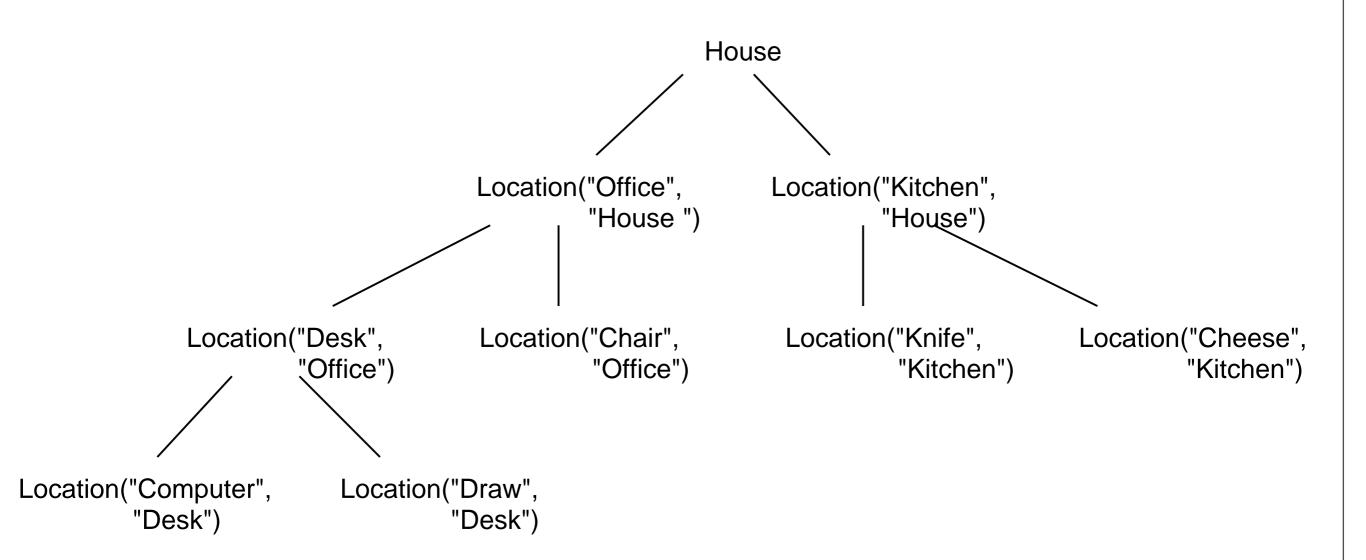
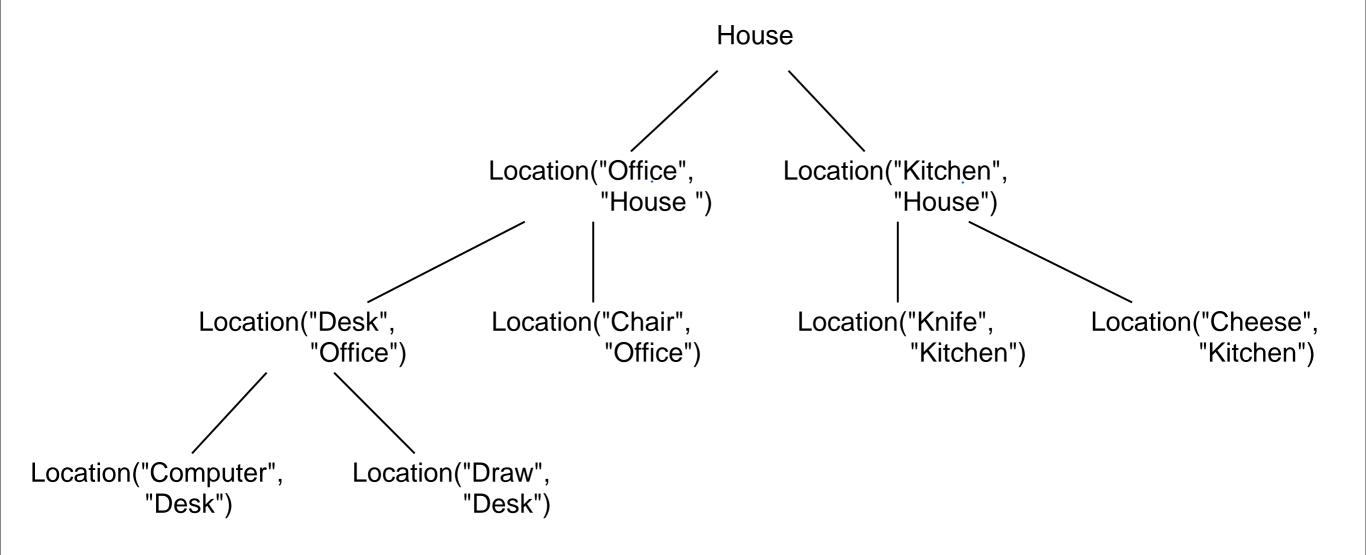
# **Reasoning with Graphs**





```
query isContainedIn( String x, String y )
  Location(x, y; )
  or
  ( Location( z, y; ) and isContainedIn( x, z; ) )
end
```

