Action Data Flow Diagrams

Leon Starr
November 1, 2021
mint.sm-meta.action.tn.1
Version 0.1.1

MODEL INTEGRATION, LLC

Change Log

Version	Date	Changes	Modified by
0.1.0	Nov 1, 2021	Copy notes in from tablet made in August/Oct 2021	Leon Starr
			Leon Starr

There are four places in Shlaer-Mellor where an Activity may be defined.

Each Activity type specifies a set of zero or more input parameter:type pairs

State Activity

OPEN

UI.Door opened(Shaft)
my Bank .= /R4/R2/Bank
Time to close -> me @ Blocked ?
    my Bank.Block clear time : my Bank.Passenger load time

Only synchronous Activities may specify a set of zero or more output parameter:type pairs

State Activities and Asynchronous External Entity Operations may not specify outputs

Class Method

Bank Level

Bank {I, R29}
Floor {I, R29}

Choose shaft(calling floor : Level Name,
service dir: Direction) : Shaft ID

=>> /R29/R1/Shaft/R2/Cabin(1, ^-Estimate delay(calling floor: Floor, in.service dir)).Shaft

Arrived at floor(cabin : Shaft ID)

Domain Operation

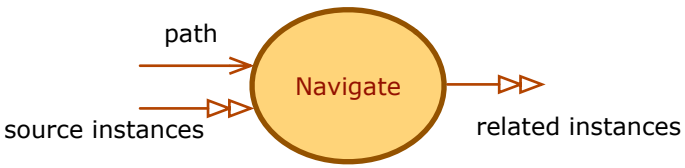
Arrived at floor -> Cabin(Shaft : in.cabin)

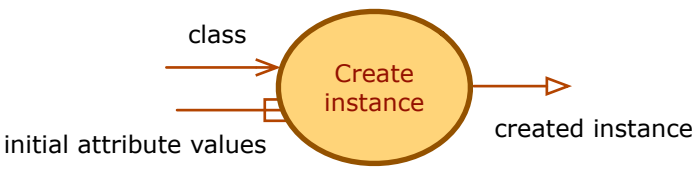
External Entity Operation

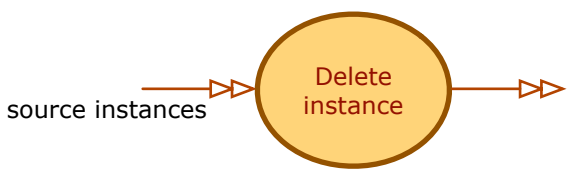
(asychronous or synchronous)

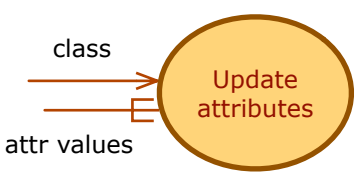
UI.Cabin arrived(shaft: Shaft ID, direction: Direction)

