University of Utah Network Operations Center

Final Project Deliverable

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IS 4420 - Database Fundamentals

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Introduction Biographies

Jacob Minson - My background is in school and more school. I haven't done a whole lot with my life yet. I like computers and business so I'm studying information systems. I want to go into some kind of management within the tech spheres, possibly product management or something like that. I'd eventually like to own my own small business. I have red hair and I've done over 200 miles of backpacking.

Jacob McKellar - I'm in my last year here majoring in Operations and Supply Chain. I'm wanting to go into healthcare administration, ideally doing BI or operations management in a hospital. I enjoy being outside doing things like running, hiking, and camping. Something unique about me is my current favorite snack, which is getting some frozen blueberries in a bowl, pouring some milk, and adding a little sugar.

David Sear- My name is David Sear and I've been at the University of Utah for 7 years now. I've been flip flopping around between Computer Science, Physical Therapy, and now I found myself in the Information System major. I love fitness as it's a big part of my daily routine. Keeping my body running for the long term is a lifelong journey. Just as passionately, I love playing/listening to music, because it is my sanctuary.

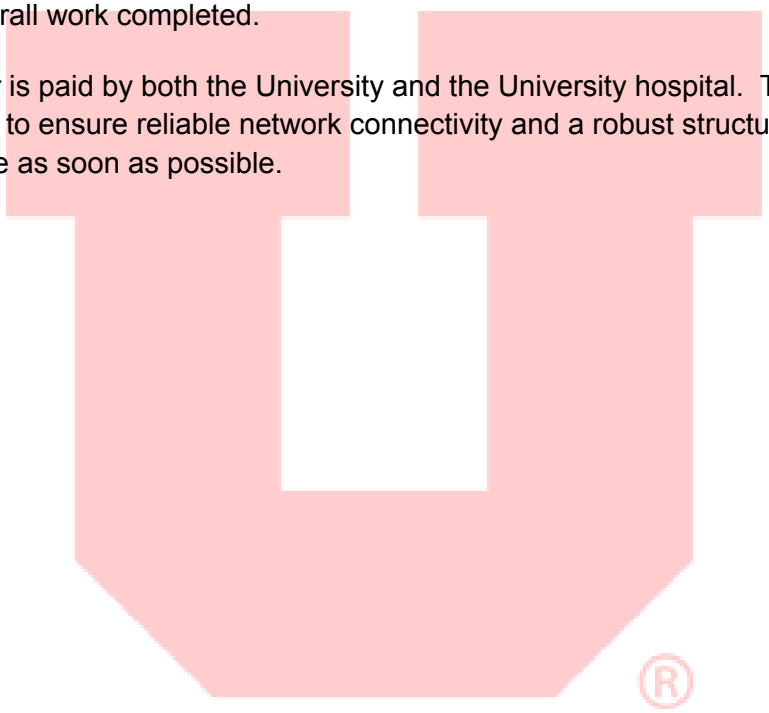
Ethan Wilkinson - My name is Ethan and I'm from Kaysville, Utah. I'm majoring in Music and Information Systems. I haven't decided which area within Information Systems I want to pursue yet, but I have enjoyed my classes thus far. I like to hang out with family and friends and I love to play and watch sports. Something unique about me is that I play the tuba.

Project Overview

The University of Utah Network Operations Center is responsible for planning, implementing, and maintaining all assigned network connectivity infrastructures and management. This includes all switches, routers, access points, and the connections between all of them, as well as backbone management, IP range assignment, VLAN structuring, and some firewall management as well, although there is a separate security team that focuses on security more directly.

The goal of this database is to track network use, as well as managing devices, and tracking tickets for fixing problems in the network. We want to make sure that management has all the information they need at any given time about who is on the network, how the network is being used, what permissions are given where, as well as what work is being done as far as ticket resolution and overall work completed.

The Netops center is paid by both the University and the University hospital. The main goal of the organization is to ensure reliable network connectivity and a robust structure for fixing any problems that arise as soon as possible.



User Requirements

We have our user requirements centered around having our Netops Center receive, record, and establish network connectivity to all users. Additionally, we are making sure that we are tracking network use, tracking devices, and tracking tickets, allowing the system to run seamlessly with little to no errors.

