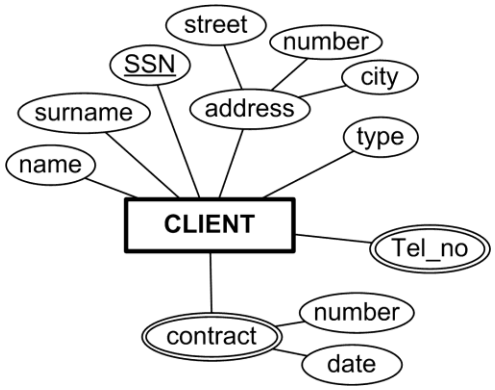
2 REAL WORLD MODEL Entity Relationship

PROBLEM 1. Model the corresponding entity and attribute information stored for the clients of a telecommunications company. For each client the company keeps track of the name and surname, the social security number (SSN), the address (composed of street, number, and city), the client type and the phone number associated with the client. Additional information is stored for the contracts the client has made with the company (contract number and date of contract).

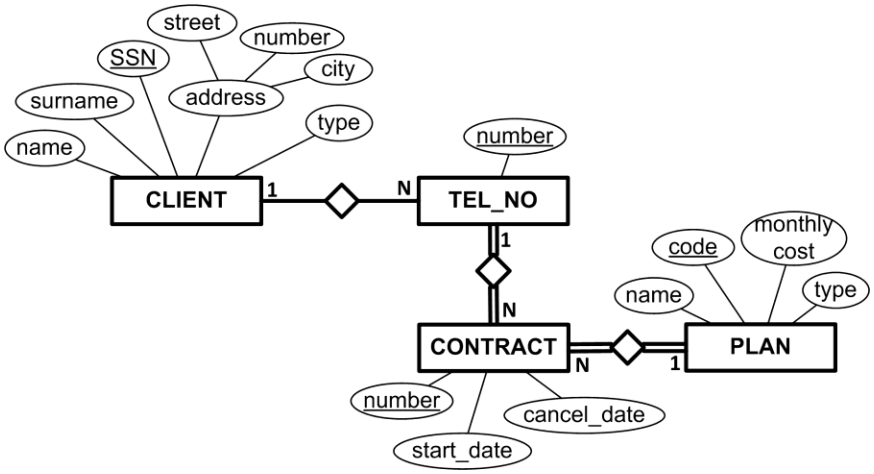
***SOLUTION*:**



PROBLEM 2. The telecommunications company also stores information for the plans it offers. Each plan is associated with its name, its code, the monthly cost and the plan type (prepaid or postpaid). Alter and/or extend the previous ER diagram if:

- a single phone number can belong only to a single client;
- contracts are associated with the phone numbers and when the contract is signed the information about the chosen plan is also stored;
- a contract can be canceled, and when a contract is canceled the information about the cancelation date is stored;
- when the contract is canceled the phone number no longer belongs to the client.

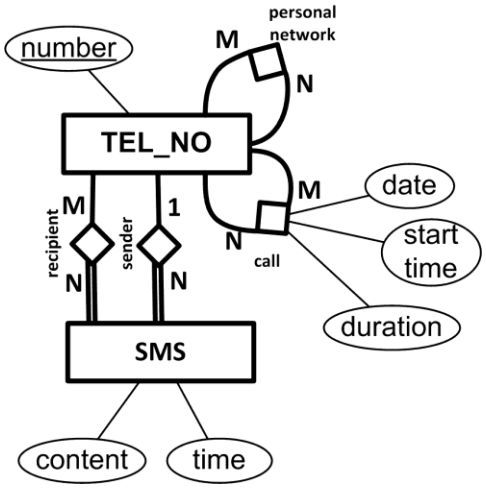
SOLUTION:



PROBLEM 3. Extend the previous ER diagram if the following information is stored in the database:

