

# CPSC 304 Project Cover Page

**Milestone #: 4**

**Date: August 4, 2024**

**Group Number: 32**

Name	Student Number	CS Alias (Userid)	Preferred E-mail Address
Aditya Goel	84873279	c3a6w	agoel25@student.ubc.ca
Ashmit Gupta	38002341	h6e5w	ashmitg229@gmail.com
Kaz Tahara-Edmonds	50257658	b1v9c	kazkte@gmail.com

**By typing our names and student numbers in the above table, we certify that the work in the attached assignment was performed solely by those whose names and student IDs are included above. (In the case of Project Milestone 0, the main purpose of this page is for you to let us know your e-mail address, and then let us assign you to a TA for your project supervisor.)**

**In addition, we indicate that we are fully aware of the rules and consequences of plagiarism, as set forth by the Department of Computer Science and the University of British Columbia**

## Project Description

Our project models a cloud service provider, offering customers the ability to create, update and delete projects to use the offered services. Users can utilize various services, create instances and view detailed metrics and information about the services and instances. An admin console is also available to view all the information throughout the system in one place. Additionally, users can also select filtering conditions to sort through services and find exactly what they need. Error handling and SQL injection safety has been added throughout the application.

## Schema Differences

1. Changed CardNumber from INTEGER data type to CHAR(16) in PaymentInfo, BillingInfo and Bills because 'Integer' type in Java cannot handle such a long range of values and card numbers have to be 16 digits long.
2. Removed all ON UPDATE SET DEFAULT clauses because oracleDB doesn't support this operation.
3. Add PartnerEmail to Project Table: Fulfilled a rubric item for INSERT query by adding a foreign key (PartnerEmail) that can be set to NULL, allowing backend error handling and user notification.
4. Project Table: the name has been set to unique as that fit our requirements better

## SQL Initialization

1. Customer(Email, Name, PhoneNumber, Password, Address)

EMAIL	NAME	PHONENUMBER	PASSWORD	ADDRESS
john.doe@dummy.com	John Doe	1234567890	password	9090 main st, Vancouver
james.w@dummy.com	James Welch	2345678901	security1	212 oak st, Tokyo
arjund122@dummy.com	Arjun Div	3456789012	12345pass	1009 nh 29, New Delhi
jin.park@dummy.com	Jin Park	4567890123	password	Blue springs, Seoul
jane.doe@dummy.com	Jane Doe	5678901234	num123	2100 Student Union, Vancouver

2. PartOf(Email, ProjectID)

EMAIL	PROJECTID
arjund122@dummy.com	3
james.w@dummy.com	2
james.w@dummy.com	6
james.w@dummy.com	7
james.w@dummy.com	8
jane.doe@dummy.com	5
jin.park@dummy.com	4
john.doe@dummy.com	1
john.doe@dummy.com	6
john.doe@dummy.com	7
john.doe@dummy.com	8

### 3. Project(ProjectID, Name, Description, CreationDate, Status, PartnerEmail)

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
1	Migrate	Migrating app to cloud	20-JUL-24	Active	james.w@dummy.com
2	Analytics	Cloud analytics	20-JUL-24	Active	john.doe@dummy.com
3	OpsPipeline	Operations Pipeline	20-JUL-24	Active	john.doe@dummy.com
4	ModelTraining	AI models on cloud GPU	20-JUL-24	Active	john.doe@dummy.com
5	Store	Cloud storage	20-JUL-24	Active	john.doe@dummy.com
6	Optimization	Optimizing all workflows	20-JUL-24	Active	james.w@dummy.com
7	DevOps	Creating DevOps workflows	20-JUL-24	Active	james.w@dummy.com
8	Networking	Creating a cloud network	20-JUL-24	Active	james.w@dummy.com

### 4. PaymentInfo(CardNumber, Email, CVV, PostalCode, ExpiryDate, IsDefault)

CARDNUMBER	EMAIL	CVV	POSTALCODE	EXPIRYDAT	ISDEF
4536123465366009	john.doe@dummy.com	1	V6T1Z2	01-DEC-24	TRUE
7878932100108375	james.w@dummy.com	900	135-0016	01-DEC-25	TRUE
2233600070708181	arjund122@dummy.com	500	110001	31-DEC-24	TRUE
2378001083456789	j.in.park@dummy.com	400	01014	30-JUN-26	TRUE
0101999963531010	jane.doe@dummy.com	249	89116	25-MAY-25	TRUE
1763867695430090	john.doe@dummy.com	234	145-0654	01-JUN-29	FALSE
0065142595430090	john.doe@dummy.com	982	1205	03-MAR-27	FALSE

### 5. AddressInfo(PostalCode, City, Country)

POSTALCODE	CITY	COUNTRY
V6T1Z2	Vancouver	Canada
135-0016	Tokyo	Japan
110001	New Delhi	India
01014	Seoul	South Korea
89116	Las Vegas	United States
145-0654	Kyoto	Japan
1205	Geneva	Switzerland