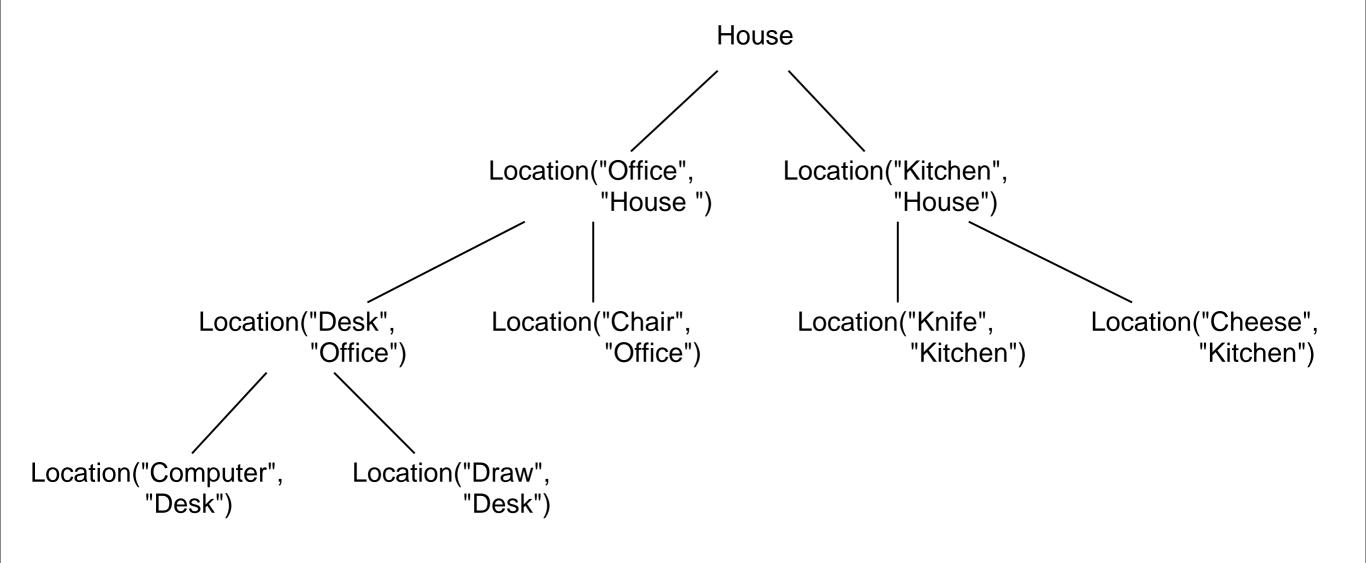




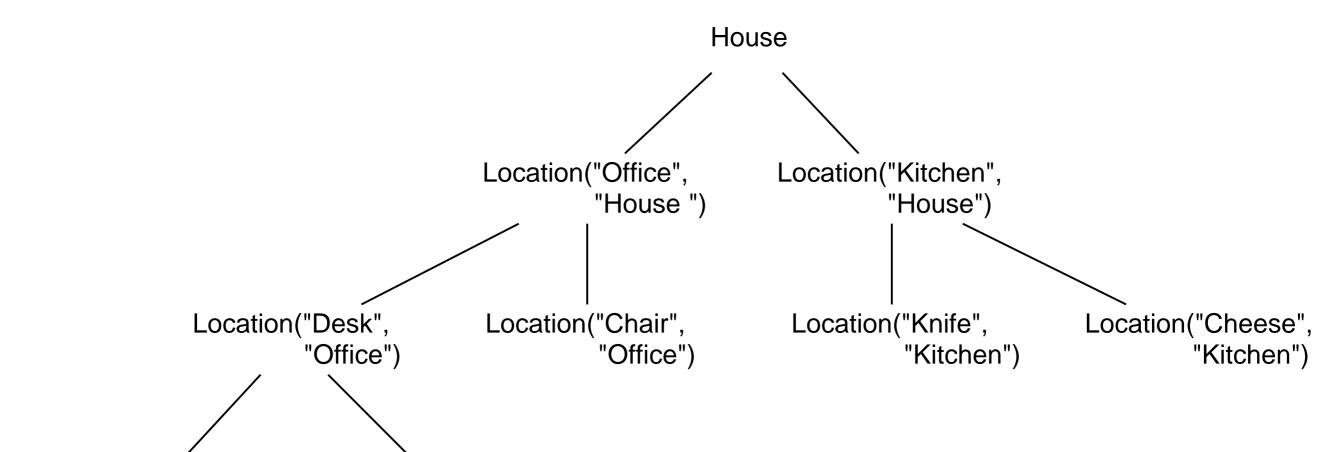
```
ksession.insert( new Location("Office", "House") );
ksession.insert( new Location("Kitchen", "House") );
ksession.insert( new Location("Knife", "Kitchen") );
ksession.insert( new Location("Cheese", "Kitchen") );
ksession.insert( new Location("Desk", "Office") );
ksession.insert( new Location("Chair", "Office") );
ksession.insert( new Location("Computer", "Desk") );
ksession.insert( new Location("Draw", "Desk") );
                                                   House
                                  Location("Office",
                                                        Location("Kitchen",
                                           "House ")
                                                                 "House")
                                                          Location("Knife",
                                                                                Location("Cheese",
            Location("Desk",
                                   Location("Chair",
                     "Office")
                                                                                        "Kitchen")
                                           "Office")
                                                                  "Kitchen")
                        Location("Draw",
Location("Computer",
        "Desk")
                                "Desk")
```



```
rule "go" salience 10
when
     $s : String( )
then
     System.out.println($s);
end
```