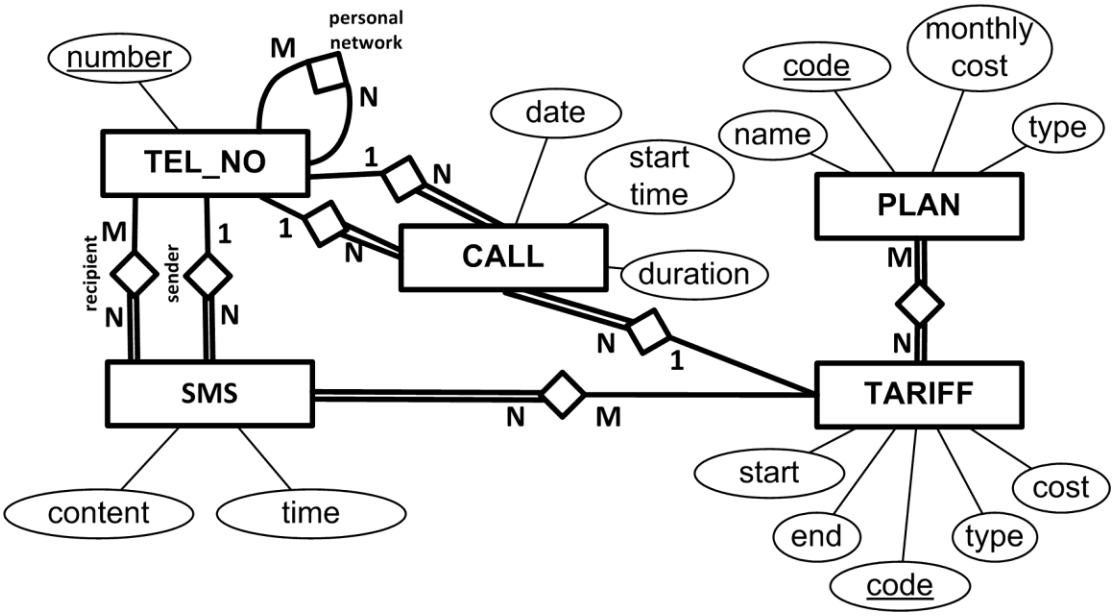
- users can activate the personal network service, and for this service the company keeps track of the personal network (phone numbers associated in the network) for each number that has the service active;
- the company stores information about the calls made by its clients (which number is the caller, which number is being called, the date of the call, the start time of the call, and the call duration in seconds);
- information is stored for the SMS massages sent by the clients (a single SMS message can be send to multiple phone numbers at once).

SOLUTION:



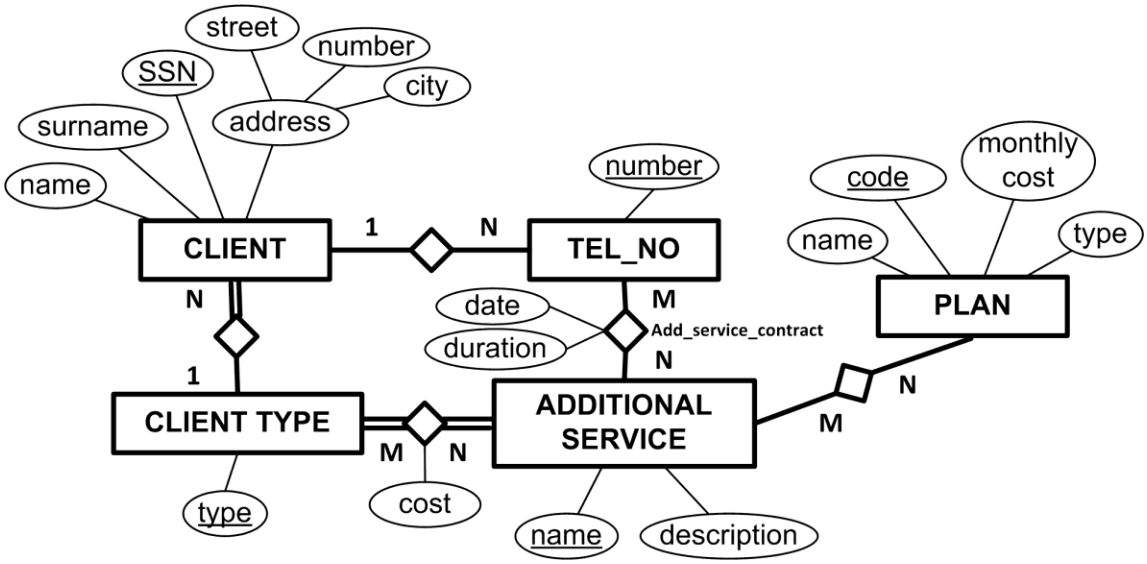
PROBLEM 4. Extend the previous ER diagram if the company wants to store information about its tariffing. Each tariff is associated with time of start and time of end (exact time in a 24 hour day system), a tariff code, a tariff type (calls or SMS), tariff cost (denars/second for calls, denars/message for SMS). For each plan offered, the company stores the tariffs associated with it, with the possibility of one tariff being associated with multiple plans. When a call is made, or a SMS message is sent, the database stores the information for the tariff used to charge the service.