### 6. BillingInfo(CardNumber, PaymentType)

CARDNUMBER	PAYMEN
4536123465366009	Credit
7878932100108375	Credit
2233600070708181	Credit
2378001083456789	Credit
0101999963531010	Credit
1763867695430090	Debit
0065142595430090	Debit

### 7. CustomerUsesService(Email, Name)

EMAIL	NAME
arjund122@dummy.com	GPUB
james.w@dummy.com	authIt
jane.doe@dummy.com	cSQL
j.in.park@dummy.com	RapidX
john.doe@dummy.com	authIt
john.doe@dummy.com	gamma

### 8. ProjectUsesService(ProjectID, Name)

PROJECTID	NAME
1	GPUB
1	RapidX
1	RapidZ
1	aSQL
1	authIt
1	bSQL
1	beta
1	cSQL
1	dSQL
1	eSQL
1	gamma
PROJECTID	NAME
1	gigaGPU
1	mlGPU
1	veryFy
1	veryFyIt
2	RapidX
3	RapidX
4	RapidX
5	RapidX
6	GPUB
6	RapidX
6	RapidZ
PROJECTID	NAME
6	aSQL
6	authIt
6	bSQL
6	beta
6	cSQL
6	dSQL
6	eSQL
6	gamma
6	gigaGPU
6	mlGPU
6	veryFy
PROJECTID	NAME
6	veryFyIt
7	GPUB
7	RapidX
7	authIt
7	cSQL
7	dSQL
7	gamma
7	mlGPU
8	RapidX

## 9. ServiceType(Type, CostType)

TYPE	COSTTYPE
Serverless	PerJob
Authentication	PerUser
GPUCompute	PerDay
HPC	PerDay
Database	PerQuery

## 10. ServiceDetails(Name, Type, Description, Status, CostPerUnit)

NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
gamma	Serverless	Handling serverless functions	Active	2
authIt	Authentication	Authentication with large capacity	Active	2
GPUB	GPUCompute	GPU-based rendering service	Active	10
RapidX	HPC	High performance computing service	Active	3
cSQL	Database	Cloud SQL database service	Active	3
dSQL	Database	Dynamic SQL	Active	1
veryFy	Authentication	Faster authentication	Active	3
gigaGPU	GPUCompute	GPU-based gaming	Active	10
mlGPU	GPUCompute	GPU-based ML training	Active	9
aSQL	Database	Agile SQL	Active	1
bSQL	Database	Broadcom SQL	Active	1
NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
eSQL	Database	Eth SQL	Active	1
RapidZ	HPC	Better High performance computing service	Active	3
beta	Serverless	Handling serverless functions slower	Active	2
veryFyIt	Authentication	Even faster authentication	Active	3

11. Storage(**Name**, Capacity, Latency)

NAME	CAPACITY	LATENCY
cSQL	300	7
dSQL	200	9
aSQL	100	7
bSQL	200	7
eSQL	500	7

12. Compute(**Name**, CPUCores, MaxMemory)

NAME	CPUCORES	MAXMEMORY
GPUB	32	128
gigaGPU	8	128
mlGPU	32	1024
RapidX	16	64
RapidZ	16	64

13. Functional(**Name**, Timeout, ConcurrencyLimit)

NAME	TIMEOUT	CONCURRENCYLIMIT
gamma	300	10
authIt	200	20
veryFy	200	40
veryFyIt	200	40
beta	200	70

14. Region(**Name**, Location, Capacity, Status)

NAME	LOCATION	CAPACITY	STATUS
us-east-1	Virginia	500	Active
us-east-2	Oregon	500	Active
eu-central-1	Frankfurt	300	Active
eu-west-1	Ireland	300	Active
sa-east-1	Caracas	200	Active

15. AvailableIn(**ServiceName**, **RegionName**)

SERVICENAME	REGIONNAME
GPUB	eu-central-1
GPUB	us-east-1
RapidX	eu-west-1
RapidX	us-east-1
RapidZ	us-east-1
aSQL	us-east-1
authIt	us-east-1
authIt	us-east-2
bSQL	us-east-1
beta	us-east-1
cSQL	sa-east-1
SERVICENAME	REGIONNAME
cSQL	us-east-1
dSQL	us-east-1
eSQL	us-east-1
gamma	us-east-1
gigaGPU	us-east-1
mlGPU	us-east-1
veryFy	us-east-1
veryFyIt	us-east-1