1. All clients must be onboarded
2. Clients must be associated with all their devices.
3. Clients must be able to connect multiple devices.
4. All users need specific permissions.
5. Permissions must be defined.
6. All devices need IP addresses.
7. All devices must have unique mac addresses.
8. Each device must be managed by a specific group.
9. We must know which users are associated at any given time.
10. We must be able to track network capacity.
11. We must know the utilization of each device.
12. We must know the function of each device.
13. We must know the lifetime of each device.
14. We must know the name of each device.
15. Users must be able to create tickets.
16. Employees must be assigned tickets.
17. Employees must have a group assignment.
18. Employees must be able to close tickets.
19. Tickets must be assigned to one employee at a time.
20. Ticket assignments must be mutable.
21. Tickets must be assigned to groups.
22. Employees need to be able to place purchase orders.
23. We must know when purchase orders are placed.
24. We must know how much each purchase costs.
25. Orders must be approved by management.

Business Rules

These business rules give us the foundation of our database. They are governed by both data integrity principles and what the Network Operations Center needs.

1. All clients must be assigned one and only one permission level.
2. Permissions can be assigned to any number of clients.
3. A client is owned by one and only one person.
4. A person can connect zero or many clients.
5. All devices connected are assigned one and only one device group.
6. Device groups are assigned to one or many devices.
7. All clients are assigned to at least 1 session log.
8. Session logs are assigned to one and only one client.
9. A person can create none or many tickets. Tickets are created by one and only one person
10. Engineer groups are responsible for one and only one device group.
11. Device groups are managed by one and only one engineer group.
12. Devices can belong to one and only one device group.
13. Device groups can only have 1 or many devices.
14. Employees can have one or multiple engineer group assignments.
15. An engineer group assignment goes to one and only one employee.
16. One engineer group assignment corresponds to one and only one engineer group.
17. Engineer groups have one or many engineer group assignments.
18. A ticket can be closed by one and only one employee.
19. A person must be a user, an employee, or both.
20. Any employee can close a ticket.
21. All employees must be assigned one and only one level of authority.
22. Authority levels must be assigned to one or many employees.
23. Any employee can make purchase orders for any number of new devices.
24. A purchase order can be placed by only one employee.
25. A purchase order can be approved by one and only one authority level.
26. An authority level can approve any number of purchase orders that it has ability to.
27. An employee is assigned one and only one authority level.
28. Authority levels can be assigned to any number of employees.

Data Outputs / Business Questions

We ran queries on our database to obtain answers to certain business questions. Below is a list of those questions and the answers that the queries provided.

1. What is the average session time?
    - **10.51 hours**

```
1    /* What is the average session time? */
2
3    CREATE VIEW Average_Session_Time AS
4    SELECT AVG(timestampdiff(hour,Session_Start,Session_End))
5    FROM SessionLog;
6
7    SELECT * FROM Average_Session_Time;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

AVG(timestampdiff(hour,Session_Start,Session_Er
10.5135

2. What devices need to be replaced?
    - **Click here to see a table with the 35 expired devices along with their MAC Addresses, locations, and when they expired.**

```
11   CREATE VIEW Expired_Devices AS
12       SELECT
13        D.Device_MAC_Address, D.Device_Type, D.Location, date_add(D.Installed_Date, INTERVAL DT.Device_Lifetime DAY) AS 'Expiration Date'
14       FROM Device AS D
15        JOIN
16        DeviceType AS DT ON D.Device_Type = DT.Device_Type
17       WHERE
18        DATE_ADD(D.Installed_Date, INTERVAL DT.Device_Lifetime DAY) <= current_date();
19
20   SELECT * FROM Expired_Devices;
```

3. What is the average time for tickets to be closed?
    - **16.5 Days**

```
9   /* What is the average time for tickets to be closed?*/
10
11  SELECT
12      AVG(TIMESTAMPDIFF(day, Open_Time, Close_Time)) as 'Average Hours Required to Close Tickets'
13  FROM
14      Ticket;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Average Hours Required to Close Tickets
16.5000

4. How many tickets are opened each month?
    - **In October, one ticket was opened. Click here for a table that shows how many tickets were opened each month since January 200.**

```
29      /* How Many Tickets are Opened Each Month? */
30
31  SELECT
32      COUNT(Ticket_Id) AS TicketCount,
33      MONTHNAME(Open_Time) AS MName,
34      YEAR(Open_Time) AS TicketYear
35  FROM Ticket
36  GROUP BY TicketYear,
37          MONTH(Open_Time),
38          MName
39  ORDER BY TicketYear  ASC,
40          MONTH(Open_Time) ASC;
```