SOLUTION:



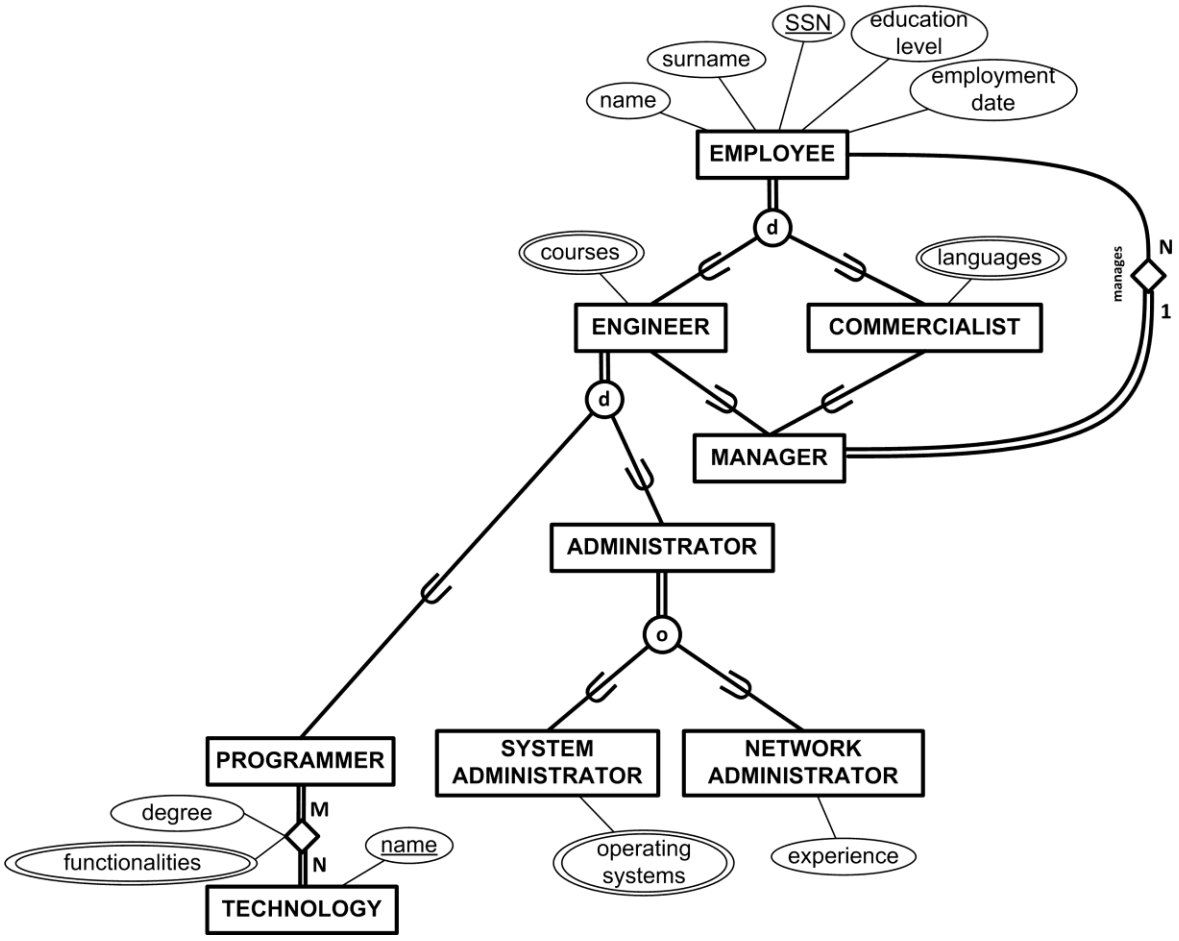
PROBLEM 5. Extend the previous ER diagram to include the additional services that the company offers. Each additional service is associated with a name and a description. The additional service cost depends on the client type. For each additional service that a client wants to use a separate contract is made and the company stores the date of the contract and its duration in months. Some of the plans have some of the additional services included within their monthly costs.

