BTS Relational Database Implementation

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Executive Summary

Beaver Technology Solutions (BTS) is a fast-growing information technology consulting company that has a developing need to expand its business and allow for variability. Currently, they are utilizing a Google document that stores their customer information as well as the information for their current projects. This implementation has limitations and BTS is reaching a point where they need new methods of storing their information and to allow for better exploration of their current projects and employees. To achieve this, we have come up with a plan that involves utilizing a relational database to be able to store all their information as well as run queries on that data to be able to help BTS achieve its goals as a company. Included in the project is an ERD or conceptual design that visually lays out the relations between each table and expands on the ideas through a simple graphic that can be referenced to understand the implementation. From here, we have provided example tables as well as sample data that the company can refer to when seeing how the actual tables will be used. To further expand on top of the utilization of a relational database that we are recommending, we ran sample queries in our business reports to be able to prove just how useful this can be in solving the issues BTS is having with their current methods.

Introduction

Beavers Technology Solutions (BTS) is a company based in many major Oregon cities that offers information technology consulting. BTS sets up its work as projects, each representing a contract signed by BTS and the customer to provide the customer with an information technology-based solution to whatever problem they are addressing. BTS prides

itself on matching its projects with the employee best suited for the job, as the company's success depends on the customers' satisfaction with the finished product and their experience working with BTS. BTS uses a shared Google Sheet to house all the critical information for their current and upcoming projects. This includes the project ID, the customer's information, a project description, the date the contract was signed, an estimated start and end date, an estimated project budget, the actual end date, the actual cost, and the BTS employee assigned to the project (listed as the project manager). The general project information is used to assign the best-matching project manager. Once assigned to a project, the manager needs to create a more detailed project plan known as the "project schedule." This requires them to break up the project into tasks to which they assign a task ID, a description, start and end dates, the skills needed for the task, and the number of employees needed to complete the task. This system worked well for BTS when they were a smaller company. Still, as they have expanded and are looking to continue expanding, it is difficult to keep track of all the projects, tasks, and employees from multiple locations on one Google Sheet, so they want a more extensive database to house this information.

Information Requirement

Beavers Technology Solution (BTS) wants its new database to provide information on all current projects to increase efficiency and employee usage and ensure no projects are lost. BTS is struggling to view all of its current projects on its Google Sheet, so it wants the database to show an overview of the current projects and the current stage each project is in, as they can ensure no projects have been forgotten. They can offer the customer more accurate progress reports and project end dates. Additionally, an extensive database could more easily store past

projects so BTS can provide technological support after completing a project. Having an overview of the current project manager assignments would also help BTS ensure they are using their employees effectively; they have reported issues with some employees being assigned to too many projects while others have none, so having a database able to show the current assignments could solve this issue. BTS also wants all their locations to see all the current projects so employees can be shared to find the best matching employee for a project.