16. ProjectSecurity(**ProjectID**, SecurityGroupID)

PROJECTID	SECURITYGROUPID
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

17. SecurityProtocol(**InboundProtocol**, OutboundProtocol)

INBOUNDPROTOCOL	OUTBOUNDPROTOCOL
HTTP	TCP
HTTPS	UDP
FTP	SNMP
SMTP	DNS
IMAP	TLS
SSH	SSL
SFTP	FTP
ICMP	TCP

## 18. SecurityInfo(ProjectID, Name, InboundProtocol, CreationDate)

PROJECTID	NAME	INBOUNDPROTOCOL	CREATIOND
1	HyperText Transfer Protocol	HTTP	21-JUL-24
2	HyperText Transfer Protocol Secure	HTTPS	21-JUL-24
3	File Transfer Protocol	FTP	21-JUL-24
4	Simple Mail Transfer Protocol	SMTP	21-JUL-24
5	Internet Message Access Protocol	IMAP	21-JUL-24
6	Secure Shell	SSH	21-JUL-24
7	Secure File Transfer Protocol	SFTP	21-JUL-24
8	Internet Control Message Protocol	ICMP	21-JUL-24

## 19. ServerTypeInfo(ServerType, Memory, Storage, OS, CPUCores)

SERVERTYPE	MEMORY	STORAGE	OS	CPUCORES
functional.micro	1	8	Linux	1
functional.large	8	32	Linux	4
compute.large	8	64	Linux	16
compute.xlarge	16	128	Linux	32
storage.large	32	1024	Windows	8

## 20. ServerInfo(ServerID, Name, ServerType, Status, Uptime, CreatedAt, UpdatedAt)

SERVID	NAME	SERVERTYPE	STATUS	UPTIME	CREATEDAT	UPDATEDAT
101	us-east-1	functional.micro	Active	1000	04-JAN-24	15-JUL-24
102	us-east-2	functional.large	Active	800	05-JAN-24	16-JUL-24
103	eu-central-1	compute.large	Active	600	01-FEB-24	16-JUL-24
104	eu-west-1	compute.xlarge	Active	1200	11-JUL-24	16-JUL-24
105	sa-east-1	storage.large	Inactive	300	16-JUL-24	16-JUL-24

## 21. Instance(InstanceID, Name, ServerID, ProjectID, Type, TotalCost, Status, LaunchDate, StopDate)

INSTANCEID	NAME	SERVID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
1	gamma	101	1	micro	100	Running	20-JUL-24	
2	authIt	102	2	large	140	Running	20-JUL-24	
3	GPUB	103	3	large	140	Running	20-JUL-24	
4	RapidX	104	4	xlarge	200	Running	20-JUL-24	
5	cSQL	105	2	large	130	Running	16-JUL-24	
15	cSQL	105	2	xlarge	130	Running	16-JUL-24	
16	cSQL	105	2	xlarge	170	Running	16-JUL-24	
6	gamma	101	1	micro	100	Running	20-JUL-24	
7	gamma	101	1	micro	90	Running	20-JUL-24	
8	gamma	101	1	large	120	Running	20-JUL-24	
9	gamma	101	1	large	130	Running	20-JUL-24	
INSTANCEID	NAME	SERVID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
10	gamma	101	1	large	120	Running	20-JUL-24	
11	gamma	101	1	xlarge	180	Running	20-JUL-24	
12	gamma	101	1	xlarge	170	Running	20-JUL-24	
13	gamma	101	1	xlarge	200	Running	20-JUL-24	
14	gamma	101	1	medium	110	Running	20-JUL-24	

## 22. Bills(InstanceID, Email, CardNumber, Cost)

INSTANCEID	EMAIL	CARDNUMBER	COST
1	john.doe@dummy.com	4536123465366009	500
2	james.w@dummy.com	7878932100108375	244
3	arjund122@dummy.com	2233600070708181	306
4	j.in.park@dummy.com	2378001083456789	123
5	jane.doe@dummy.com	0101999963531010	890
6	john.doe@dummy.com	4536123465366009	400

# SQL Queries

## Important Notes:

- 1. All queries required for the change have been listed in the list
- 2. Question marks in the queries indicate user input
- 3. All queries are located in file DatabaseConnectionHandler.java

## INSERT:

- INSERT INTO project VALUES (?, ?, ?, ?, ?, ?) [Line: 152]
- INSERT INTO PartOf VALUES (?, ?) [Line: 169]
- INSERT INTO ProjectSecurity VALUES (?, ?) [Line: 182]
- INSERT INTO PartOf VALUES (?, ?) [Line: 196]

## Before:

### Project

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
1	Migrate	Migrating app to cloud	20-JUL-24	Active	james.w@dummy.com
2	Analytics	Cloud analytics	20-JUL-24	Active	john.doe@dummy.com
3	OpsPipeline	Operations Pipeline	20-JUL-24	Active	john.doe@dummy.com
4	ModelTraining	AI models on cloud GPU	20-JUL-24	Active	john.doe@dummy.com
5	Store	Cloud storage	20-JUL-24	Active	john.doe@dummy.com
6	Optimization	Optimizing all workflows	20-JUL-24	Active	james.w@dummy.com
7	DevOps	Creating DevOps workflows	20-JUL-24	Active	james.w@dummy.com
8	Networking	Creating a cloud network	20-JUL-24	Active	james.w@dummy.com

