

**University of Victoria  
Engineering & Computer Science Co-op  
Work Term Report  
Summer 2018**

**Data Storage  
Assessment**

**Prime Engineering**

**Victoria, BC, Canada**

**Kurt Elliott  
V00877791  
W01  
Engineering  
Kurtelliott@uvic.ca  
09/03/2018**

**In partial fulfillment of the academic requirements of this co-op term**

**Supervisor's Approval: To be completed by Co-op Employer**

This report will be handled by UVic Co-op staff and will be read by one assigned report marker who may be a co-op staff member within the Engineering and Computer Science Co-operative Education Program, or a UVic faculty member or teaching assistant. The report will be either returned to the student or, subject to the student's right to appeal a grade, held for one year after which it will be destroyed.

I approve the release of this report to the University of Victoria for evaluation purposes only.

Signature: \_\_\_\_\_ Position: \_\_\_\_\_ Date: \_\_\_\_\_

Name (print): \_\_\_\_\_ E-Mail: \_\_\_\_\_

For (Company Name) Prime Engineering \_\_\_\_\_

Kurt Elliott  
901-360 Douglas  
St. Victoria, British-  
Columbia V8R-2X1

September 3, 2018

Mrs. Korol  
Coop Coordinator  
Faculty of Engineering,  
University of Victoria  
P.O.Box 1700  
Victoria, British Columbia,  
V8W-2Y2

To whom it concerns,

Please accept the accompanying work term report entitled “Data Storage Assessment.”

This report is the result of work for Prime Engineering, which was completed during my first work term as an engineering student at University of Victoria. Well working at Prime Engineering I was apart of the Power Systems Study team. As a part of this team I would build ECAD models of electrical systems that we would perform electrical studies on. As I learned my way through the office my responsibilities grow from making the models to doing power distribution studies such as short circuit, and arc flash analysis as well as preparing reports for clients.

Through this summer work term, I have had the opportunity to work with as incredible team where I was able to learn about electrical distribution network analysis, ground analysis, and databases. This work term has helped me develop knowledge and competencies that will help be progress throughout my engineering career.

I would like to thank the general manager, Eric Sleigh for giving me the opportunity to work with the Power Systems team at Prime Engineering and I would also like to thank my manager Jennifer Magdalenich, for her patience and always being willing to help or explain any questions that I would have.

Sincerely,

Kurt Elliott

## Contents

List of Figures and Tables .....	i
Glossary .....	ii
Executive Summary .....	iii
1. Introduction.....	1
1.1 Background Information .....	1
1.2 Scope .....	1
1.3 Problem Definition .....	1
2. Discussion .....	2
2.1 Types of Databases.....	2
2.1.1 Relational Database .....	2
2.1.1.1 Advantages .....	3
2.1.1.2 Disadvantages .....	3
2.1.2 Non-Relational Database.....	4
2.1.2.1 Advantages .....	5
2.1.2.2 Disadvantages .....	5
3. Conclusion .....	5
4. Recommendations .....	6
General References: .....	7
Image References: .....	7

## List of Figures and Tables

Figure 1 - Relational Database Diagram [2] .....	3
Figure 2 - Object Oriented Diagram [3] .....	4

## Glossary

DBMS – Database Management System

ECAD – Electrical Computer Aided Design

PSS – Power Systems Study Team

SQL – Structured Query Language

Paging – Divide (a piece of software or data) into sections, keeping the most frequently accessed in main memory and storing the rest in virtual memory.

## Executive Summary

This report addresses Prime Engineering's need for a comprehensive database solution for its data storage needs. This report will only be covering the data from the Power System Study Team; however, it could be easily expanded to address the whole company's data storage at a later date. The two most used types of database management systems (DBSM) will be looked at and evaluated to assess, which type would be the best solution for Prime Engineering. Relational databases are the most common type of database, these types of databases relate the data to other data to make it easy to track and manage [1]. The Second type of databases is categorized as being non-relational databases. Non-relational databases have a wide arrange of variations, however this report will be assessing object orientated databases for non-relational databases. This type of database relates data to an "object" rather than relating to other information.

## 1. Introduction

Prime Engineering is an Electrical Engineering firm in Victoria, British Columbia they are a relatively young company, which was started by four people. The company does work in electrical distribution ranging from high voltage industrial applications to low voltage residential. They also provide services such as commissioning equipment and performing ECAD electrical engineering studies. The company has grown over the past 8 years to approximately 150+ employees. They have been growing their assets as needed, however one area that has been neglected is their data storage.

### 1.1 Background Information

The current storage method for information storage is filing the information in manually made folders with cascading sub-folder. Although this method is remarkable simple and effective with small amounts of information; the drawbacks become apparent as the amount of information increases as well as the number of people required to access the information increases. The other main issue with manually made folders is that it becomes increasingly difficult to standardize folder naming conventions; this in turn makes it nearly impossible to have everyone follow the same file locations and that makes it extremely difficult to find the information once it is in the system.