5. How much money have we spent in a given year?
    - **In 2021, we spent $6.58 million.**

```
120     /* How much money have we spent in a given year? */
121     delimiter //
122 •   CREATE PROCEDURE Money_Spent_In_Year (IN inYear VARCHAR(4))
123     BEGIN
124         SELECT SUM(Purchase_Cost) AS Year
125         FROM PurchaseOrder
126         WHERE Year(Purchase_Date) = inYear;
127     END //
128     delimiter ;
129
130 •   SELECT EGA.Group_ID,
131     COUNT(E.Person_ID) AS 'Number of Employees'
132      FROM EngineerGroupAssignment AS EGA
133      JOIN
134      Employee AS E ON EGA.Person_ID = E.Person_ID
135     GROUP BY EGA.Group_ID
136      ORDER BY Group_ID;
```

6. How many employees are assigned to a given team?
    - **In group 1, there is 1 employee assigned. Click here to see a full list of groups**

```
/* How many employees are on a given team? */
delimiter //
CREATE PROCEDURE Employees_Per_Group(IN inGroup_ID SMALLINT)
BEGIN
SELECT EGA.Group_ID,
COUNT(E.Person_ID) AS 'Number of Employees'
 FROM EngineerGroupAssignment AS EGA
 JOIN
 Employee AS E ON EGA.Person_ID = E.Person_ID
 WHERE Group_ID = inGroup_ID
 GROUP BY EGA.Group_ID
 ORDER BY Group_ID;
 END//

 delimiter ;
```

7. What group is an engineer assigned to?
    - **Click here to see a table with a list of all employees and their group assignment**

```
/* What Group is an Engineer Assigned to? */

SELECT EGA.Person_Id,
       EGA.Group_Id,
       CONCAT(P.Person_Fname, ' ',P.Person_Lname) AS EmployeeName,
       EG.Device_Group_Description
FROM EngineerGroupAssignment AS EGA
    JOIN
Person AS P ON EGA.Person_Id = P.Person_Id
    JOIN
EngineerGroup AS EG ON EG.Group_Id = EGA.Group_Id;
```

8. How many users are currently associated?
    - **3**

```
171     /* How many users are currently associated? */
172 •   SELECT COUNT(Session_Start)
173     FROM SessionLog
174     WHERE Session_End IS NULL;
```

9. How many of a given device type are there?
    - **Controller - 5**
      DDC - 4
      Firewall - 3
      Router - 5
      Switch - 10
      Wireless -13

```
177     /* How many of a given device type are there? */
178
179     delimiter //
180 •   CREATE procedure Device_Type_Count(IN inType VARCHAR(20))
181     BEGIN
182         SELECT
183             count(Device_Type)
184         FROM
185             Device
186         WHERE Device_Type = inType;
187     END //
188     delimiter ;
```