Location("Draw",

"Desk")



Location("Computer",

```
rule "go1"
rule "go" salience 10
                                       when
when
                                            String( this == "go1" )
    $s : String( )
                                            isContainedIn("Office", "House"; )
then
                                       then
    System.out.println($s);
                                            System.out.println( "office is in the house");
end
                                       end
query isContainedIn( String x, String y )
  Location (x, y; )
  or
  (Location(z, y;) and isContainedIn(x, z;)) House
end
                                                 Location("Office",
                                                                   Location("Kitchen",
                                                        "House ")
                                                                          "House")
                              Location("Desk",
                                                 Location("Chair",
                                                                    Location("Knife",
                                                                                      Location("Cheese",
                                     "Office")
                                                                                             "Kitchen")
                                                        "Office")
                                                                           "Kitchen")
                    Location("Computer",
                                        Location("Draw",
                           "Desk")
                                               "Desk")
```



```
rule "go1"
rule "go" salience 10
                                      when
when
                                           String( this == "go1" )
    $s : String( )
                                           isContainedIn("Office", "House"; )
then
                                      then
    System.out.println($s);
                                           System.out.println( "office is in the house" );
end
                                      end
query isContainedIn( String x, String y )
  Location (x, y; )
  or
  (Location(z, y;) and isContainedIn(x, z;)) House
end
                                                Location("Office",
                                                                  Location("Kitchen",
ksession.insert( "go1" );
                                                       "House ")
                                                                         "House")
ksession.fireAllRules();
qo1
                              Location("Desk",
                                                                  Location("Knife",
                                                Location("Chair",
                                                                                    Location("Cheese",
office is in the house
                                     "Office")
                                                                                           "Kitchen")
                                                       "Office")
                                                                         "Kitchen")
                   Location("Computer",
                                       Location("Draw",
                           "Desk")
                                              "Desk")
```