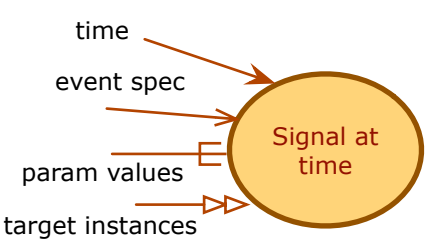
// Tell UI that a cabin has arrived

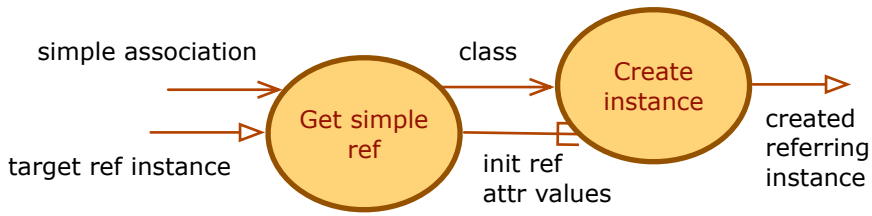


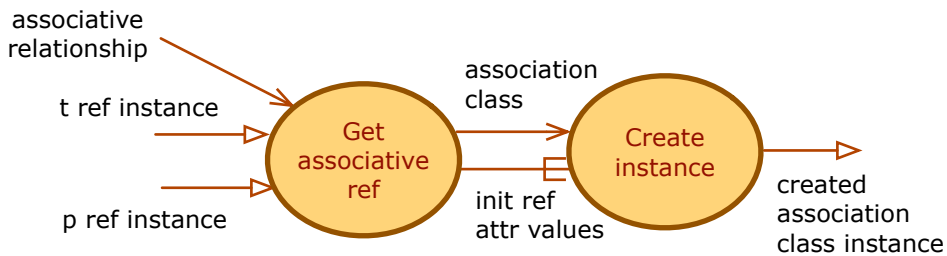


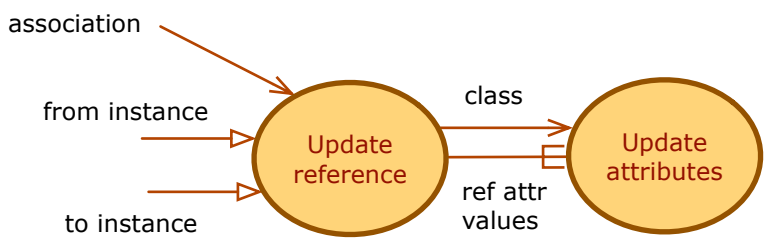


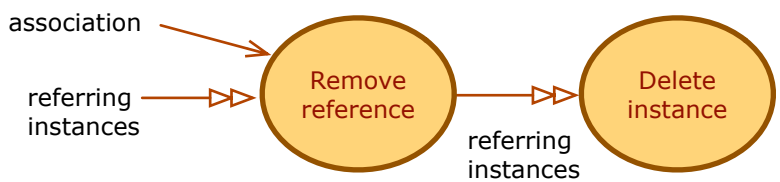


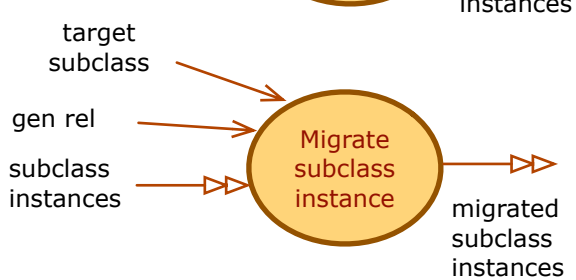


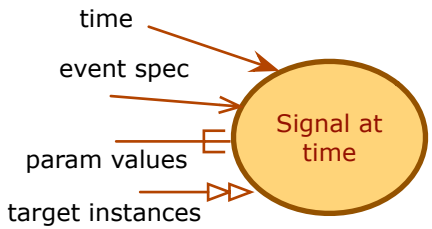


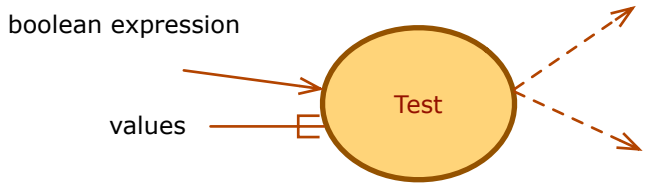


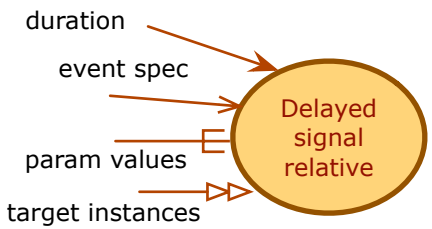


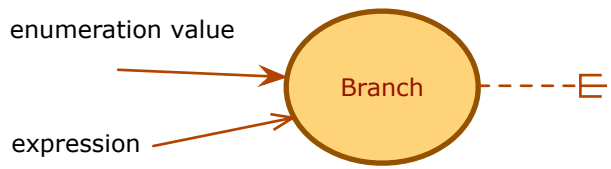


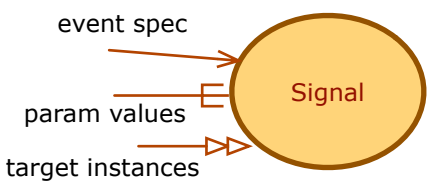


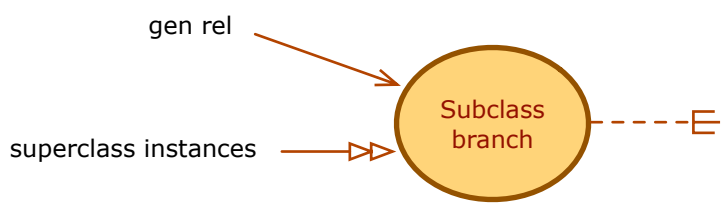












Let's examine how the following Scrall statement is broken down into metamodel components (in the Link Action Subsystem)

```
*Aircraft( tail number, altitude, airspeed, heading ) &R1 *Pilot( id )
```

We'll assume that the parameter values and names match in the attribute initialization expressions