10. What is the average age of employees?
    - **56**

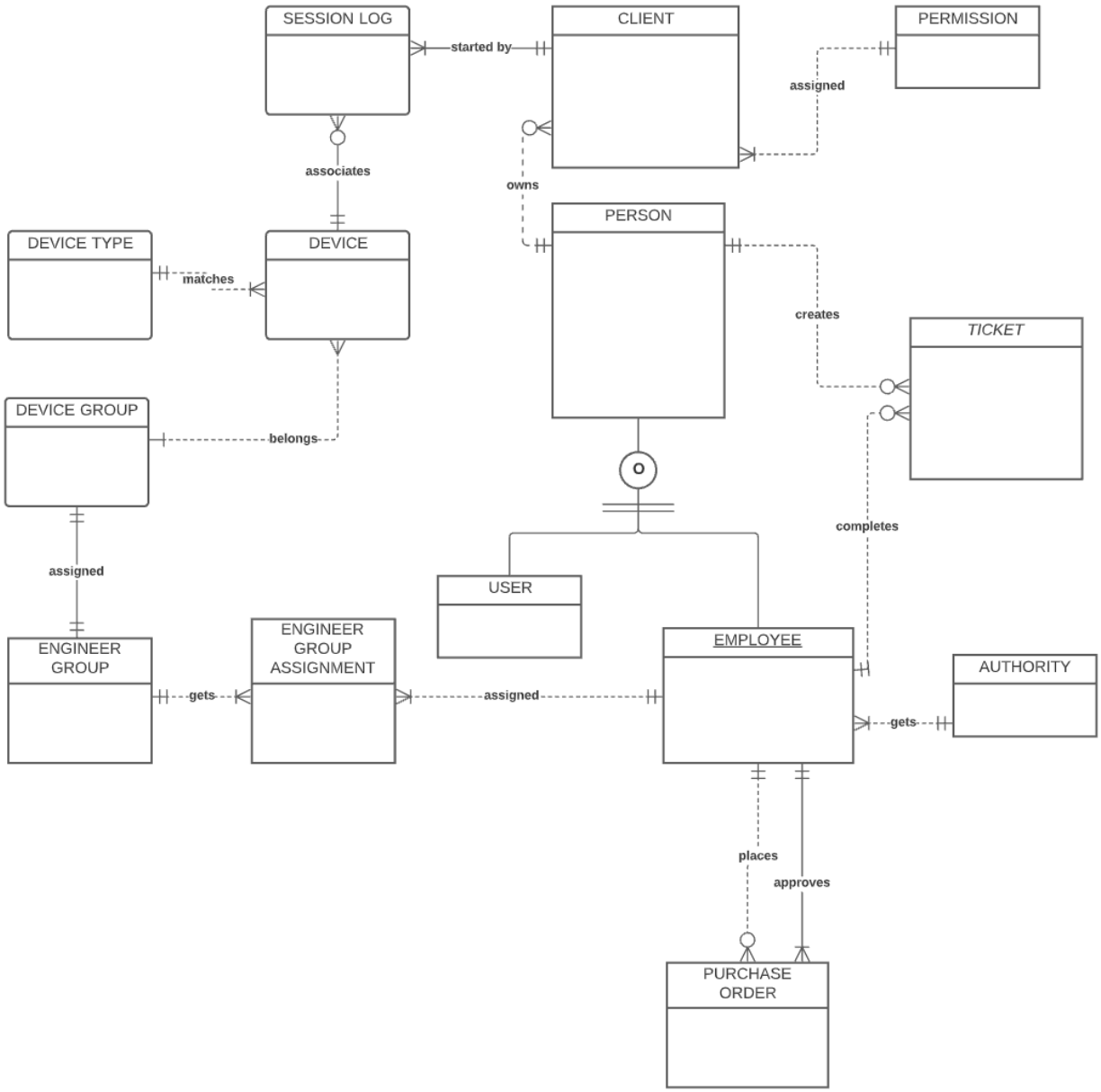
```
191 •   /* What is the Average Age of Employees? */
192
193     SELECT
194         AVG(YEAR(CURDATE())-YEAR(Person_DOB)) AS EmployeeAge
195     FROM Person
196     WHERE Person_Is_Employee = 'Y'
197     ORDER BY EmployeeAge ASC;
198
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

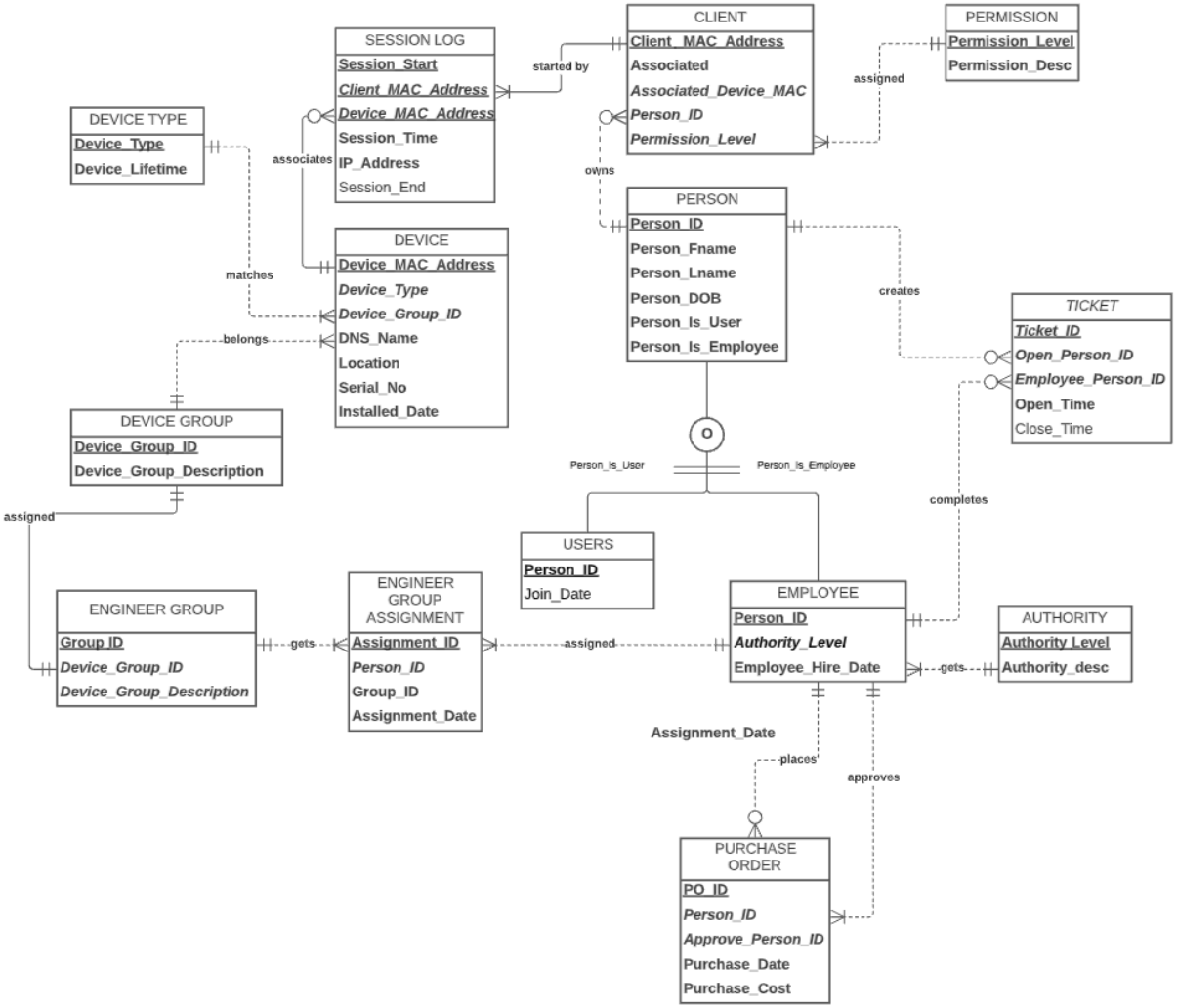
EmployeeAge
55.8261

Entity Relationship Diagrams

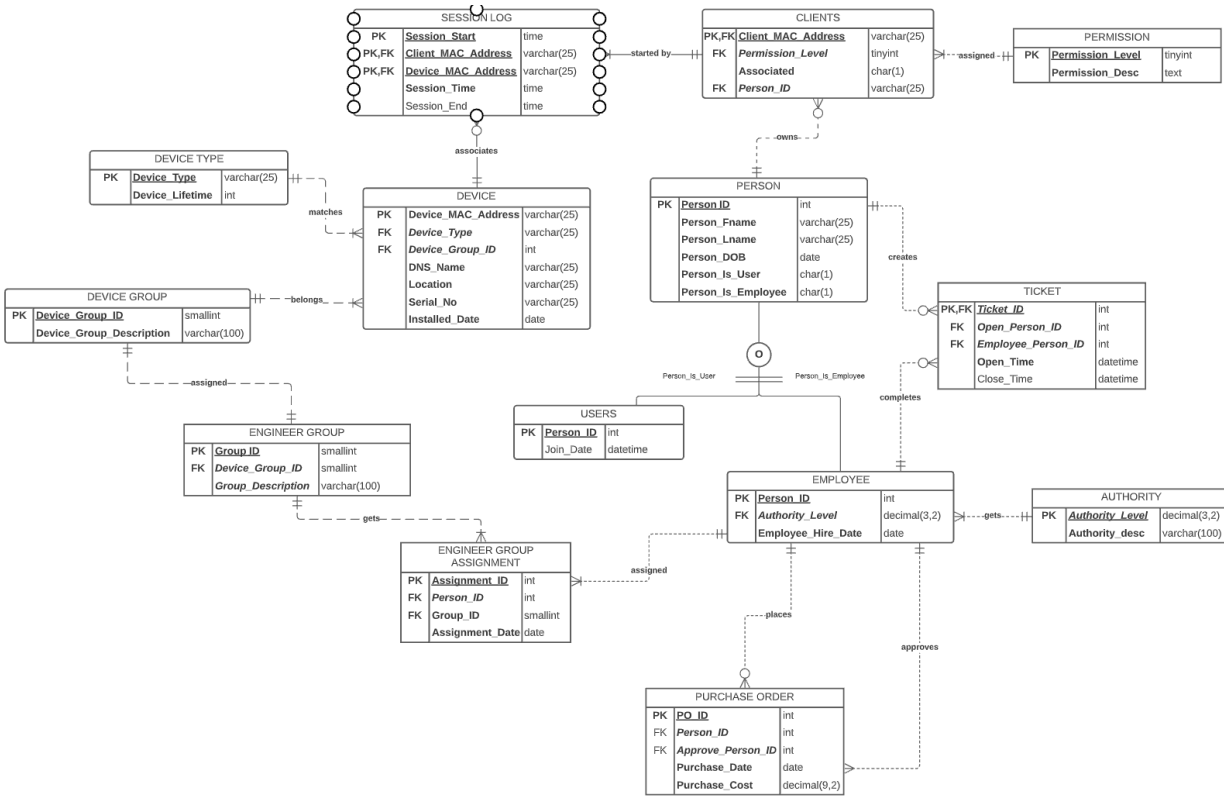
Conceptual



Logical


CLIENT
Client_MAC_Address
Associated
Associated_Device_MAC
Person_ID
Permission_Level
PERMISSION
Permission_Level
Permission_Desc
SESSION LOG
Session_Start
Client_MAC_Address
Device_MAC_Address
Session_Time
IP_Address
Session_End
started by
assigned
DEVICE TYPE
Device_Type
Device_Lifetime
associates
owns
PERSON
Person_ID
Person_Fname
Person_Lname
Person_DOB
Person_Is_User
Person_Is_Employee
DEVICE
Device_MAC_Address
Device_Type
Device_Group_ID
DNS_Name
Location
Serial_No
Installed_Date
matches
creates
TICKET
