Answers to the exercise #3 on Computer Networks

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Question. Design a protocol to be used between an automatic teller machine (ATM) and a bank's centralised computer. Your protocol should allow a user's card and password to be verified, the account balance (which is maintained at the bank) to be queried, and an account withdrawal to be made (money is given to the customer). **1. Specify your protocol** by listing the messages exchanged and the action taken by the ATM or the bank's centralised computer on transmission or receipt of each message:

From ATM to Bank	
Message name and arguments	Meaning/Action

From Bank to ATM	
Message name and arguments	Meaning/Action

2. Sketch the operation of your protocol, using a diagram, for the cases of a simple withdrawal **(a)** with no errors, **(b)** with one error.

Answer. One example is as follows.
Messages from ATM to server:

Message name	Purpose
HELO <userid>	Let server know that there is a card in the ATM, then transmits user ID to server
PASSWD <passwd>	User enters PIN, which is sent to server
BALANCE	User requests balance
WITHDRAWAL <amount>	User asks to withdraw money
BYE	User all done

Messages from server to ATM (display):

Message name	Purpose
PASSWD	Ask user for PIN (password)
OK	Last requested operation (PASSWD, WITHDRAWAL) OK
ERR	Last requested operation (PASSWD, WITHDRAWAL) resulted in error
AMOUNT <amount>	Sent in response to BALANCE request
BYE	User done, display welcome screen at ATM

A correct withdrawal looks like this:

```
HELO <userid>         ------------> (Check if valid userid)
                      <------------ PASSWD
PASSWD <passwd>       ------------> (Check password)
                      <------------ OK (password is OK)
BALANCE               ------------>
                      <------------ AMOUNT <amount>
WITHDRAWAL <amount>   ------------> (Check if enough money)
                      <------------ OK
ATM dispenses money
BYE                   ------------>
                      <------------ BYE
```