```
%IIoT
role nodeU (U,Gw: agent,
            Hmac: hash_func,
       Qca,Qg,Qu: public_key,
       Dg,Du,Kug: symmetric_key,
         SND,RCV: channel (dy))
played_by U def=
local
State: nat,
Idu,Idg,Certu,Certg,Su,Sg,Ts0,
Ts1,Lt0,Lt1,N5,Au,Ag,H4:text,
M5: message
init State:= 0
transition
1. State = 0 /\ RCV(start) =|>
  State':= 1 /\ N5' := new()
             /\ Ag' := {Idg.Certg.Sg.Ts0.Lt0}_Qca
             /\ Au' := {Idu.Certu.Su.Ts1.Lt1}_Qca
             /\ H4' := Hmac(Kug.Idg.N5.Au)
             /\ M5' := {Idg.N5.Au.H4}_Qg
             /\ SND(M5')
             /\ secret({Idg,Au'},sub1,{U,Gw})
end role

role gateway (U,Gw: agent,
              Hmac: hash_func,
         Qca,Qg,Qu: public_key,
         Dg,Du,Kug: symmetric_key,
           SND,RCV: channel (dy))
played_by Gw def=
local
State :nat,
Idu,Idg,Certu,Su,
Ts1,Lt1,N5,Au,H4:text,
M5: message
init State:= 1
transition
1. State = 1 /\ RCV(M5') =|>
  State':= 2 /\ M5' := {Idg.N5.Au.H4}_Dg
             /\ Au' := {Idu.Certu.Su.Ts1.Lt1}_Qca
             /\ H4' := Hmac(Kug.Idg.N5.Au)
             /\ witness(Gw,U,nodeU_gateway_n5,N5)
             /\ witness(Gw,U,nodeU_gateway_lt1,Lt1)
end role

role session (U,Gw: agent,
              Hmac: hash_func,
         Qca,Qg,Qu: public_key,
         Dg,Du,Kug: symmetric_key)
def=
local SU,RU,SGw,RGw: channel(dy)
composition
  nodeU(U,Gw,Hmac,Qca,Qg,Qu,Dg,Du,Kug,SU,RU)
/\gateway(U,Gw,Hmac,Qca,Qg,Qu,Dg,Du,Kug,SGw,RGw)
end role

role environment ()
def=
const    nodeU,gateway: agent,
             qca,qg,qu: public_key,
dg,du,kug,dgi,dui,kugi:symmetric_key,
idu,idg,certu,certg,su,sg,
ts0,ts1,lt0,lt1,n5,au,ag,h4: text,
hmac: hash_func,
nodeU_gateway_n5,nodeU_gateway_lt1,sub1: protocol_id
intruder_knowledge = {nodeU,gateway,hmac,dgi,dui,qca,qg,qu}
composition
```

```
  session(nodeU,gateway,hmac,qca,qg,qu,dg,du,kug)
/\session(nodeU,i,hmac,qca,qg,qu,dgi,dui,kugi)
/\session(i,gateway,hmac,qca,qg,qu,dgi,dui,kugi)
end role

goal
secrecy_of sub1
authentication_on nodeU_gateway_n5
authentication_on nodeU_gateway_lt1
end goal
environment ()
```