<u>Conceptual Design: ERD and Business Rules</u>
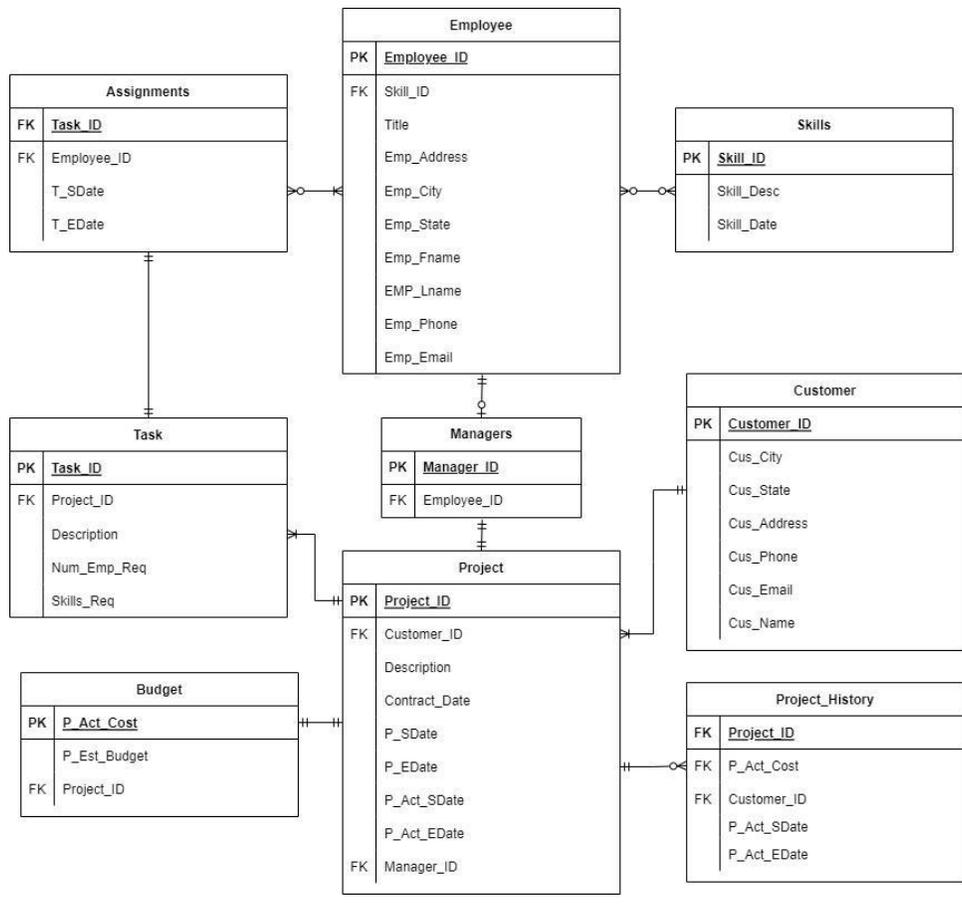

Figure 1.   *Entity Relationship Diagram with crow's foot notation denoting the connections. Primary keys are listed with PK and foreign keys are listed with FK*

Here is a visual representation of the tables that we recommend implementing into the relational database. Listed are the entities, the variables inside each entity, as well as the connections of each entity and how they relate to each other. Starting with the main entity, project, we can see that the rest of the database connects to this with several connections directly to it. Of important note, inside the project entity, we can see metadata that will be included with each project. This will be things like the date entered, the manager ID associated with who entered information, as well as metadata that will keep track of entries on the contract itself. Utilizing the metadata associated with these entries, we can confirm the exact dates on all of the proper entries. By allowing the entries to be tracked, accountability will be easier to keep track of as this data will be associated directly with the project ID and allow for easier searching of each characteristic of the project.

Utilizing foreign keys, the project as a whole will update throughout the database accordingly, allowing for easy storage of the proper information and easier tracking throughout the different departments in the company. For example, we can see a one-to-one connection between the Budget entity and the Project entity. From this, we can confirm that each project has one and only one proper budget entered into the project. Utilizing this connection we can further elaborate on the storage of proper information throughout the project history as well. Looking at the connection between the Project and Project_History entities, we see a one to zero-or-many relationship. This means that with each official project, we can then store the information on as many past projects as needed. Utilizing the foreign keys, this information is accurately entered. On this entity, there will also be other metadata involved besides just the information that came from the other fields. This will be things such as the date/time the information was last entered,

what employee last accessed the information, as well as a history of past updates on the

information.