### PartOf

EMAIL	PROJECTID
arjund122@dummy.com	3
james.w@dummy.com	2
james.w@dummy.com	6
james.w@dummy.com	7
james.w@dummy.com	8
jane.doe@dummy.com	5
jin.park@dummy.com	4
john.doe@dummy.com	1
john.doe@dummy.com	6
john.doe@dummy.com	7
john.doe@dummy.com	8

### ProjectSecurity

PROJECTID	SECURITYGROUPID
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8



During:

Create New Project

Cloud Operations

Creating a new Cloud Operation

james.w@dummy.com

Create ProjectClose

After:

Project

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
9	Cloud Operations	Creating a new Cloud Operation	05-AUG-24	active	james.w@dummy.com
1	Migrate	Migrating app to cloud	20-JUL-24	Active	james.w@dummy.com
2	Analytics	Cloud analytics	20-JUL-24	Active	john.doe@dummy.com
3	OpsPipeline	Operations Pipeline	20-JUL-24	Active	john.doe@dummy.com
4	ModelTraining	AI models on cloud GPU	20-JUL-24	Active	john.doe@dummy.com
5	Store	Cloud storage	20-JUL-24	Active	john.doe@dummy.com
6	Optimization	Optimizing all workflows	20-JUL-24	Active	james.w@dummy.com
7	DevOps	Creating DevOps workflows	20-JUL-24	Active	james.w@dummy.com
8	Networking	Creating a cloud network	20-JUL-24	Active	james.w@dummy.com

PartOf

EMAIL	PROJECTID
arjund122@dummy.com	3
james.w@dummy.com	2
james.w@dummy.com	6
james.w@dummy.com	7
james.w@dummy.com	8
james.w@dummy.com	9
jane.doe@dummy.com	5
jin.park@dummy.com	4
john.doe@dummy.com	1
john.doe@dummy.com	6
john.doe@dummy.com	7
john.doe@dummy.com	8
john.doe@dummy.com	9

ProjectSecurity

PROJECTID	SECURITYGROUPID
9	9
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

DELETE [Line: 251]

- DELETE FROM project WHERE ProjectID = ?

Before:

Project

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
1	Migrate	Migrating app to cloud	20-JUL-24	Active	james.w@dummy.com
2	Analytics	Cloud analytics	20-JUL-24	Active	john.doe@dummy.com
3	OpsPipeline	Operations Pipeline	20-JUL-24	Active	john.doe@dummy.com
4	ModelTraining	AI models on cloud GPU	20-JUL-24	Active	john.doe@dummy.com
5	Store	Cloud storage	20-JUL-24	Active	john.doe@dummy.com
6	Optimization	Optimizing all workflows	20-JUL-24	Active	james.w@dummy.com
7	DevOps	Creating DevOps workflows	20-JUL-24	Active	james.w@dummy.com
8	Networking	Creating a cloud network	20-JUL-24	Active	james.w@dummy.com

PartOf

EMAIL	PROJECTID
arjund122@dummy.com	3
james.w@dummy.com	2
james.w@dummy.com	6
james.w@dummy.com	7
james.w@dummy.com	8
jane.doe@dummy.com	5
jin.park@dummy.com	4
john.doe@dummy.com	1
john.doe@dummy.com	6
john.doe@dummy.com	7
john.doe@dummy.com	8

ProjectSecurity

PROJECTID	SECURITYGROUPID
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8

ProjectUsesService

PROJECTID	NAME
1	GPUB
1	RapidX
1	RapidZ
1	aSQL
1	authIt
1	bSQL
1	beta
1	cSQL
1	dSQL
1	eSQL
1	gamma

PROJECTID	NAME
1	gigaGPU
1	mlGPU
1	veryFy
1	veryFyIt
2	RapidX
3	RapidX
4	RapidX
5	RapidX
6	GPUB
6	RapidX
6	RapidZ

PROJECTID	NAME
6	aSQL
6	authIt
6	bSQL
6	beta
6	cSQL
6	dSQL
6	eSQL
6	gamma
6	gigaGPU
6	mlGPU
6	veryFy

PROJECTID	NAME
6	veryFyIt
7	GPUB
7	RapidX
7	authIt
7	cSQL
7	dSQL
7	gamma
7	mlGPU
8	RapidX

During (Deleting projectID = 1):

Projects

Migrate

Migrating app to cloud

View

Edit

Optimization

Optimizing all workflows

View

Edit

DevOps

Creating DevOps workflows

View

Edit

Networking

Creating a cloud network

View

Edit

After:

GUI:

Projects

Optimization

Optimizing all workflows

View

Edit

DevOps

Creating DevOps workflows

View

Edit

Networking

Creating a cloud network

View

Edit

Project:

