

The gas station, a case study for Quasar

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We aim here to study and eventually correct a program with the verification tool Quasar. This program, given below, simulates an automated gas station system consisting of an operator, a pump and a customer.

```
task body Customer is
begin
  loop
    Operator.Prepay;
    Pump.Start;
    Pump.Finish;
    accept Change;
  end loop;
end Customer;

task body Operator is
begin
  loop
    select
      accept Prepay do
        Pump.Activate;
      end Prepay;
    or
      accept Charge do
        Customer.Change;
      end Charge;
    end select;
  end loop;
end Operator;

task body Pump is
begin
  loop
    accept Activate;
    accept Start;
    accept Finish do
      Operator.Charge;
    end Finish;
  end loop;
end Pump;
```

We easily see that there is a simple and unavoidable deadlock that Quasar reports instantaneously giving us the execution which leads to the deadlock. This one occurs as soon as the customer calls the Finish entry. The pump is then accepting the call and in its turn calling the operator charge entry which is accepted by the operator. Finally the operator calls the customer change entry. Being given the customer hasn't been acknowledged by the pump, we reach a deadlock. Here is the execution corresponding to this one :

```
Customer : Operator.Prepay
Operator  : accept Prepay
Operator  : Pump.Activate
Pump      : accept Activate
Customer  : Pump.Start
Pump      : accept Start
Customer  : Pump.Finish
Pump      : accept Finish
Pump      : Operator.Charge
Operator  : Customer.Change
```

With the execution given by Quasar we easily manage to correct the program. This can be done by removing the Operator.Charge entry call in the pump body from the enclosing accept statement. With this update Quasar reports no deadlock. The verification of more complex properties will soon be available in Quasar but can be done with tools such Prod, a reachability analyser. For example :

- A client can get gas only if he already payed
- A client who payed always gets his gas
- ...