SOLUTION:



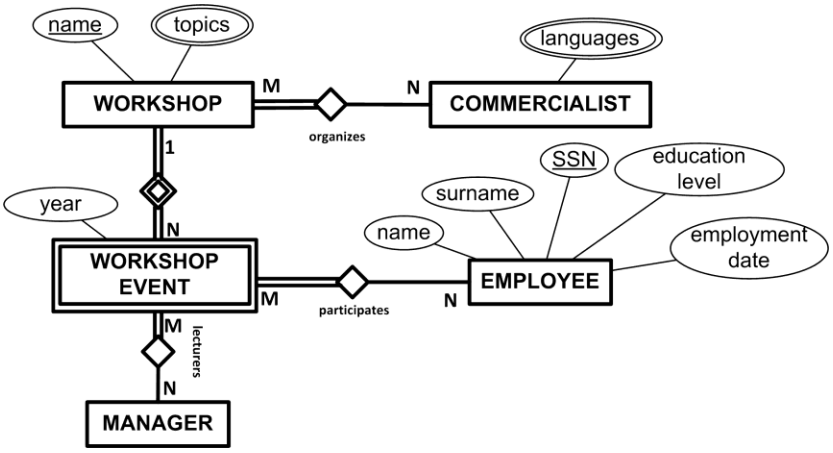
PROBLEM 6. The telecommunications company stores information about its employees and it keeps track of their name and surname, their SSN, their level of education, and the date of their employment. The employees can be either engineers or commercialists. For the engineers additional information is stored for the training courses they have completed and for the commercialists the foreign languages they speak. Some employees are managers (managers can be either engineers or commercialists) and for each employee the database keeps track of his/her manager. The engineers can further be divided in programmers, system administrators or network administrators, and an engineer can be both a system and a network administrator. The database keeps track of the information about the operating systems the system administrator works on, and information of the work experience (duration in years) of the network administrator. For each programmer the database stores the information about the technologies he/she uses. For each technology a programmer uses the database keeps track of the functionalities being used and the degree of knowledge the programmer has (1,2,3,4,5). Model the EER diagram for the company employees.

SOLUTION:



PROBLEM 7. The company organizes yearly workshops for which it stores the name of the workshop and the topics covered. The commercialists organize the workshops and the database stores the information of which commercialist is responsible for which workshop. For each workshop the company keeps track of the employees that participate in a given year's workshop event and who are the lecturers. Only the managers can be lecturers on a workshop. Model the ER diagram for the company workshops.

SOLUTION:



PROBLEM 8. Model the ER diagram if the following hold:

- when a plan contract is made, the database stores the information about the commercialist who signs the contract
- when an additional service contract is made, the database stores the information about the manager who signs the contract
- every additional service is further described with a service level (1,2,3,4,5)
- for every additional service the database keeps track of the hours a programmer has spent implementing the additional service using a certain technology; multiple programmers can take part in an implementation
- for every service implemented programmers receive a bonus for every hour spent, and the bonus value depends on the service level and the degree of knowledge the programmer has for the technology used to implement the service.

SOLUTION: