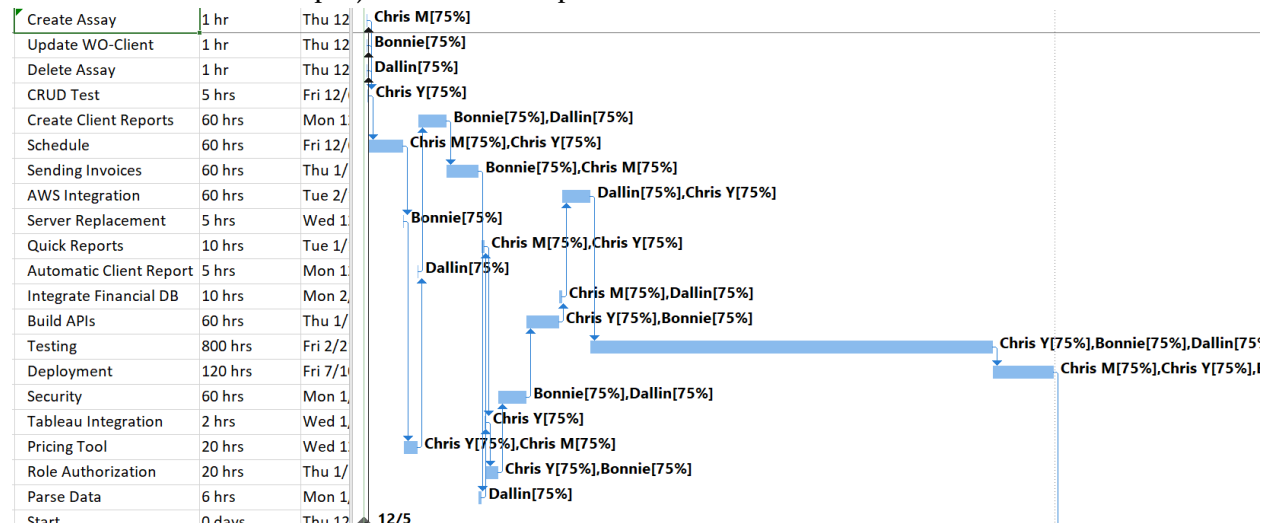
These strategy elements were created to help maintain Northwest Labs's current customer base, promote professionalism, and attract new clients.

Estimated Schedule and Resources

We consider this project to be highly feasible due to the schedule and resources used. We will explain this in the following sections.

Schedule

The Gantt chart for the project schedule is pictured below.



We estimate that this project will take an additional six months to develop and implement the requirements of the Northwest Labs system. Requirements that are estimated to take further time to develop and test are:

- Creating a scheduling system for assay tests in Singapore,
- Integrating the current financial database and sending invoices to clients, and
- Developing further modes of communication/synchronization of reports and requests between Singapore and Seattle.

Due to the confidential nature of assay result and financial data involved in the Northwest Labs system, it is necessary that the Dream Team spend a considerable amount of time (estimated 800 hours) for testing and resolving errors. We want to deliver a capable web application for Northwest Labs to increase profitability and communication/data efficiency.

Furthermore, we estimate a five-month window for testing and resolving errors before deploying the web application and database to Amazon Web Services. It is estimated that the website will be fully operational and deployed by July 20th, 2020.

Resources

In total, we anticipate 1,315 hours needed from the Dream Team to finish the project as well as a \$55,798 initial outlay with \$14,503.80 in yearly differential costs.

Team Hours

We anticipate an additional 1,315 hours remaining to finish this project. These hours include building website features such as:

- Creating and deleting assays
- Updating work orders
- Creating, reading, updating, and deleting tests
- Creating client reports
- Singapore schedule
- Sending invoices
- Generating quick reports
- Security
- Tableau integration

We will also spend hours doing the following tasks:

- Integrating to AWS
- Replacing server
- Integrating financial database
- Building API's
- Testing
- Deploying

Costs

As part of this section, we will evaluate present values of costs as well as other significant ratios. For these ratios, we will use an internal rate of return (IRR) of 3.2% as outlined by Deloitte.²

² (Deloitte 2018)

Sunk Costs

The cost thus far of the project is \$6400. These costs come from the hours the Dream Team has spent in the last week to analyze and design the project. These costs are broken down as follows:

Task	Hours	Rate	Total
Database build	7	40	\$280
Website	60	40	\$2,400
Analysis and design	93	40	\$3,720
			\$6,400

However, Northwest Labs must recognize that the \$6400 is a **sunk cost**. Sunk costs **should not be considered in the final decision to invest**.

