**Student Projects Chapter 10 - Planning for Distribution**

Read the sample project steps for this chapter and apply the same techniques to the student project that you are developing. Use the normalized set of relations developed in Chapter 6 as the global schema.

For the project you have chosen, assume that there are at least four locations or branches for the enterprise and that the processing is to be distributed to these locations. Identify the applications that will be performed at each of the locations, and then follow the steps below to plan the distribution of your database.

We will assume The Car Dealership has expanded to four locations, Downtown, which is the original gallery, plus Uptown, Midtown and Westside. We wish to distribute the database among the four locations. We will use the normalized set of relations developed in Chapter 6 as the global schema.

The schema is:

**Ad** (adNumber, placedIn, initialDate, totalCost, frequency, contactPerson, areaCode, phoneNumber)

**Customer** (custId, firstName, lastName, street, *zip*, areaCode, phoneNumber, driversLicNo, referredBy, *adSeen*)

**Zips** (zip, city, state)

**NewCar** (newCarId, VIN, make, model, listPrice, dateManufactured, placeManufactured, cylinders, doors, weight, capacity, color, delDate, delMiles)

**OptionsMenu** (carOption, price)

**NewCar\_Options** (*newCarId, carOption*)

**CustomizationMenu** (customId, item, price)

**Salesperson** (empId, firstName, lastName, street, *zip*, homeAreaCode, homePhoneNumber, officeAreaCode, officePhoneNumber, cellAreaCode, cellPhoneNumber, dateHired)

**Registration** (registrationNo, plateNo, fee)

**Insurance** (insId, insPolicyNo, companyName, street, *zip*, areaCode, phoneNumber, startDate, endDate)

**Financing** (finId, finPolicyNo, companyName, street, *zip*, AreaCode, PhoneNumber, startDate, amountFinanced, rate, numberMonths)

**Warrantee** (warId, warType, cost, period)

**UsedCar** (usedCarId, VIN, make, model, cylinders, doors, weight, capacity, color, modelYear, mileage, bookValue)

**UsedCarFeatures** (*usedCarId*, feature)

**Sale** (invoiceNo, saleDate, salePrice, tax, amountPaid, tradeInAmount, amountDue, saleMiles, *custId*, *empId*, *newCarId*, *usedCarId*, *insId*, *finId*, tradeInVIN, *registrationNo*, *warId*)

**Sale\_CustomItem** (*invoiceNo*, *customId*)

**Survey** (surveyNumber, dealershipRating, carRating, salespersonRating, *invoiceNo*)

**Step 10.1 - Write out a set of end user locations and the applications performed at each.**

The four locations are Downtown (the main site), Uptown, Midtown and Westside. The applications performed at each branch for that branch’s own data are

* 1. Maintaining car records
  2. Producing sales invoice
  3. Maintaining sales records
  4. Maintaining the customer records
  5. Producing the Cars for Sale report
  6. Producing the Sales This Week report
  7. Producing the Sales This Month report
  8. Producing Customer report
  9. Producing the Salesperson Performance Report
  10. Producing Survey This Month report

In addition, the following applications are performed at Downtown only

* 1. Producing the Car Make Sales report
  2. Producing the New Car sales report
  3. Producing the Used Car sales report
  4. Producing the Survey This Year report

**Step 10.2 - For each application, decide what tables are required.**

1. Maintaining car records: NewCar, UsedCar
2. Producing sales invoice: Sale, Customer, Salesperson, NewCar, UsedCar, Insurance, Financing, Registration, Warrantee, Zip
3. Maintaining sales records: Sale, Customer, Salesperson, Zip, NewCar, UsedCar
4. Maintaining the customer records: Customer, Zip, Ad
5. Producing the Cars for Sale report: NewCar, UsedCar
6. Producing the Sales This Week report: Sale, Salesperson, Customer, Zip, NewCar, UsedCar
7. Producing the Sales This Month report: Sale, Salesperson, Customer, Zip, NewCar, UsedCar
8. Producing Customer report: Customer, Zip, Ad
9. Producing the Salesperson Performance Report: Sale, NewCar, UsedCar, Salesperson, Zip
10. Producing Survey This Month report: Survey, Salesperson, NewCar, UsedCar
11. Producing the Car Make Sales report: NewCar, UsedCar, Sale
12. Producing the New Car sales report: NewCar, Sale
13. Producing the Used Car sales report: UsedCar, Sale
14. Producing the Survey This Year report: Survey, Salesperson, NewCar, UsedCar

**Step 10.3 - Using the normalized relations, perform selection and projection operations, to create the set of vertical, horizontal and mixed data fragments needed for each application.**

**Zips**. Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Customer.** Each branch will have its own customer records.

CustomerDowntown = σID LIKE ‘D%’ (Customer)

CustomerMidtown = σID LIKE ‘M%’ (Customer)

CustomerUptown = σID LIKE ‘U%’ (Customer)

CustomerWestside= σID LIKE ‘W%’ (Customer)

**NewCar**. Each branch needs this table to maintain records of new car at that branch (1), and sales records (3). We can form these using a selection operation, if we assume the newCarId contains a code indicating the branch, as we did for Customer. The fragments are identified using

NewCarDowntown= σID LIKE ‘D%’(NewCar)

NewCarMidtown = σID LIKE ‘M%’(NewCar)

NewCarUptown = σID LIKE ‘U%’(NewCar)

NewCarWestside = σID LIKE ‘W%’(NewCar)

The branch also uses these same table fragments to produce its own Cars for Sale report (5), Sales This Week report (6), Sales This Month report (7), Customer report (8), Salesperson Performance report (9) and Survey This Month report (10).

Downtown also uses the entire table for reports 11, 12, and 14.

**UsedCar**. Each branch needs this table to maintain records of used car at that branch (1), and sales records (3). We can form these using a selection operation, if we assume the usedCarId contains a code indicating the branch, as we did for PotentialCustomer. The fragments are identified using

UsedCarDowntown= σID LIKE ‘D%’(NewCar)

USedCarMidtown = σID LIKE ‘M%’(NewCar)

UsedCarUptown = σID LIKE ‘U%’(NewCar)

UsedCarWestside = σID LIKE ‘W%’(NewCar)

The branch also uses these same table fragments to produce its own Cars for Sale report (5), Sales This Week report (6), Sales This Month report (7), Customer report (8), Salesperson Performance report (9), and Survey This Month report (10).

Downtown also uses the entire table for reports 11, 13 and 14.

**Sale**. Each branch uses this table for producing sales invoices (2), maintaining its sales records (3), and for reports 6, 7, and 9. Each branch can use its own set of invoice numbers, whose initial digit identifies the branch. We can create horizontal fragments to identify the branch for each sale, using

SaleDowntown = σinvoiceNumber>0 and invoiceNumer <20000 (Sale)

SaleMidtown = σ invoiceNumber>20000 and invoiceNumer <40000 (Sale)

SaleUptown =σ invoiceNumber>40000 and invoiceNumer <60000 (Sale)

SaleWestside = σinvoiceNumber>60000 and invoiceNumer <80000 (Sale)

Downtown also uses the entire table for reports 11, 12, and 13.

**Salesperson**. Each branch uses this table for producing sales invoices (2), maintaining sales records (3), and for reports 6, 7 and 9. We will add an attribute, branch, to the table to identify the branch a salesperson belongs to. Using selection, we form the horizontal subsets

SalespersonDowntown = σbranch=’Downtown’(Salesperson)

SalespersonMidtown = σbranch=’Midtown’(Salesperson)

SalespersonUptown = σbranch=’Uptown’(Salesperson)

SalespersonWestside = σbranch=’Westiside’(Salesperson)

Downtown also uses the table for reports 14.

**Insurance.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Financing.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Warrantee.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Registration.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Ad.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Survey.** Each branch uses this table for producing Survey This Month report (10). We will add an attribute, branch, to the table to identify the branch a survey belongs to. Using selection, we form the horizontal subsets

SurveyDowntown = σbranch=’Downtown’(Survey)

SurveyMidtown = σbranch=’Midtown’(Survey)

SurveyUptown = σbranch=’Uptown’(Survey)

SurveyWestside = σbranch=’Westiside’(Survey)

Downtown also uses the entire table for reports 14.

**Step 10.4 - Map the fragments to the applications and locations. For each fragment that is required at more than one application location, decide whether the fragment can be replicated, by considering frequency of use and of update.**

**Zips**. This table is needed at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Customer.** Each branch stores data about its own customers, using the fragments, CustomerDowntown, CustomerMidtown, CustomerUptown and CustomerWestside.

**NewCar**. Each branch stores records about is own new cars, using fragments NewCarDowntown, NewCarMidtown, NewCarUptown and NewCarWestside. Downtown stores a copy of the entire table.

**UsedCar**. Each branch stores records about is own new cars, using fragments UsedCarDowntown, UsedCarMidtown, UsedCarUptown and UsedCarWestside. Downtown stores a copy of the entire table.

**Sale**. Each branch has its own sales records, identified by invoice number SaleDowntown, SaleMidtown, SaleUptown, and SaleWestside. .Downtown also keeps a copy of the entire table.

**Salesperson**. Each branch keeps records of its own salespersons, namely SalespersonDowntown, SalespersonMidtown, SalespersonUptown, and SalespersonWestside.

**Insurance**. This table is needed at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Financing**. This table is needed at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Warrantee**. This table is needed at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Registration**. This table is needed at every location, is rarely updated, and does not contain any sensitive date, so we replicate it everywhere.

**Ad.** Since the table is rarely updated and is needed at every location, we will replicate the entire table at each branch.

**Survey**. Each branch has its own sales records, identified by invoice number SurveyDowntown, SurveyMidtown, SurveyUptown, and SurveyWestside. .Downtown also keeps a copy of the entire table.