### 1.2 Scope

For this report, two types of databases will be assessed, which are relational and non-relational databases. The two types are generalized into these two categories because there are so many variations and sub-types, therefore for non-relational databases, Object Orientated databases will be assessed. This will give me a good base foundation of understanding the two types of databases and help evaluate, which type is best suited for the Power System Study team (PSS).

### 1.3 Problem Definition

To keep the PSS team information efficiently organized and readily available a comprehensive database system is required. The system must handle the large amount of

information, well keeping it efficiently organized and readily available for when the team members need access to it.

## 2. Discussion

To address the PSS teams needs for data storage, the areas of DBMS type will be assessed. There are many different variations of each type of DBMS, each tailored to their specific application; therefore, there is not only one solution, but many different solutions. This makes the problem not to find one solution, but rather the right solution for the given application.

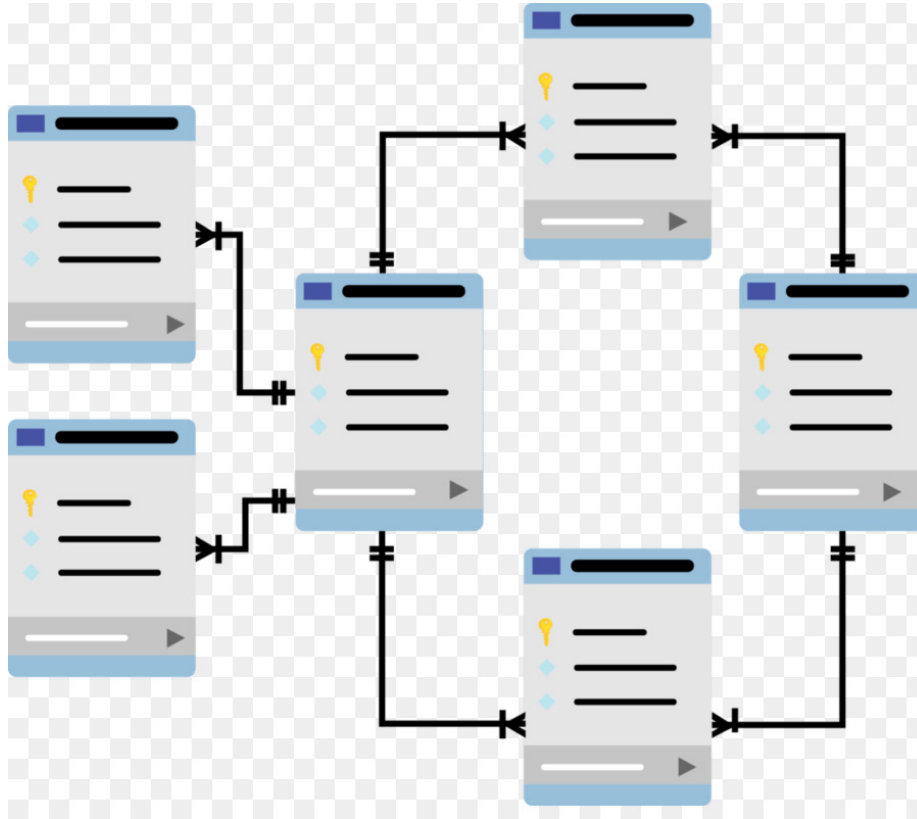
### 2.1 Types of Databases

DBMS will be broken down into two parts for this report. The first part will discuss relational DBMS and their advantages and disadvantages. The second part will discuss non-relational DBMS and their advantages and disadvantages.

#### 2.1.1 Relational Database

A relational database is a database model created around the concept of mapping data sets, which was first conceptualized by Dr. Edgar Codd at IBM in 1970 and is based on mathematical proofs in set theory. The relational database uses a concept of organizing data into tables, columns and rows. Each table would be considered a category of data to be stored, each row is a field or attribute which describes what is being stored about the category and a row is an entity, namely stating that each row is containing its own unique data.

Tables and rows in a relational model, are referenced together using primary and foreign keys. The primary key allows each row in a table to maintain singularity and have a unique identifier. The foreign key, links to the primary key of another table, allowing two tables to interact, essentially merging the tables together, which could then be accessed by SQL queries and joining statements. Refer to figure 1 for diagram representation of a relational database.



**Figure 1 - Relational Database Diagram [2]**

#### 2.1.1.1 Advantages

The following is a list of advantages for relational databases:

- are scalable because they can be easily edited without modifying existing records.
- have stood the test of time.
- are the most commonly used database type [cite something].
- standard SQL commands can be used to efficiently retrieve data from the database.
- simply structured making them very readable and easy to understand data flow.