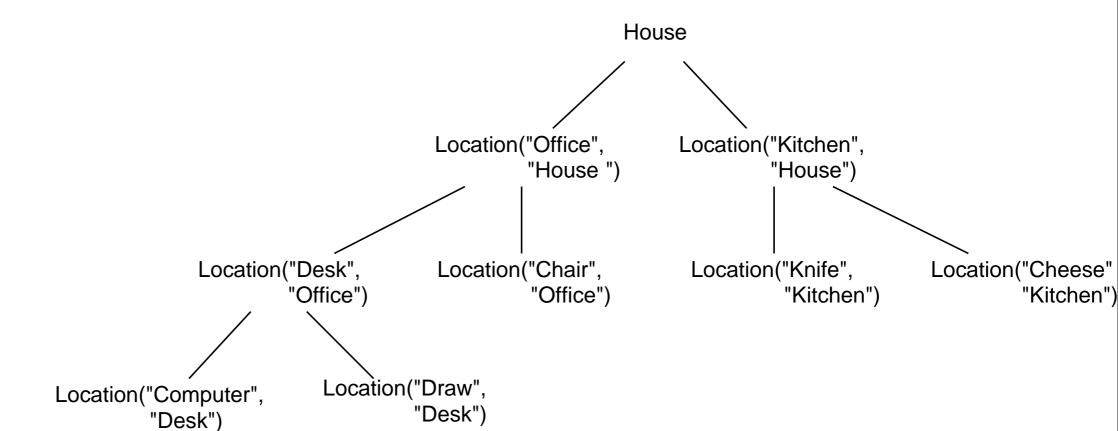


```
rule "go1"
rule "go" salience 10
                                      when
when
                                           String( this == "go1" )
    $s : String( )
                                           isContainedIn("Office", "House"; )
then
                                      then
    System.out.println($s);
                                           System.out.println( "office is in the house" );
end
                                      end
                                                         isContainedIn(x==Office, y==House)
query isContainedIn( String x, String y )
  Location (x, y; )
  or
  (Location(z, y;) and isContainedIn(x, z;)) House
end
                                               Location("Office",
                                                                 Location("Kitchen",
ksession.insert( "go1" );
                                                      "House ")
                                                                        "House")
ksession.fireAllRules();
qo1
                              Location("Desk",
                                                                  Location("Knife",
                                                Location("Chair",
                                                                                    Location("Cheese",
office is in the house
                                    "Office")
                                                      "Office")
                                                                         "Kitchen")
                                                                                          "Kitchen")
                   Location("Computer",
                                       Location("Draw",
                          "Desk")
                                              "Desk")
```



```
rule "go1"
rule "go" salience 10
                                      when
when
                                          String( this == "go1" )
    $s : String( )
                                           isContainedIn("Office", "House"; )
then
                                      then
    System.out.println($s);
                                          System.out.println( "office is in the house" );
end
                                      end
                                                        isContainedIn(x==Office, y==House)
query isContainedIn( String x, String y )
                                                        Location (x==Office, y==House)
  Location (x, y; )
  or
  (Location(z, y;) and isContainedIn(x, z;)) House
end
                                               Location("Office",
                                                                 Location("Kitchen",
ksession.insert( "go1" );
                                                      "House ")
                                                                        "House")
ksession.fireAllRules();
qo1
                             Location("Desk",
                                                                  Location("Knife",
                                               Location("Chair",
                                                                                   Location("Cheese",
office is in the house
                                    "Office")
                                                      "Office")
                                                                         "Kitchen")
                                                                                          "Kitchen")
                   Location("Computer",
                                       Location("Draw",
                          "Desk")
                                             "Desk")
```







```
rule "go2"
when
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
then
     System.out.println( "Draw in the House" );
end
query isContainedIn( String x, String y )
  Location (x, y; )
                                                                  House
  or
   ( Location ( z, y; ) and isContainedIn( x, z; )
end
                                                   Location("Office",
                                                                       Location("Kitchen",
                                                                              "House")
                                                           "House ")
                                Location("Desk",
                                                    Location("Chair",
                                                                        Location("Knife",
                                                                                           Location("Cheese",
                                        "Office")
                                                                                                  "Kitchen")
                                                           "Office")
                                                                               "Kitchen")
                     Location("Computer",
                                          Location("Draw",
                             "Desk")
                                                  "Desk")
```



```
rule "go2"
                                                           ksession.insert( "go2" );
when
                                                           ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                           go2
then
                                                           Draw in the House
     System.out.println( "Draw in the House" );
end
query isContainedIn( String x, String y )
  Location (x, y; )
                                                                 House
  or
  ( Location ( z, y; ) and isContainedIn( x, z; )
end
                                                                     Location("Kitchen",
                                                  Location("Office",
                                                         "House ")
                                                                            "House")
                               Location("Desk",
                                                                                         Location("Cheese",
                                                   Location("Chair",
                                                                      Location("Knife",
                                       "Office")
                                                          "Office")
                                                                             "Kitchen")
                                                                                                "Kitchen")
                                         Location("Draw",
                     Location("Computer",
                                                "Desk")
                            "Desk")
```



```
rule "qo2"
                                                          ksession.insert( "go2" );
when
                                                          ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                          go2
then
                                                          Draw in the House
     System.out.println( "Draw in the House" );
end
                                                           isContainedIn(x==Draw, y==House)
query isContainedIn( String x, String y )
  Location (x, y;)
                                                                House
  or
  ( Location ( z, y; ) and isContainedIn ( x, z;
end
                                                                    Location("Kitchen",
                                                  Location("Office",
                                                         "House ")
                                                                           "House")
                                                                                        Location("Cheese",
                               Location("Desk",
                                                                     Location("Knife",
                                                  Location("Chair",
                                      "Office")
                                                         "Office")
                                                                            "Kitchen")
                                                                                               "Kitchen")
                    Location("Computer",
                                         Location("Draw",
                            "Desk")
                                                "Desk")
```



```
rule "qo2"
                                                         ksession.insert( "go2" );
when
                                                         ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                         go2
then
                                                         Draw in the House
     System.out.println( "Draw in the House" );
end
                                                          isContainedIn(x==Draw, y==House)
                                                           Location (z==Office, y==House)
query isContainedIn( String x, String y )
  Location (x, y; )
                                                               House
  or
  ( Location( z, y; ) and isContainedIn( x, z; )
end
                                                 Location("Office",
                                                                   Location("Kitchen",
                                                        "House ")
                                                                          "House")
                               Location("Desk",
                                                                    Location("Knife",
                                                                                       Location("Cheese",
                                                 Location("Chair",
                                      "Office")
                                                                           "Kitchen")
                                                                                             "Kitchen")
                                                        "Office")
                    Location("Computer",
                                        Location("Draw",
```