**Step 10.5 - Make a table showing a geographical network, listing nodes and applications and showing the data fragments at each node.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| APPLICATION | Downtown | Midtown | Uptown | Westside |
| 1 Maintaining Car Records | NewCarDowntown  UsedCarDowntown | NewCarMidtown  UsedCarMidtown | NewCarUptown  UsedCarUptown | NewCarWestside  UsedCarWestside |
| 2 Producing Sales Invoice | SaleDowntown  CustomerDowntown  SalespersonDowntown  NewCarDowntown  UsedCarDowntown  Financing  Insurance  Warrantee  Registration  Zip | SaleMidtown  CustomerMidtown  SalespersonMidtown  NewCarMidtown  UsedCarMidtown  Financing  Insurance  Warrantee  Registration  Zip | SaleUptown  CustomerUptown  SalespersonUptown  NewCarUptown  UsedCarUptown  Financing  Insurance  Warrantee  Registration  Zip | SaleWestside  CustomerWestside  SalespersonWestside  NewCarWestside  UsedCarWestside  Financing  Insurance  Warrantee  Registration  Zip |
| 3 Maintaining Sales Records | SaleDowntown  CustomerDowntown  SalespersonDowntown  NewCarDowntown  UsedCarDowntown  Zip | SaleMidtown  CustomerMidtown  SalespersonMidtown  NewCarMidtown  UsedCarMidtown  Zip | SaleUptown  CustomerUptown  SalespersonUptown  NewCarUptown  UsedCarUptown  Zip | SaleWestside  CustomerWestside  SalespersonWestside  NewCarWestside  UsedCarWestside  Zip |
| 4 Maintaining Customer  Record | CustomerDowntown  Zip  Ad | CustomerMidtown  Zip  Ad | CustomerUptown  Zip  Ad | CustomerWestside  Zip  Ad |
| 5 Cars for Sale Report | NewCarDowntown  UsedCarDowntown | NewCarMidtown  UsedCarMidtown | NewCarUptown  UsedCarUptown | NewCarWestside  UsedCarWestside |
| 6 Sales This Week | SaleDowntown  CustomerDowntown  SalespersonDowntown  NewCarDowntown  UsedCarDowntown | SaleMidtown  CustomerMidtown  SalespersonMidtown  NewCarMidtown  UsedCarMidtown | SaleUptown  CustomerUptown  SalespersonUptown  NewCarUptown  UsedCarUptown | SaleWestside  CustomerWestside  SalespersonWestside  NewCarWestside  UsedCarWestside |
| 7 Sales This Month | SaleDowntown  CustomerDowntown  SalespersonDowntown  NewCarDowntown  UsedCarDowntown | SaleMidtown  CustomerMidtown  SalespersonMidtown  NewCarMidtown  UsedCarMidtown | SaleUptown  CustomerUptown  SalespersonUptown  NewCarUptown  UsedCarUptown | SaleWestside  CustomerWestside  SalespersonWestside  NewCarWestside  UsedCarWestside |
| 8 Customer Report | CustomerDowntown  Zip  Ad | CustomerMidtown  Zip  Ad | CustomerUptown  Zip  Ad | CustomerWestside  Zip  Ad |
| 9 Salesperson Performance  Report | SalespersonDowntown  SaleDowntown  NewCarDowntown  UsedCarDowntown Zip | SalespersonMidtown  SaleMidtown  NewCarMidtown  UsedCarMidtown  Zip | SalespersonUptown  SaleUptown  NewCarUptown  UsedCarUptown  Zip | SalespersonWestside  SaleWestside  NewCarWestside  UsedCarWestside  Zip |
| 10 Survey This Month report | SurveyDowntown  SalespersonDowntown  NewCarDowntown  UsedCarDowntown | SurveyMidtown  SalespersonMidtown  NewCarMidtown  UsedCarMidtown | SurveyUptown  SalespersonUptown  NewCarUptown  UsedCarUptown | SurveyWestside  SalespersonWestside  NewCarWestside  UsedCarWestside |
| 11 Car Make Sales report | Sale  NewCar  UsedCar |  |  |  |
| 12 New Car sales report | Sale  NewCar |  |  |  |
| 13 Used Car sales report | Sale  UsedCar |  |  |  |
| 14 Survey This Year report | Survey  Salesperson  NewCar  UsedCar |  |  |  |

**Step 10.6 - For each application in the geographical network, determine whether access will be local, remote, or compound. Make up a table showing each site, and the applications requiring local access, remote access, and compound access.**

The table is shown in Figure 1.

**Step 10.7 - For each of the non-local accesses, identify the application and the location of the data. Estimate the number of accesses required per day using estimates such as low, medium, or high. If it is high, justify your choice of non-local storage.**

The only applications requiring remote access are the sales invoice and the owner payment stub applications, which require that the branches access the midtown location to determine the name, address, and social security number of the owner of the artwork. We have decided to maintain these in only one site for privacy reasons. The volume will correspond to the number of sales in each site. For original artwork of the type offered at The Art Gallery, the number of transactions per day will not be large.

**Step 10.8 - Make any adjustments indicated by your analysis of applications and traffic, and plan a final geographical network.**

Since most accesses are local, there is no need to adjust the geographical network shown in Figure 1.

Figure 1:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| APPLICATION | Downtown | Midtown | Uptown | Westside |
| 1 Maintaining Car Records | local | local | local | local |
| 2 Producing Sales Invoice | local | remote | remote | remote |
| 3 Maintaining Sales Records | local | local | local | local |
| 4 Maintaining Customer  Record | local | local | local | local |
| 5 Cars for Sale Report | local | local | local | local |
| 6 Sales This Week | local | local | local | local |
| 7 Sales This Month | local | local | local | local |
| 8 Customer Report | local | local | local | local |
| 9 Salesperson Performance  Report | local | local | local | local |
| 10 Survey This Month report | local | local | local | local |
| 11 Car Make Sales report | local | remote | remote | remote |
| 12 New Car sales report | local | local | local | local |
| 13 Used Car sales report | local | local | local | local |
| 14 Survey This Year report | local | local | local | local |