#### 2.1.1.2 Disadvantages

The following is a list of disadvantages for relational databases:

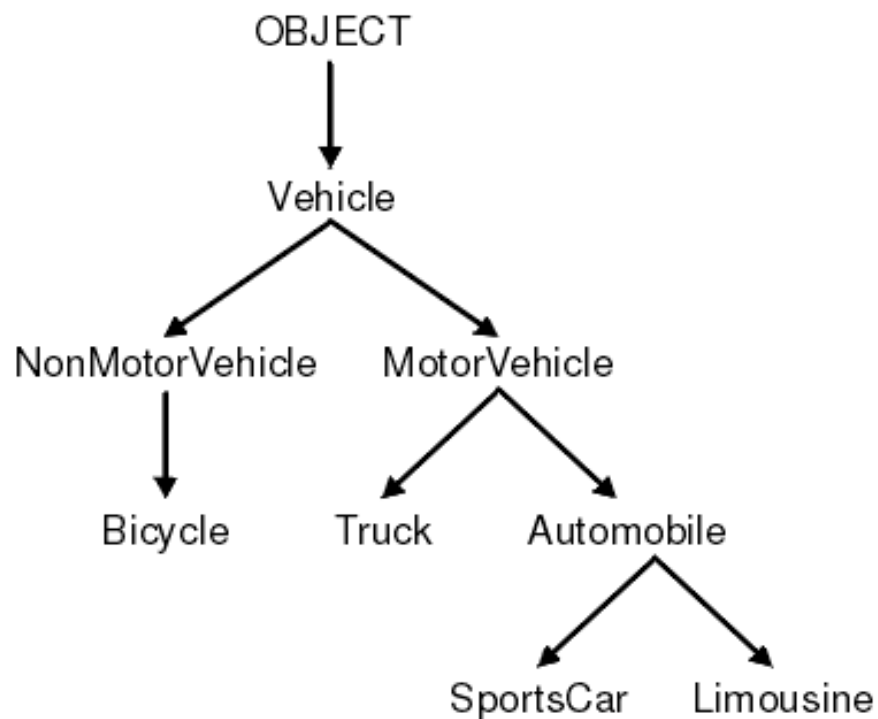
- lack the support for complex data types such as images and videos.
- difficult to access complex queries.
- data being stored must be preemptively known beforehand to accommodate fields structure.



### 2.1.2 Non-Relational Database

Object orientated databases are databases that store “objects” rather than data as individual relations. They make use of object orientated computer programming languages, such as Java, C++, and C#. Objects consist of their attributes as well as executable methods on that object to query data. One of the most important attributes of object orientated databases is classes, which define the way in which an object is structured. Objects can have inheritance relationships with other classes, allowing one object to contain the data of another object as well as the data of the new object inheriting.

With an object orientated structure, classes could be considered as tables of the database and the objects as the rows. Attributes will define the fields content and methods within them as a form of conveniently accessible store procedures. Each object contains a unique ID, which similar to relational databases grants singularity through the rows and tables of the database. Refer to figure 2 for diagram representation of an object oriented database.



**Figure 2 - Object Oriented Diagram [3]**

#### 2.1.2.1 Advantages

The following is a list of advantages for object orientated databases:

- Has reduced paging.
- Objects are simpler to navigate to in a database.
- Objects makes the data more concurrent and easier to see whole picture.
- Structure is based on more perceive view of the data than trying to fit model.

#### 2.1.2.2 Disadvantages

The following is a list of disadvantages for object orientated databases:

- Efficiency is greatly reduced when it come to working with simple data and relationships.
- There are less resources available for object oriented databases.

### 3. Conclusion

To keep the PSS team information efficiently organized and retally available a comprehensive database system is required. The system must handle the large amount of information, well keeping it efficiently organized and retally available for when the PSS team members need to access to it.

Prime Engineering PSS team relies on having the data available, therefore either type of database would be an acceptable solution.

However, the relational database may be a more realistic solution based on the advantages that it would offers more available support and offer more scalability. This would prove to be a crucial aspect for the PSS team given that Prime Engineering is a continually growing company in an industry that is not likely to be slowing down any time soon. The disadvantages also are not that applicable for the PSS team, in typical databases images or videos are not kept in the database or if they are it is for a specific application.

Alternatively, an object oriented database model could be used implemented and would work, but it would be a lot more work to scale the database up.

#### 4. Recommendations

It is highly recommended that Prime Engineering implements a database. This would increase efficiency for projects and provide better work place communication between different department as well as project managers. It is also recommended that Prime Engineering investigate implementing an office wide database, which then would give a quantifiable number for measuring performance of projects.

## General References:

- [1] Harrington, J. L. Relational Database Design and Implementation, Fourth Edition. Publisher: Morgan Kaufmann. 2016, Chapter 2-5.

## Image References:

- [2] Source URL:  
[https://www.ibm.com/support/knowledgecenter/en/SSB23S\\_1.1.0.14/gtpd1/oocon.html](https://www.ibm.com/support/knowledgecenter/en/SSB23S_1.1.0.14/gtpd1/oocon.html)
- [3] Source URL:  
<https://www.kisspng.com/png-relational-database-management-system-database-sch-741671/>