"Desk")



```
rule "qo2"
                                                         ksession.insert( "go2");
when
                                                         ksession.fireAllRules();
    String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                         go2
then
                                                         Draw in the House
     System.out.println( "Draw in the House" );
end
                                                          isContainedIn(x==Draw, y==House)
                                                          Location (z==Office, y==House)
query isContainedIn( String x, String y )
                                                          isContainedIn(x==Draw, z==Office)
  Location (x, y; )
                                                              House
  or
  ( Location( z, y; ) and isContainedIn( x, z; )
end
                                                Location("Office",
                                                                  Location("Kitchen",
                                                       "House ")
                                                                          "House")
                              Location("Desk",
                                                                   Location("Knife",
                                                                                      Location("Cheese",
                                                 Location("Chair",
                                     "Office")
                                                        "Office")
                                                                          "Kitchen")
                                                                                            "Kitchen")
                    Location("Computer",
                                        Location("Draw",
```

"Desk")



```
rule "qo2"
                                                   ksession.insert( "go2");
when
                                                   ksession.fireAllRules();
    String( this == "go2" )
    isContainedIn("Draw", "House"; )
                                                   go2
then
                                                   Draw in the House
    System.out.println( "Draw in the House" );
end
                                                    isContainedIn(x==Draw, y==House)
                                                     Location (z==Office, y==House)
query isContainedIn( String x, String y )
                                                     isContainedIn(x==Draw, z==Office)
  Location (x, y; )
                                                      Location (z==Kitchen, y==House)
  or
  (Location(z, y;) and isContainedIn(x, z;)) isContainedIn(x==Draw, z==Kitchen)
end
                                                   House
                                        Location("Office",
                                                      Location("Kitchen",
                                             "House")
                                                            "House")
```

Location("Chair",

"Office")

Location("Knife",

"Kitchen")

Location("Cheese",

"Kitchen")

Location("Desk",

Location("Computer",

"Desk")

"Office")

Location("Draw",



```
rule "go2"
                                                          ksession.insert( "go2" );
when
                                                          ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                          go2
then
                                                          Draw in the House
     System.out.println( "Draw in the House" );
end
                                                            isContainedIn(x==Draw, y==Office)
query isContainedIn( String x, String y )
  Location (x, y; )
                                                               House
  or
  ( Location ( z, y; ) and isContainedIn( x, z; )
end
                                                                    Location("Kitchen",
                                                 Location("Office",
                                                        "House ")
                                                                           "House")
                               Location("Desk",
                                                                                       Location("Cheese",
                                                  Location("Chair",
                                                                     Location("Knife",
                                      "Office")
                                                         "Office")
                                                                            "Kitchen")
                                                                                              "Kitchen")
                    Location("Computer",
                                         Location("Draw",
```

"Desk")



```
rule "qo2"
                                                         ksession.insert( "go2");
when
                                                         ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                         go2
then
                                                         Draw in the House
     System.out.println( "Draw in the House" );
end
                                                           isContainedIn(x==Draw, y==Office)
query isContainedIn( String x, String y )
                                                           Location (z==Desk, y==Office)
  Location (x, y; )
                                                               House
  or
  ( Location( z, y; ) and isContainedIn( x, z; )
end
                                                 Location("Office",
                                                                   Location("Kitchen",
                                                        "House ")
                                                                          "House")
                               Location("Desk",
                                                                    Location("Knife",
                                                                                      Location("Cheese",
                                                 Location("Chair",
                                     "Office")
                                                                           "Kitchen")
                                                                                             "Kitchen")
                                                        "Office")
                    Location("Computer",
                                        Location("Draw",
```