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
2	Analytics	Cloud analytics	28-JUL-24	Active	john.doe@dummys.com
3	OpsPipeline	Operations Pipeline	28-JUL-24	Active	john.doe@dummys.com
4	ModelTraining	AI models on cloud GPU	28-JUL-24	Active	john.doe@dummys.com
5	Store	Cloud storage	28-JUL-24	Active	john.doe@dummys.com
6	Optimization	Optimizing all workflows	28-JUL-24	Active	james.w@dummys.com
7	DevOps	Creating DevOps workflows	28-JUL-24	Active	james.w@dummys.com
8	Networking	Creating a cloud network	28-JUL-24	Active	james.w@dummys.com

PartOf

EMAIL	PROJECTID
arjund122@dummys.com	3
james.w@dummys.com	2
james.w@dummys.com	6
james.w@dummys.com	7
james.w@dummys.com	8
jane.doe@dummys.com	5
j.in.park@dummys.com	4
john.doe@dummys.com	6
john.doe@dummys.com	7
john.doe@dummys.com	8

ProjectSecurity

PROJECTID	SECURITYGROUPID
2	2
3	3
4	4
5	5
6	6
7	7
8	8

ProjectUsesService

PROJECTID	NAME
2	RapidX
3	RapidX
4	RapidX
5	RapidX
6	GPUB
6	RapidX
6	RapidZ
6	aSQL
6	authIt
6	bSQL
6	beta
PROJECTID	NAME
6	cSQL
6	dSQL
6	eSQL
6	gamma
6	gigaGPU
6	mLGPU
6	veryFy
6	veryFyIt
7	GPUB
7	RapidX
7	authIt
PROJECTID	NAME
7	cSQL
7	dSQL
7	gamma
7	mLGPU
8	RapidX

UPDATE [Line: 99]

- UPDATE project SET Name = ?, Description = ?, CreationDate = ?, Status = ?  
WHERE ProjectID = ?

Before:

Project

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
2	Analytics	Cloud analytics	20-JUL-24	Active	john.doe@dumy.com
3	OpsPipeline	Operations Pipeline	20-JUL-24	Active	john.doe@dumy.com
4	ModelTraining	AI models on cloud GPU	20-JUL-24	Active	john.doe@dumy.com
5	Store	Cloud storage	20-JUL-24	Active	john.doe@dumy.com
6	Optimization	Optimizing all workflows	20-JUL-24	Active	james.w@dumy.com
7	DevOps	Creating DevOps workflows	20-JUL-24	Active	james.w@dumy.com
8	Networking	Creating a cloud network	20-JUL-24	Active	james.w@dumy.com

During (Editing project ID = 1):

Edit Project

Migrate New Version

Migrating app to cloud New

Closed

Update Project

Close

After:

GUI:

Projects

Migrate New Version

Migrating app to cloud New

View

Edit

Project

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
1	Migrate New Version	Migrating app to cloud New	20-JUL-24	Closed	james.w@dumy.com
2	Analytics	Cloud analytics	20-JUL-24	Active	john.doe@dumy.com
3	OpsPipeline	Operations Pipeline	20-JUL-24	Active	john.doe@dumy.com
4	ModelTraining	AI models on cloud GPU	20-JUL-24	Active	john.doe@dumy.com
5	Store	Cloud storage	20-JUL-24	Active	john.doe@dumy.com
6	Optimization	Optimizing all workflows	20-JUL-24	Active	james.w@dumy.com
7	DevOps	Creating DevOps workflows	20-JUL-24	Active	james.w@dumy.com
8	Networking	Creating a cloud network	20-JUL-24	Active	james.w@dumy.com

## Selection [Line: 538]

- SELECT \* FROM ServiceDetails WHERE + whereQuery (whereQuery variable is passed from the front end)

Before:

### Service Details

NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
gamma	Serverless	Handling serverless functions	Active	2
authIt	Authentication	Authentication with large capacity	Active	2
GPub	GPUCompute	GPU-based rendering service	Active	10
RapidX	HPC	High performance computing service	Active	3
cSQL	Database	Cloud SQL database service	Active	3
dSQL	Database	Dynamic SQL	Active	1
veryFy	Authentication	Faster authentication	Active	3
gigaGPU	GPUCompute	GPU-based gaming	Active	10
mlGPU	GPUCompute	GPU-based ML training	Active	9
aSQL	Database	Agile SQL	Active	1
bSQL	Database	Broadcom SQL	Active	1
NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
eSQL	Database	Eth SQL	Active	1
RapidZ	HPC	Better High performance computing service	Active	3
beta	Serverless	Handling serverless functions slower	Active	2
veryFyIt	Authentication	Even faster authentication	Active	3

During:

### Admin Content

Add Condition

Type

=

Serverless

OR

Remove

Type

=

Database

AND

Remove

CostPerUnit

=

3

Remove

Show

### Selection Result

Name	Type	Description	Status	CostPerUnit
gamma	Serverless	Handling serverless functions	Active	2
cSQL	Database	Cloud SQL database service	Active	3
beta	Serverless	Handling serverless functions slower	Active	2

After: No tables affected

## Projection [Line: 565]

- SELECT + attributes + FROM + relation (attributes and relation variables are passed from the front end)