Server Costs

As mentioned above, we recommend using AWS for website hosting through the Elastic Computer Cloud (EC2) as well as database hosting through the Relational Database Service (RDS). The cost per month for each are as follows:

	Cost per month	Yearly cost
EC2 Server	\$52	\$624
RDS (database)	\$106.65	\$1279.80
Total	\$158.65	\$1903.80

Since this cost will occur annually, we consider these costs to be part of the differential costs. We can also calculate the present value of these differential costs. The equation for the present value of a perpetual cost is

$$\frac{\text{Yearly Cost}}{IRR}$$

Based off of this equation, the present value of the two services (compounded monthly) is **\$713,925**.

We also recommend buying two servers for internet access for both the Singapore and Seattle offices. We recommend the Dell PowerEdge R810 with 40 cores. This server should be able to

process approximately 120 requests per second and is available on Amazon for \$699,³ or \$1398 total for both servers. The current tech support will replace these servers, so we will not consider that cost here. The cost of the servers would be considered part of the initial outlay cost.

Software Costs

We plan to use the Tableau creator subscription for 15 users in the Seattle offices. This includes managers, IT support, and the data analyst.

The costs involved for this subscription are as follows:

Cost/user/year	\$840
Users	15
Total yearly cost	\$12,600

We would consider this to be a differential cost to the project as it would occur yearly. The present value of this cost would be **\$393,750**.

Database Costs

While we have designed and built a database and schema for the new system, this design may need adjustments according to requests by users. We also anticipate additional costs for designing the linking table to join the main database to the financial database. These costs total \$600 and are as follows:

Hours to finish database and link to financial database	15
Rate	\$40
Total cost	\$600

We consider these costs to be part of the initial outlay for the project. The upkeep costs for the database will be calculated into the costs for a database administrator.

³ (Amazon 2019)

Website Costs

As mentioned before, we anticipate using an additional 1,315 hours to finish this project, based on this, the cost to finish the website is as follows:

Hours to finish	1,315
Rate	\$40
Total	\$52,600

The \$52,600 would be part of the initial outlay of this project.

API Costs

Considering that Northwest Labs will need two API's built for this project, we estimate 30 hours will be needed to build the API as an initial outlay. The cost for this build is as follows:

Hours to build	30
Rate	\$40
Total cost	\$1,200

The API's will also require some upkeep, which will be maintained by the IT support staff. Considering we already pay for IT support staff, we will not consider this in the costs.

Feasibility Analysis

Based off the current system and the future system requirements, we consider this project to be highly feasible. We evaluated this according to

- economic feasibility,
- technical feasibility, and
- organizational feasibility

The following table illustrates the feasibility level we determined with each of the areas

Feasibility Area	Feasibility Level
Economic	High
Technical	High
Organizational	High

We came to these conclusions based off of the risks involved in each area and the resources and methods available to Northwest Labs to manage risks.

Economic Feasibility

The costs for the initial outlay of this project would be as follows:

Item	Cost
Database	\$600
Website	\$52,600
API	\$1,200
Personnel	\$0
Server	\$1,398
Software	\$0
Total Initial Outlay	\$55,798

Additionally, this project will have the following yearly costs for upkeep and maintenance of the system:

Item	Cost
Database	0
Website	0
API	0
Personnel	0
Server	\$1,903.80
Software	\$12,600.00
Total Differential Costs	\$14,503.80

This results in a present value of **\$1,163,473**. As one of the cutting-edge pharmacy testing companies, we consider Northwest Labs to be capable of investing in this project, especially since future funds will be saved in server maintenance after replacing our servers with AWS.

Northwest should also consider the funds that will be saved from more accurate costing after having data more accessible.

In summary, this investment involves the following costs:

Initial outlay	\$55,798.00
Differential (yearly) costs	\$14,503.80

The total net present value for the cost of this project is \$1,219,271.

Risks Involved

We consider the overall economic risk to be low. The economic risks include:

- Increase in monthly AWS rates
- Increase in initial outlay through extended project duration

The table below assesses each of these risks according to impact, likelihood, lack of forewarning (how much warning we would or would not have of this occurring), and overall risk.

	Impact	Likelihood	Lack of Forewarning	Overall
Increase in monthly cost	L	L	M	M
Increase in initial outlay	M	M	L	M

We don't anticipate monthly costs of AWS increasing significantly, which is why we consider the likelihood to be low. Additionally, AWS's rates must stay low enough to compete with other services such as Azure, so we consider the likelihood to be low. However, the forewarning of the event would be rather short.

If we were to have an increase in the initial outlay due to additional time needed on the project, we would consider that time to be minimal considering our current skills and capabilities as a team. However, we would say the likelihood of this occurring is also moderate, but we would be able to give fair warning to Northwest Labs the moment we noticed a reason to prolong the project.