"Desk")



```
rule "qo2"
                                                         ksession.insert( "go2");
when
                                                         ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                         go2
then
                                                         Draw in the House
     System.out.println( "Draw in the House" );
end
                                                           isContainedIn(x==Draw, y==Office)
query isContainedIn( String x, String y )
                                                           Location (z==Desk, y==Office)
  Location(x, y;)
                                                           isContainedIn(x==Draw, z==Desk)
  or
  ( Location ( z, y; ) and isContainedIn(x, z; ) )
                                                              House
end
                                                Location("Office",
                                                                   Location("Kitchen",
                                                       "House ")
                                                                          "House")
                              Location("Desk",
                                                 Location("Chair",
                                                                    Location("Knife",
                                                                                      Location("Cheese",
                                     "Office")
                                                        "Office")
                                                                           "Kitchen")
                                                                                             "Kitchen")
                    Location("Computer",
                                        Location("Draw",
                           "Desk")
                                               "Desk")
```



```
rule "qo2"
                                                          ksession.insert( "go2" );
when
                                                          ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                          go2
then
                                                          Draw in the House
     System.out.println( "Draw in the House" );
end
                                                            isContainedIn(x==Draw, y==Desk)
query isContainedIn( String x, String y )
  Location (x, y; )
                                                                House
  or
  ( Location ( z, y; ) and isContainedIn(x, z; ) )
end
                                                 Location("Office",
                                                                    Location("Kitchen",
                                                         "House ")
                                                                           "House")
                               Location("Desk",
                                                  Location("Chair",
                                                                     Location("Knife",
                                                                                        Location("Cheese",
                                                                                              "Kitchen")
                                      "Office")
                                                         "Office")
                                                                            "Kitchen")
                    Location("Computer",
                                         Location("Draw",
                            "Desk")
                                                "Desk")
```



```
rule "qo2"
                                                         ksession.insert( "go2" );
when
                                                         ksession.fireAllRules();
     String( this == "go2" )
     isContainedIn("Draw", "House"; )
                                                         go2
then
                                                         Draw in the House
     System.out.println( "Draw in the House" );
end
                                                            isContainedIn(x==Draw, y==Desk)
query isContainedIn( String x, String y )
                                                            Location (x==Draw, y==Desk)
  Location (x, y; )
  or
                                                               House
  ( Location ( z, y; ) and isContainedIn(x, z; ) )
end
                                                 Location("Office",
                                                                    Location("Kitchen",
                                                                           "House")
                                                        "House ")
                                                                                       Location("Cheese",
                               Location("Desk",
                                                 Location("Chair",
                                                                     Location("Knife",
                                      "Office")
                                                        "Office")
                                                                            "Kitchen")
                                                                                              "Kitchen")
                    Location("Computer",
                                         Location("Draw",
                           "Desk")
                                                "Desk")
```



Location("Computer",

"Desk")

```
rule "go3"
when
    String( this == "go3" )
     isContainedIn("Key", "Office"; )
then
     System.out.println( "Key in the Office" );
end
                                                         House
                                       Location("Office",
                                                             Location("Kitchen",
                                                "House ")
                                                                      "House")
                  Location("Desk",
                                                                                     Location("Cheese",
                                        Location("Chair",
                                                               Location("Knife",
                          "Office")
                                                "Office")
                                                                       "Kitchen")
                                                                                             "Kitchen")
```

Location("Draw",



```
rule "go3"
when
     String( this == "go3" )
     isContainedIn("Key", "Office"; )
then
     System.out.println( "Key in the Office");
end
                                                           House
ksession.insert( "go3" );
ksession.fireAllRules();
go3
                                                                Location("Kitchen",
                                          Location("Office",
                                                   "House")
                                                                        "House")
                     Location("Desk",
                                           Location("Chair",
                                                                 Location("Knife",
                                                                                      Location("Cheese",
                             "Office")
                                                   "Office")
                                                                         "Kitchen")
                                                                                              "Kitchen")
         Location("Computer",
                                Location("Draw",
                  "Desk")
                                         "Desk")
```



```
rule "qo3"
when
     String( this == "go3" )
     isContainedIn("Key", "Office"; )
then
     System.out.println( "Key in the Office" );
end
ksession.insert( "go3" );
ksession.fireAllRules();
go3
                                                                  House
ksession.insert( new Location("Key", "Draw")
ksession.fireAllRules();
                                                    Location("Office",
                                                                       Location("Kitchen",
                                                           "House ")
                                                                              "House")
Key in the Office
                                Location("Desk",
                                                    Location("Chair",
                                                                        Location("Knife",
                                                                                           Location("Cheese",
                                        "Office")
                                                           "Office")
                                                                               "Kitchen")
                                                                                                  "Kitchen")
                     Location("Computer",
                                          Location("Draw",
                             "Desk")
                                                  "Desk")
                                           Location("Key",
                                                  "Draw")
```

```
rule "qo4"
when
    String( this == "go4" )
    isContainedIn(thing, "Office"; )
then
    System.out.println("thing" + thing + " is in the Office");
end
                                                        House
                                       Location("Office",
                                                             Location("Kitchen",
                                               "House")
                                                                     "House")
                 Location("Desk",
                                       Location("Chair",
                                                              Location("Knife",
                                                                                   Location("Cheese",
                         "Office")
                                               "Office")
                                                                      "Kitchen")
                                                                                            "Kitchen")
    Location("Computer",
                            Location("Draw",
             "Desk")
                                     "Desk")
                             Location("Key",
                                     "Draw")
```