Before:

Instance:

INSTANCEID	NAME	SERVERID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
1	gamma	101	1	micro	100	Running	20-JUL-24	
2	authIt	102	2	large	140	Running	20-JUL-24	
3	GPUB	103	3	large	140	Running	20-JUL-24	
4	RapidX	104	4	xlarge	200	Running	20-JUL-24	
5	cSQL	105	2	large	130	Running	16-JUL-24	
15	cSQL	105	2	xlarge	130	Running	16-JUL-24	
16	cSQL	105	2	xlarge	170	Running	16-JUL-24	
6	gamma	101	1	micro	100	Running	20-JUL-24	
7	gamma	101	1	micro	90	Running	20-JUL-24	
8	gamma	101	1	large	120	Running	20-JUL-24	
9	gamma	101	1	large	130	Running	20-JUL-24	
INSTANCEID	NAME	SERVERID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
10	gamma	101	1	large	120	Running	20-JUL-24	
11	gamma	101	1	xlarge	180	Running	20-JUL-24	
12	gamma	101	1	xlarge	170	Running	20-JUL-24	
13	gamma	101	1	xlarge	200	Running	20-JUL-24	
14	gamma	101	1	medium	110	Running	20-JUL-24	

During:

Admin Content

Select Table:

Instance

Select Attribute:

Select an attribute

Selected Attributes

Name

Remove

ProjectID

Remove

ServerID

Remove

Type

Remove

LaunchDate

Remove

TotalCost

Remove

Show Attributes From Database

Projection Result

Name	ProjectID	ServerID	Type	LaunchDate	TotalCost
gamma	1	101	micro	2024-07-20 00:00:00	100
authIt	2	102	large	2024-07-20 00:00:00	140
GPUB	3	103	large	2024-07-20 00:00:00	140
RapidX	4	104	xlarge	2024-07-20 00:00:00	200
cSQL	2	105	large	2024-07-16 00:00:00	130
cSQL	2	105	xlarge	2024-07-16 00:00:00	130
cSQL	2	105	xlarge	2024-07-16 00:00:00	170
gamma	1	101	micro	2024-07-20 00:00:00	100
gamma	1	101	micro	2024-07-20 00:00:00	90
gamma	1	101	large	2024-07-20 00:00:00	120
gamma	1	101	large	2024-07-20 00:00:00	130
gamma	1	101	large	2024-07-20 00:00:00	120
gamma	1	101	xlarge	2024-07-20 00:00:00	180
gamma	1	101	xlarge	2024-07-20 00:00:00	170
gamma	1	101	xlarge	2024-07-20 00:00:00	200
gamma	1	101	medium	2024-07-20 00:00:00	110

After: Does not affect any tables

## Join [Line: 268 - 270]

- SELECT ServiceDetails.Name, ServiceDetails.Description,  
ServiceDetails.Status, ServiceDetails.CostPerUnit, ServiceType.Type,  
ServiceType.CostType  
FROM ProjectUsesService  
JOIN ServiceDetails ON ProjectUsesService.Name = ServiceDetails.Name  
JOIN ServiceType ON ServiceDetails.Type = ServiceType.Type WHERE  
ProjectUsesService.ProjectID = ?

## Before:

## ProjectUsesService:

PROJECTID	NAME
1	GPub
1	RapidX
1	RapidZ
1	aSQL
1	authIt
1	bSQL
1	beta
1	cSQL
1	dSQL
1	eSQL
1	gamma

PROJECTID	NAME
1	gigaGPU
1	mLGPU
1	veryFy
1	veryFyIt
2	RapidX
3	RapidX
4	RapidX
5	RapidX
6	GPub
6	RapidX
6	RapidZ

PROJECTID	NAME
6	aSQL
6	authIt
6	bSQL
6	beta
6	cSQL
6	dSQL
6	eSQL
6	gamma
6	gigaGPU
6	mLGPU
6	veryFy

PROJECTID	NAME
6	veryFyIt
7	GPub
7	RapidX
7	authIt
7	cSQL
7	dSQL
7	gamma
7	mLGPU
8	RapidX



## ServiceDetails

NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
gamma	Serverless	Handling serverless functions	Active	2
authIt	Authentication	Authentication with large capacity	Active	2
GPUB	GPUCompute	GPU-based rendering service	Active	10
RapidX	HPC	High performance computing service	Active	3
cSQL	Database	Cloud SQL database service	Active	3
dSQL	Database	Dynamic SQL	Active	1
veryFy	Authentication	Faster authentication	Active	3
gigaGPU	GPUCompute	GPU-based gaming	Active	10
mlGPU	GPUCompute	GPU-based ML training	Active	9
aSQL	Database	Agile SQL	Active	1
bSQL	Database	Broadcom SQL	Active	1
NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
eSQL	Database	Eth SQL	Active	1
RapidZ	HPC	Better High performance computing service	Active	3
beta	Serverless	Handling serverless functions slower	Active	2
veryFyIt	Authentication	Even faster authentication	Active	3

## ServiceType:

TYPE	COSTTYPE
Serverless	PerJob
Authentication	PerUser
GPUCompute	PerDay
HPC	PerDay
Database	PerQuery

## During (ran for ProjectID=7):

### DevOps

Creating DevOps workflows

#### Services

gamma

Add Instance

authIt

Add Instance

GPUB

Add Instance

RapidX

Add Instance

cSQL

Add Instance

dSQL

Add Instance

mlGPU

Add Instance

After: Does not affect any tables.