Ticket_ID
Open_Person_ID
Employee_Person_ID
Open_Time
Close_Time
belongs
DEVICE GROUP
Device_Group_ID
Device_Group_Description
O
Person_Is_User
Person_Is_Employee
completes
assigned
USERS
Person_ID
Join_Date
ENGINEER GROUP
Group ID
Device_Group_ID
Device_Group_Description
ENGINEER GROUP ASSIGNMENT
Assignment_ID
Person_ID
Group_ID
Assignment_Date
gets
assigned
EMPLOYEE
Person_ID
Authority_Level
Employee_Hire_Date
AUTHORITY
Authority Level
Authority_desc
gets
Assignment_Date
places
approves
PURCHASE ORDER
PO_ID
Person_ID
Approve_Person_ID
Purchase_Date
Purchase_Cost

Physical


SESSION LOG
PK Session_Start time
PK,FK Client_MAC_Address varchar(25)
PK,FK Device_MAC_Address varchar(25)
Session_Time time
Session_End time
started by
CLIENTS
PK,FK Client_MAC_Address varchar(25)
FK Permission_Level tinyint
Associated char(1)
FK Person_ID varchar(25)
assigned
PERMISSION
PK Permission_Level tinyint
Permission_Desc text
associates
owns
DEVICE TYPE
PK Device_Type varchar(25)
Device_Lifetime int
matches
DEVICE
PK Device_MAC_Address varchar(25)
FK Device_Type varchar(25)