Implementation: Tables and Sample Data

Project_ID	Customer_ID	Description	Contract_Date	P_SDate	P_EDate	P_Act_SDate	P_Act_EDate	Manager_ID
0000010000	0000000001	Small project	3/11/2024	3/12/2024	4/10/2024	3/13/2024	4/10/2024	0000001000
0000020000	0000000002	medium project	3/10/2024	3/11/2024	7/6/2024	3/11/2024	8/4/2024	0000002000
0000030000	0000000003	very important	3/9/2024	3/11/2024	8/6/2024	3/12/2024	7/31/2024	0000001000
0000040000	0000000004	save the world	1/24/2024	2/13/2024	3/5/2024	2/19/2024	4/26/2024	0000001000
0000050000	0000000005	defeat an evil ne	9/12/2023	10/10/2023	1/9/2024	1/8/2024	3/14/2024	0000002000

Table 1. Project Table

In this table, we store the most important information associated with the current projects

taking place. With Project_ID being the primary key, this has information regarding the

Customer_ID (foreign key), a brief description of the project itself, as well as the expected

start/end date that the customer will be told, and then another entry for the actual start/end date.

At the end of the table is a foreign key, Manager_ID, that will let BTS track which manager is in

charge of the project.

Project_ID	P_Act_Cost	Customer_ID	P_Act_SDate	P_Act_EDate
0000010000	150	0000000001	3/13/2024	4/10/2024
0000020000	2554	0000000002	3/11/2024	8/4/2024
0000030000	651898	0000000003	3/12/2024	7/31/2024

Table 2. Project_History Table

The Project History Table allows for easy storage of all important information associated

with previous projects that BTS has completed. The primary key of this table is the Project_ID

and has two foreign keys, P_Act_Cost as well as Customer_ID. This table allows for easy

storage of information from previous projects.

Customer_ID	Cus_City	Cus_State	Cus_Address	Cus_Phone	Cus_Email	Cus_Name
0000000001	Corvallis	OR	123 1st street	1111111111	JohnD@gmail.c	John Doe
0000000002	Albany	NY	234 2nd street	2222222222	JaneD@gmail.c	Jane Doe
0000000003	Salem	MA	345 3rd street	3333333333	BB@gmail.com	Benny Beaver
0000000004	New York	NY	456 4th street	4444444444	GW@gmail.com	George Washing
0000000005	Baltimore	MD	567 5th street	5555555555	AL@gmail.com	Abraham Lincol

Table 3. Customer Table

The Customer Table will have all the information needed about every customer that BTS

works with on various projects. The primary key of this table is the Customer_ID and included in

the table is important information such as their location and contact information.

Project_ID	P_Est_Budge	P_Act_Cost
0000010000	100	150
0000020000	20	2554
0000050000	123123	22222
0000040000	5688	88888
0000030000	6516	651898

Table 4. Budget Table

In the Budget Table, foreign keys are utilized to list the Project_ID. With each Project_ID

there is an estimated budget that is discussed with the clients. After this, is the P_Act_Cost which

has the cost of the total project and can either be the same as before or have an adjusted amount

based on requests throughout the project.

Skill_ID	Skill_Desc	Skill_Date
0000000010	typing	3/11/2024
0000000020	leadership	3/5/2024
0000000030	email	3/6/2024
0000000040	speaking spanisl	3/2/2024
0000000050	DBMS	3/1/2024

Table 5. Skills Table

Using a skills table, BTS will be able to have a list of all the skills that every employee can have or has had at one point. Skill_ID is the primary key and will be used to reference the associated skill. Skill_Desc will have a description of the skill itself and the date of when the skill either expires or is entered will be able to be entered into the Skill_Date section.

Task_ID	Project_ID	Description	Num_Emp_R	Skills_Req
0000100000	0000010000	make a chart	1	0000000050
0000200000	0000010000	do something	2	0000000050
0000300000	0000010000	write somethin,	3	0000000040
0000400000	0000020000	read a book	4	0000000040
0000500000	0000020000	watch a movie	5	0000000040

Table 6 Tasks Table

The Tasks table is used to have information on the specific tasks of each project and allows BTS to break down the project into an easy-to-read layout. Task_ID is the primary key and it references the project ID itself with a foreign key. It has information about the description, amount of employees needed, and what skills are required for each task.