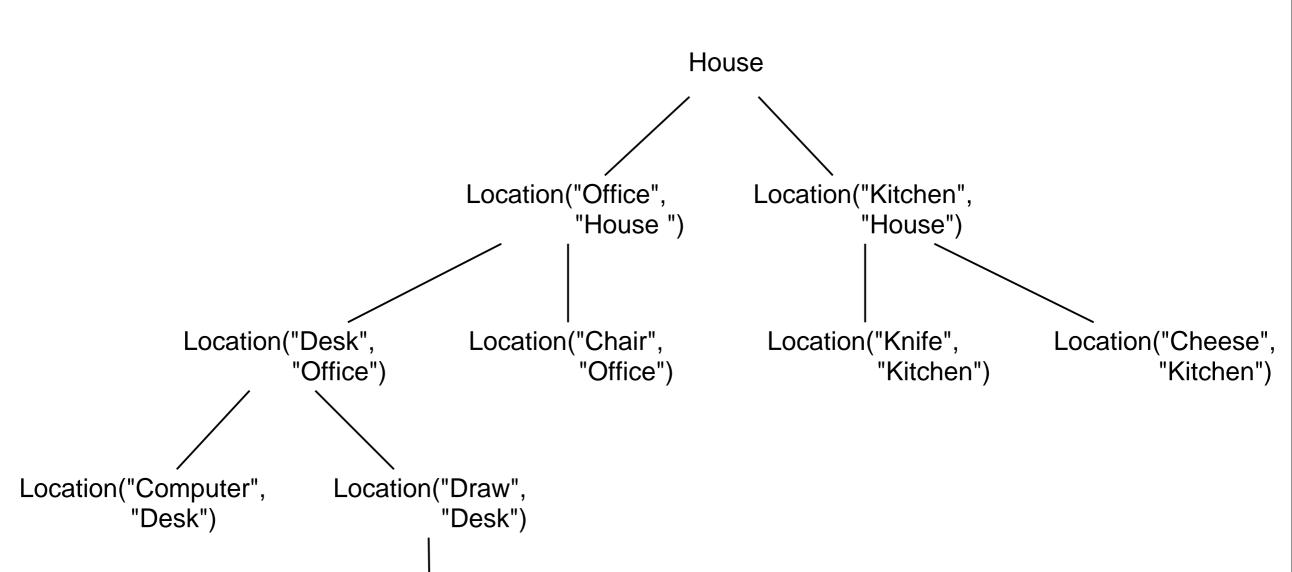


```
rule "go4"
when

String( this == "go4"
    isContainedIn(thing, "Office"; )
then

System.out.println( "thing " + thing + " is in the Office" );
end
```

Location("Key",





```
Out Var
rule "qo4"
                                         (unbound)
when
     String( this == "go4"
     isContainedIn(thing, "Office"; )
then
     System.out.println("thing" + thing + " is in the Office");
end
ksession.insert( "go4" );
ksession.fireAllRules();
                                                            House
qo4
thing Key is in the Office
thing Computer is in the Office
thing Draw is in the Office
                                             Location("Office",
                                                                 Location("Kitchen",
thing Desk is in the Office
                                                     "House ")
                                                                        "House")
thing Chair is in the Office
                                              Location("Chair",
                           Location("Desk",
                                                                  Location("Knife",
                                                                                     Location("Cheese",
                                  "Office")
                                                     "Office")
                                                                         "Kitchen")
                                                                                            "Kitchen")
               Location("Computer",
                                     Location("Draw",
                       "Desk")
                                            "Desk")
                                     Location("Key",
                                            "Draw")
```