FK Device_Group_ID int
DNS_Name varchar(25)
Location varchar(25)
Serial_No varchar(25)
Installed_Date date
PERSON
PK Person ID int
Person_Fname varchar(25)
Person_Lname varchar(25)
Person_DOB date
Person_Is_User char(1)
Person_Is_Employee char(1)
creates
DEVICE GROUP
PK Device_Group_ID smallint
Device_Group_Description varchar(100)
belongs
TICKET
PK,FK Ticket_ID int
FK Open_Person_ID int
FK Employee_Person_ID int
Open_Time datetime
Close_Time datetime
Person_Is_User
Person_Is_Employee
completes
assigned
USERS
PK Person_ID int
Join_Date datetime
ENGINEER GROUP
PK Group ID smallint
FK Device_Group_ID smallint
Group_Description varchar(100)
EMPLOYEE
PK Person_ID int
FK Authority_Level decimal(3,2)
Employee_Hire_Date date
gets
AUTHORITY
PK Authority_Level decimal(3,2)
Authority_desc varchar(100)
gets
ENGINEER GROUP ASSIGNMENT
PK Assignment_ID int
FK Person_ID int
FK Group_ID smallint
Assignment_Date date
assigned
places
approves
PURCHASE ORDER
PK PO_ID int
FK Person_ID int
FK Approve_Person_ID int
Purchase_Date date
Purchase_Cost decimal(9,2)