Task_ID	Employee_ID	T_SDate	T_EDate
0000100000	0000000500	3/13/2024	3/14/2024
0000200000	0000000500	3/14/2024	3/16/2024
0000300000	0000000300	3/15/2024	3/22/2024
0000400000	0000000300	3/13/2024	4/12/2024
0000500000	0000000300	3/15/2024	5/16/2024

Table 7. Assignment Table

The Assignment Table uses several foreign keys, Task_ID and Employee_ID to show which employees are assigned to which task. This has the task start and task end date as well so that BTS can reference the table to see which employees are assigned to tasks and for how long.

Manager_ID	Employee_ID
0000001000	0000000400
0000002000	0000000100
0000003000	0000000200

Table 8. Manager Table

The Manager Table is a bridge entity that allows employees to be assigned manager IDs as they are promoted to project manager and then this enables the assignment of a manager to the actual projects. Manager_ID is the primary key here and references Employee_ID, a foreign key.

Employee_ID	Emp_Address	Skill_ID	Title	Emp_City	Emp_State	Emp_FName	Emp_LName	Emp_Phone	Emp_Email
0000000100	1 1st street	0000000010	Manager	Corvallis	OR	A	F	6666666666	E@gmail.com
0000000200	2 2nd street	0000000040	Manager	Corvallis	MT	B	G	7777777777	M@gmail.com
0000000300	3 3rd street	0000000040	Intern	Albany	NY	C	H	8888888888	A@gmail.com
0000000400	4 4th street	0000000020	Manager	New York	NY	D	I	9999999999	I@gmail.com
0000000500	5 5th street	0000000050	Intern	Albany	OR	E	J	0111111111	L@gmail.com

Table 9. Employee Table

The Employee Table is the largest table, with the most variables included in it. This is crucial as BTS needs to prioritize having the most optimal employee assignments for each project. With Employee_ID being the primary key, from here each row lists information about said employee. This has their skill IDs, title in the company, where they are located, and what their contact information is. By referencing the employee table, BTS can ensure that when they are assigning employees to projects, it is the best match.

Business Reports

Business Report 1

Project_ID	Customer	EstimatedBudget	Actual Cost	Description	Start Date	End Date
Projected Completed in the Year 2024					
0000010000	John Doe	100	150	Small project	12-Mar-24	10-Apr-24
0000020000	Jane Doe	100	150	medium project	11-Mar-24	06-Jul-24
0000030000	Benny Beaver	100	150	very important	11-Mar-24	06-Aug-24
0000040000	George Washingl	100	150	save the world	13-Feb-24	05-Mar-24
0000010000	John Doe	20	2554	Small project	12-Mar-24	10-Apr-24
0000020000	Jane Doe	20	2554	medium project	11-Mar-24	06-Jul-24
0000030000	Benny Beaver	20	2554	very important	11-Mar-24	06-Aug-24
0000040000	George Washingl	20	2554	save the world	13-Feb-24	05-Mar-24
0000010000	John Doe	123123	22222	Small project	12-Mar-24	10-Apr-24
0000020000	Jane Doe	123123	22222	medium project	11-Mar-24	06-Jul-24
0000030000	Benny Beaver	123123	22222	very important	11-Mar-24	06-Aug-24
0000040000	George Washingl	123123	22222	save the world	13-Feb-24	05-Mar-24
0000010000	John Doe	5688	88888	Small project	12-Mar-24	10-Apr-24
0000020000	Jane Doe	5688	88888	medium project	11-Mar-24	06-Jul-24
0000030000	Benny Beaver	5688	88888	very important	11-Mar-24	06-Aug-24
0000040000	George Washingl	5688	88888	save the world	13-Feb-24	05-Mar-24
0000010000	John Doe	6516	651898	Small project	12-Mar-24	10-Apr-24
0000020000	Jane Doe	6516	651898	medium project	11-Mar-24	06-Jul-24
0000030000	Benny Beaver	6516	651898	very important	11-Mar-24	06-Aug-24
0000040000	George Washingl	6516	651898	save the world	13-Feb-24	05-Mar-24

Description:

This report shows the projects that have been finished within the Year 2024 so far. It shows the ProjectID, Customer Name, Estimated Budget, Actual Cost, Description of the project, and the start and end date of the project. This report would serve as a good summary of what the company has done so far

in the year and would be able to highlight some big projects they've completed and new customers they've worked with.