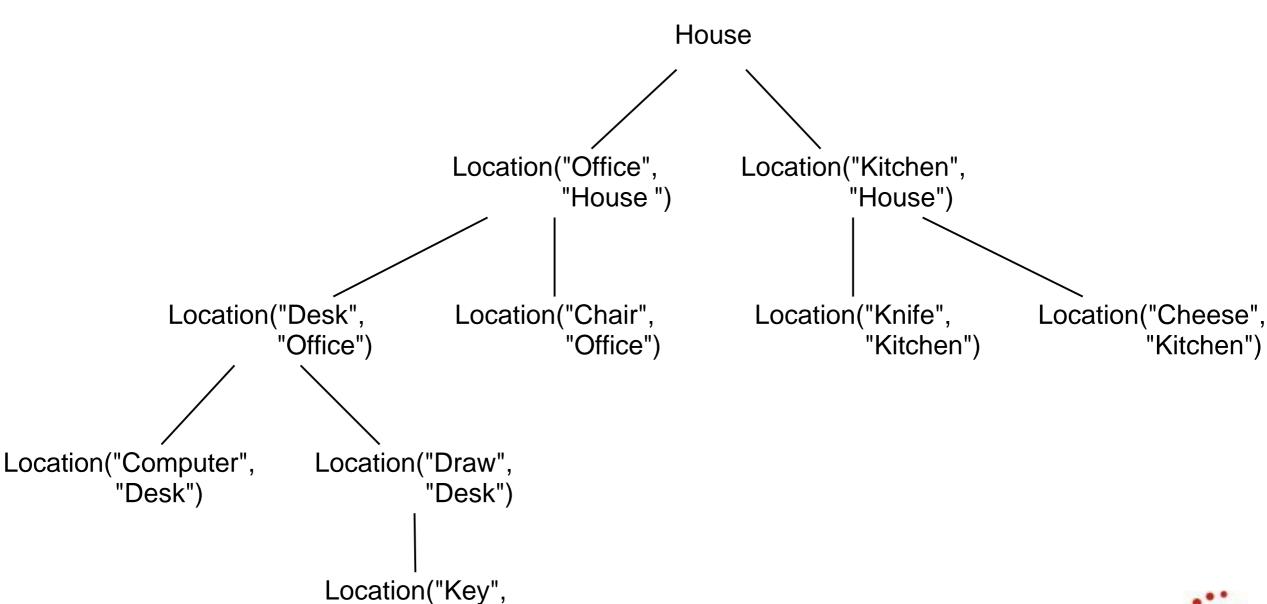
```
rule "go5"
when
    String( this == "go5")
     isContainedIn(thing, location; )
then
     System.out.println( "thing " + thing + " is in " + location );
end
                                                         House
                                        Location("Office",
                                                              Location("Kitchen",
                                                 "House")
                                                                       "House")
                                                               Location("Knife",
                   Location("Desk",
                                         Location("Chair",
                                                                                     Location("Cheese",
                           "Office")
                                                 "Office")
                                                                                             "Kitchen")
                                                                        "Kitchen")
      Location("Computer",
                              Location("Draw",
               "Desk")
                                       "Desk")
                               Location("Key",
```



```
rule "go5"
when

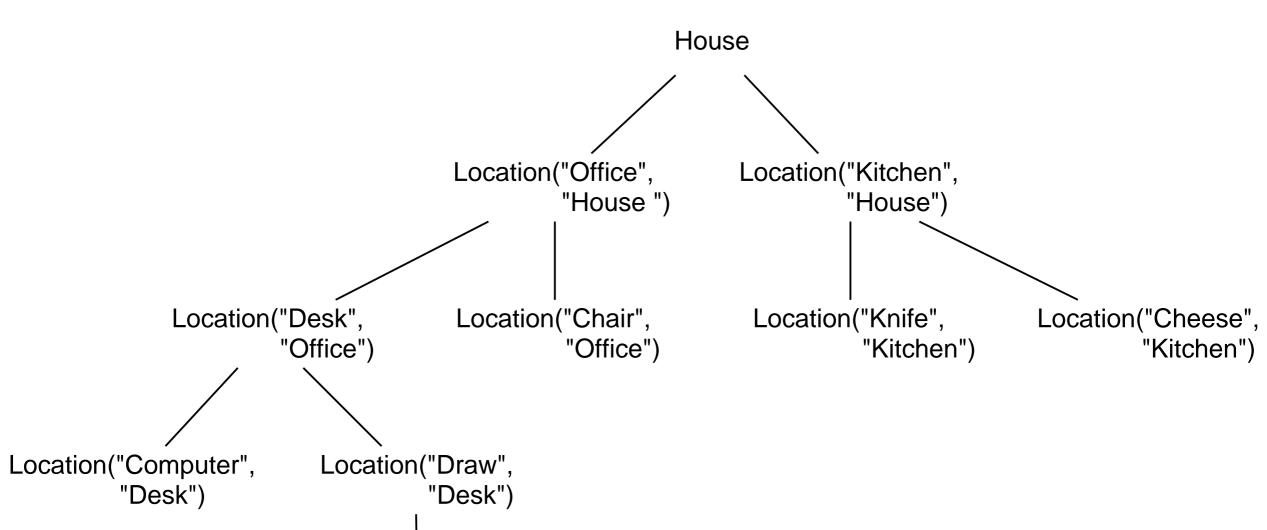
String( this == "go5"
    isContainedIn(thing, location; )
then

System.out.println( "thing " + thing + " is in " + location );
end
```





Location("Key",





```
Out Var
rule "qo5"
                                                      Out Var
                                         (unbound)
when
                                                      (unbound)
     String( this == "go5"
     isContainedIn(thing, location;
then
     System.out.println( "thing " + thing + " is in " + location );
end
ksession.insert( "go5" );
ksession.fireAllRules();
qo5
thing Knife is in House
                                  thing Computer is in Desk
thing Cheese is in House
                                  thing Knife is in Kitchen
thing Key is in House
                                  thing Cheese is in Kitchen
thing Computer is in House
                                  thing Kitchen is in House
thing Draw is in House
                                  thing Key is in Draw
                                                                         House
thing Desk is in House
                                  thing Draw is in Desk
thing Chair is in House
                                  thing Desk is in Office
thing Key is in Office
                                  thing Chair is in OfficeLocation("Office",
                                                                            Location("Kitchen",
                                                                    "House ")
                                                                                 "House")
thing Computer is in Office
thing Draw is in Office
thing Key is in Desk
                                                  Location("Desk",
                                                               Location("Chair",
                                                                             Location("Knife",
                                                                                          Location("Cheese",
                                                       "Office")
                                                                    "Office")
                                                                                  "Kitchen")
                                                                                               "Kitchen")
thing Office is in House
                                          Location("Computer",
                                                         Location("Draw",
                                                "Desk")
                                                              "Desk")
                                                         Location("Key",
```