## Aggregation with GROUP BY [Line: 591]

- SELECT Type, SUM(TotalCost) AS TotalCost FROM Instance WHERE ProjectID = ? GROUP BY Type

Before:

INSTANCEID	NAME	SERVERID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
1	gamma	101	1	micro	100	Running	20-JUL-24	
2	authIt	102	2	large	140	Running	20-JUL-24	
3	GPUB	103	3	large	140	Running	20-JUL-24	
4	RapidX	104	4	xlarge	200	Running	20-JUL-24	
5	cSQL	105	2	large	130	Running	16-JUL-24	
15	cSQL	105	2	xlarge	130	Running	16-JUL-24	
16	cSQL	105	2	xlarge	170	Running	16-JUL-24	
6	gamma	101	1	micro	100	Running	20-JUL-24	
7	gamma	101	1	micro	90	Running	20-JUL-24	
8	gamma	101	1	large	120	Running	20-JUL-24	
9	gamma	101	1	large	130	Running	20-JUL-24	
INSTANCEID	NAME	SERVERID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
10	gamma	101	1	large	120	Running	20-JUL-24	
11	gamma	101	1	xlarge	180	Running	20-JUL-24	
12	gamma	101	1	xlarge	170	Running	20-JUL-24	
13	gamma	101	1	xlarge	200	Running	20-JUL-24	
14	gamma	101	1	medium	110	Running	20-JUL-24	

During (run for ProjectID = 1):

Get Cost Per Instance Type	
Type	Cost
large	370
micro	290
xlarge	550
medium	110

After: Does not affect any tables.

## Aggregation with HAVING [Line: 609 - 611]

- SELECT ServiceDetails.Type, COUNT(\*) AS Count  
FROM ServiceDetails, ProjectUsesService  
WHERE ServiceDetails.name = ProjectUsesService.name  
AND ProjectUsesService.ProjectID = ?  
GROUP BY ServiceDetails.Type  
HAVING COUNT(\*) > 1;

Before:

ServiceDetails:

NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
gamma	Serverless	Handling serverless functions	Active	2
authIt	Authentication	Authentication with large capacity	Active	2
GPUB	GPUCompute	GPU-based rendering service	Active	10
RapidX	HPC	High performance computing service	Active	3
cSQL	Database	Cloud SQL database service	Active	3
dSQL	Database	Dynamic SQL	Active	1
veryFy	Authentication	Faster authentication	Active	3
gigaGPU	GPUCompute	GPU-based gaming	Active	10
mIGPU	GPUCompute	GPU-based ML training	Active	9
aSQL	Database	Agile SQL	Active	1
bSQL	Database	Broadcom SQL	Active	1
NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
eSQL	Database	Eth SQL	Active	1
RapidZ	HPC	Better High performance computing service	Active	3
beta	Serverless	Handling serverless functions slower	Active	2
veryFyIt	Authentication	Even faster authentication	Active	3

ProjectUsesService:

PROJECTID	NAME
1	GPUB
1	RapidX
1	RapidZ
1	aSQL
1	authIt
1	bSQL
1	beta
1	cSQL
1	dSQL
1	eSQL
1	gamma
PROJECTID	NAME
1	gigaGPU
1	mIGPU
1	veryFy
1	veryFyIt
2	RapidX
3	RapidX
4	RapidX
5	RapidX
6	GPUB
6	RapidX
6	RapidZ
PROJECTID	NAME
6	aSQL
6	authIt
6	bSQL
6	beta
6	cSQL
6	dSQL
6	eSQL
6	gamma
6	gigaGPU
6	mIGPU
6	veryFy
PROJECTID	NAME
6	veryFyIt
7	GPUB
7	RapidX
7	authIt
7	cSQL
7	dSQL
7	gamma
7	mIGPU
8	RapidX

During (run for ProjectID = 1):

Get Duplicate Service Counts	
Type	Count
Authentication	3
GPUCompute	3
Database	5
Serverless	2
HPC	2

After: Does not affect any tables.