SQL Query:

Select Project.Project_ID, Customer.Cus_Name As [Customer], Budget.P_Est_Budget As [EstimatedBudget], Budget.P_Act_Cost As [Actual Cost], Project.Description, Project.P_SDate As [Start Date], Project.P_EDate As [End Date]

From Project, Budget, Customer

Where Year(Project.P_SDate) = 2024 And Project.Customer_ID = Customer.Customer_ID

Business Report 2

Task Summary for the Most Recent Project				
Employee First Name	Employee Last Name	Task Description	Task Start Date	Task End Date
E	J	make a chart	13-Mar-24	14-Mar-24
E	J	do something	14-Mar-24	16-Mar-24
C	H	write something	15-Mar-24	22-Mar-24
C	H	read a book	13-Mar-24	12-Apr-24
C	H	watch a movie	15-Mar-24	16-May-24

Description:

This Report shows a task summary for the most recent project finished. It shows the Employee's First Name, Last Name, and the Task they completed, along with the start and end date. This would be used as a way to reflect on what everyone did in the project.

SQL Query:

Select Employee.Emp_FName As [EmployeeFirstName], Employee.Emp_LName As

[EmployeeLastName], Task.Description As [TaskDescription], Assignments.T_SDate As

[TaskStartDate], Assignments.T_EDate As [TaskEndDate]

From Employee, Task, Assignments, Project

Where Employee.Employee_ID = Assignments.Employee_ID And Assignments.Task_ID =

Task.Task_ID And Project.Project_ID = "0000010000"

Business Report 3

Employee's and Their Skills				
Employee First Name	Employee Last Name	Employee City	Skills	Employee Phone Number
A	F	Corvallis	typing	(666) 666-6666
D	I	New York	leadership	(999) 999-9999
B	G	Corvallis	speaking spanish	(777)777-7777
C	H	Albany	speaking spanish	(888) 888-8888
E	J	Albany	DBMS	(011) 111-1111

Description:

This report shows a list of employees and the skills that that particular employee has.

This could be useful for managers so that they can allocate that employee to a project that suits

their particular skills. It lists their first and last names, city, skills, and their phone number.

SQL Query:

Select Employee.Emp_FName As [EmployeeFirstName], Employee.Emp_LName As

[EmployeeLastName], Employee.Emp_City As [Employee City], Skills.Skill_Desc As Skills,

Employee.Emp_Phone As [EmployeePhoneNumber]

From Employee, Skills

Where Skills.Skill_ID = Employee.Skill_ID

Example Data:

These reports used data from the tables Project, Project History, Customer, Budget, Skills, Task, Assignments, Managers, and Employee.

<u>Conclusion</u>

As Beaver Technology Solutions continues to grow as a company, it's crucial that their technology and database systems grow with them and allow room for future expansion. Evolving from a google docs to a relational database will allow BTS to continue to expand into the market of information technology consulting and have the competitive advantage required to stand out in a saturated market. By utilizing the relational database that we have laid out for them, BTS will be able to tackle a variety of new challenges. They can do this while still remaining true to their core business model of bringing customer satisfaction through employee skill matching based on project requirements. With a firm foundation to rely on, additions of new tables in a relational database are simple to connect to the existing database and can help amplify BTS' business as a whole. Utilizing queries on the relational database, BTS will be capable of sorting through their data and information they have stored to figure out new ways to expand in the market. With new capabilities they can learn how to focus on what matters most and streamline operations, providing a better business model that will attract customers. Adding in the relational database methods that we have provided, will help ensure continued prosperity and higher revenues throughout all operations at Beaver Technology Solutions.