Based off of this evaluation, we consider the overall economic risk of this project to be moderate.

Risk Management

While we do not have much opportunity to manage risks around AWS, we will establish a highly communicative culture with our sponsor at Northwest Labs to help give adequate forewarning for a delayed schedule on the project.

Due to this, we consider the overall economic feasibility to be high.

Technical Feasibility

Execution of this project requires significant skills in programming, integration, and database design and management. The Dream Team is highly proficient in programming and databases, however, we have little experience in integration. Throughout the duration of this project, we have learned a lot about it, and anticipate success at integration with AWS due to our learning and Amazon's superior customer service.

Risks Involved

We anticipate several technical risks involved in this project, including

- Insufficient time to build the project
- Incompatibility between research equipment in Singapore and the database
- Crashes to AWS
- Underqualified or inexperienced database administrator or data analyst

We evaluate these risks using the table below.

	Impact	Likelihood	Lack of Forewarning	Overall
Insufficient Time	M	M	L	M
Incompatibility	H	L	M	M
AWS Crashes	L	L	H	L
Underqualified or inexperienced DBA or data analyst	H	L	M	L

The Dream Team would encounter insufficient time if management at Northwest Labs created unrealistic deadlines for the team.

If the research reports don't properly insert into the database, the entire project will be rendered useless, however, with the BLOB data type available in databases, we don't anticipate this being a problem.

AWS has had minimal crashes in the last several years, and these crashes are usually fixed quickly, which is why we consider the impact and likelihood to be low. However, we would receive no forewarning to this kind of risk.

If our DBA or data analyst are inexperienced or underqualified, Northwest Labs would encounter problems within the database as well with the reporting system. This presents a high impact risk for the company. However, through training, we anticipate this to be a low risk with moderate lack of forewarning.

Overall, we consider the technical risk to be at a low level, and the feasibility to be moderate.

Risk Management

To manage the insufficient time risk, communication between management and the team is essential. We will be sure to communicate schedule as well as productivity factors with management to mitigate this risk.

We plan to do a large amount of testing to help mitigate the risk of poor integration. However, we cannot do anything to mitigate the risk of crashes in AWS. We are dependent on Amazon's maintenance of its systems.

To help mitigate the risks around DBA and data analyst skillsets, we recommend adequate training time for adoption of the new system.

Based off of these results, we consider the overall technical risk to be medium and the feasibility to be high.

Organizational Feasibility

This project would be highly useful to Northwest Labs, boosting productivity, communication, and efficiency. Because of that and the risks involved, we consider it to be highly feasible.

Risks Involved

The organizational risks involved include:

- Poor adoption of new system
- Hackers to the database or servers
- Insufficient workload for the data analyst

The table below assesses each of these risks according to impact, likelihood, lack of forewarning (how much warning we would or would not have of this occurring), and overall risk.

	Impact	Likelihood	Lack of Forewarning	Overall
Poor adoption of system	H	M	L	M
Hackers	H	L	H	M
Insufficient workload for data analyst	M	L	L	L

If the system isn't adopted correctly, the project will be practically useless, however, we consider the likelihood of this to be only moderate with a relatively low lack of forewarning.

Hackers within the system could result in severe consequences for Northwest Labs. However, considering our use of AWS, we consider the likelihood of this attack to be low.

If Northwest doesn't effectively use the data analyst within his or her role, this could have a large impact considering the amount invested into the analyst yearly. However, we consider this risk to be low with a low lack of forewarning.

Risk Management

To help effectively adopt the system, we recommend training, testing, and employee input throughout the testing and implementation process to ensure that the clients feel capable to use the system and also feel that they have input regarding the system.

We can do little with the hackers on the AWS side of the system, but we recommend password requirements for users as well as frequent password changes to help mitigate the risk of hackers.

The data analyst will be responsible for helping managers with Tableau, analyzing data for more accurate price quotes, and working with the marketing team to increase clientele. We consider this to be a sufficient amount of work for the data analyst.

Overall, we consider the organizational risk to be at a low level, and the feasibility to be high.

Conclusion

In summary, we anticipate this to be a highly feasible project. Thus far, Northwest Labs has invested \$6,400 into the project. To finish the project, Northwest can anticipate investing the following resources over a period of approximately 7 months:

Man hours	1,315
Initial investment	\$55,798
Yearly differential cost	\$14,503.80

The total net present cost of this project is \$1,219,271.

Overall, this project will support the following elements of Northwest Labs's business strategies:

- Improved quality, reliability, and consistency of reports/data
- Improved speed and responsiveness
- Ability to produce quotes
- Increased efficiency
- Improved communication with customers
- Improved planning/reporting capabilities and scheduling

By boosting these elements, we plan to increase customer and employee satisfaction.

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