**Nested Aggregation with GROUP BY [Line: 629 - 635]**

- SELECT I.Type  
FROM Instance I  
WHERE I.ProjectID = ?  
GROUP BY I.Type  
HAVING AVG(I.TotalCost) >= ALL (  
SELECT AVG(I2.TotalCost)  
FROM Instance I2  
WHERE I2.ProjectID = ?  
);

Before:

INSTANCEID	NAME	SERVERID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
1	gamma	101	1	micro	100	Running	20-JUL-24	
2	authIt	102	2	large	140	Running	20-JUL-24	
3	GPUB	103	3	large	140	Running	20-JUL-24	
4	RapidX	104	4	xlarge	200	Running	20-JUL-24	
5	cSQL	105	2	large	130	Running	16-JUL-24	
15	cSQL	105	2	xlarge	130	Running	16-JUL-24	
16	cSQL	105	2	xlarge	170	Running	16-JUL-24	
6	gamma	101	1	micro	100	Running	20-JUL-24	
7	gamma	101	1	micro	90	Running	20-JUL-24	
8	gamma	101	1	large	120	Running	20-JUL-24	
9	gamma	101	1	large	130	Running	20-JUL-24	
INSTANCEID	NAME	SERVERID	PROJECTID	TYPE	TOTALCOST	STATUS	LAUNCHDAT	STOPDATE
10	gamma	101	1	large	120	Running	20-JUL-24	
11	gamma	101	1	xlarge	180	Running	20-JUL-24	
12	gamma	101	1	xlarge	170	Running	20-JUL-24	
13	gamma	101	1	xlarge	200	Running	20-JUL-24	
14	gamma	101	1	medium	110	Running	20-JUL-24	

During (run for ProjectID = 1):

Get Instance Type With Maximum Average Cost

xlarge

After: Does not affect any tables.

**Division** [Line: 653 - 658]

- SELECT Project.Name FROM Project  
WHERE NOT EXISTS (  
    (SELECT ServiceDetails.Name FROM ServiceDetails)  
    MINUS  
    (SELECT ProjectUsesService.Name  
    FROM ProjectUsesService  
    WHERE ProjectUsesService.ProjectID = Project.ProjectID)  
)  
AND Project.ProjectID IN (  
    SELECT PartOf.ProjectID  
    FROM PartOf  
    WHERE PartOf.email = ?  
);

Before:

Project:

PROJECTID	NAME	DESCRIPTION	CREATIOND	STATUS	PARTNEREMAIL
1	Migrate	Migrating app to cloud	20-JUL-24	Active	james.w@dumny.com
2	Analytics	Cloud analytics	20-JUL-24	Active	john.doe@dumny.com
3	OpsPipeline	Operations Pipeline	20-JUL-24	Active	john.doe@dumny.com
4	ModelTraining	AI models on cloud GPU	20-JUL-24	Active	john.doe@dumny.com
5	Store	Cloud storage	20-JUL-24	Active	john.doe@dumny.com
6	Optimization	Optimizing all workflows	20-JUL-24	Active	james.w@dumny.com
7	DevOps	Creating DevOps workflows	20-JUL-24	Active	james.w@dumny.com
8	Networking	Creating a cloud network	20-JUL-24	Active	james.w@dumny.com

## ServiceDetails

NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
gamma	Serverless	Handling serverless functions	Active	2
authIt	Authentication	Authentication with large capacity	Active	2
GPUB	GPUCompute	GPU-based rendering service	Active	10
RapidX	HPC	High performance computing service	Active	3
cSQL	Database	Cloud SQL database service	Active	3
dSQL	Database	Dynamic SQL	Active	1
veryFy	Authentication	Faster authentication	Active	3
gigaGPU	GPUCompute	GPU-based gaming	Active	10
mLGPU	GPUCompute	GPU-based ML training	Active	9
aSQL	Database	Agile SQL	Active	1
bSQL	Database	Broadcom SQL	Active	1
NAME	TYPE	DESCRIPTION	STATUS	COSTPERUNIT
eSQL	Database	Eth SQL	Active	1
RapidZ	HPC	Better High performance computing service	Active	3
beta	Serverless	Handling serverless functions slower	Active	2
veryFyIt	Authentication	Even faster authentication	Active	3

## ProjectUsesService:

PROJECTID	NAME
1	GPUB
1	RapidX
1	RapidZ
1	aSQL
1	authIt
1	bSQL
1	beta
1	cSQL
1	dSQL
1	eSQL
1	gamma
PROJECTID	NAME
1	gigaGPU
1	mLGPU
1	veryFy
1	veryFyIt
2	RapidX
3	RapidX
4	RapidX
5	RapidX
6	GPUB
6	RapidX
6	RapidZ
PROJECTID	NAME
6	aSQL
6	authIt
6	bSQL
6	beta
6	cSQL
6	dSQL
6	eSQL
6	gamma
6	gigaGPU
6	mLGPU
6	veryFy
PROJECTID	NAME
6	veryFyIt
7	GPUB
7	RapidX
7	authIt
7	cSQL
7	dSQL
7	gamma
7	mLGPU
8	RapidX

During (ran for Email=john.doe@dummy.com):

Get Projects Using All Services

Project

Migrate

Optimization

After: Does not affect any table.