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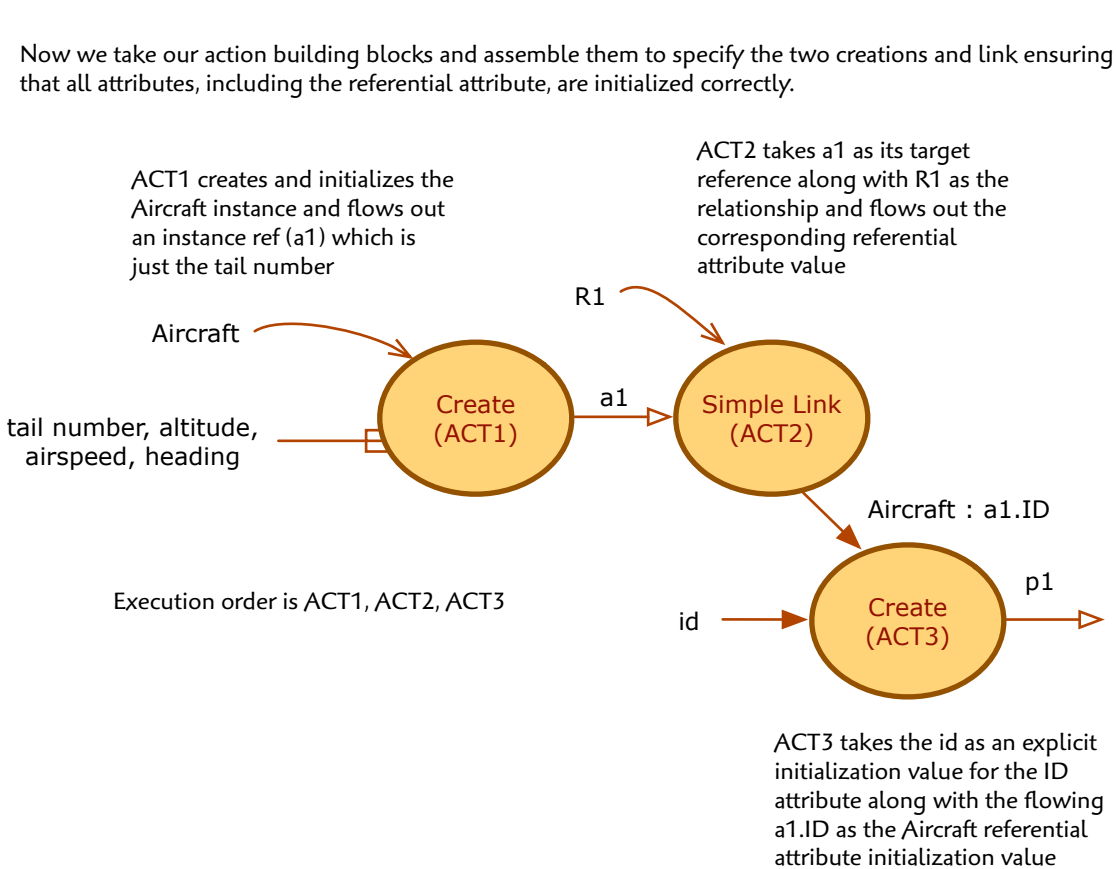
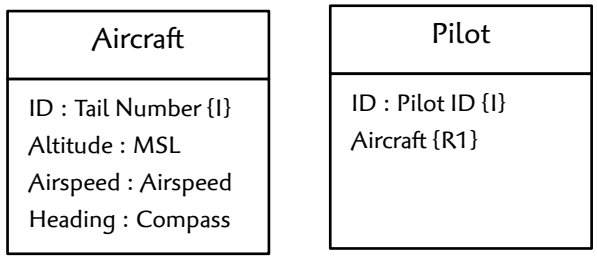
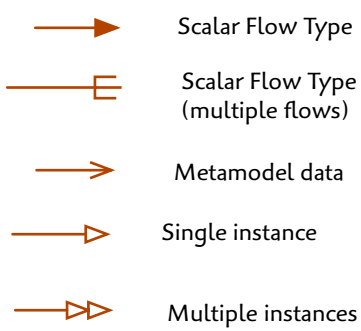
Now we take our action building blocks and assemble them to specify the two creations and link ensuring that all attributes, including the referential attribute, are initialized correctly.

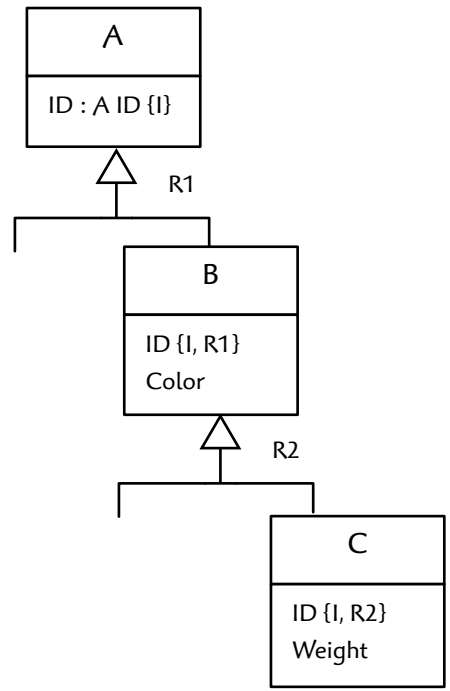






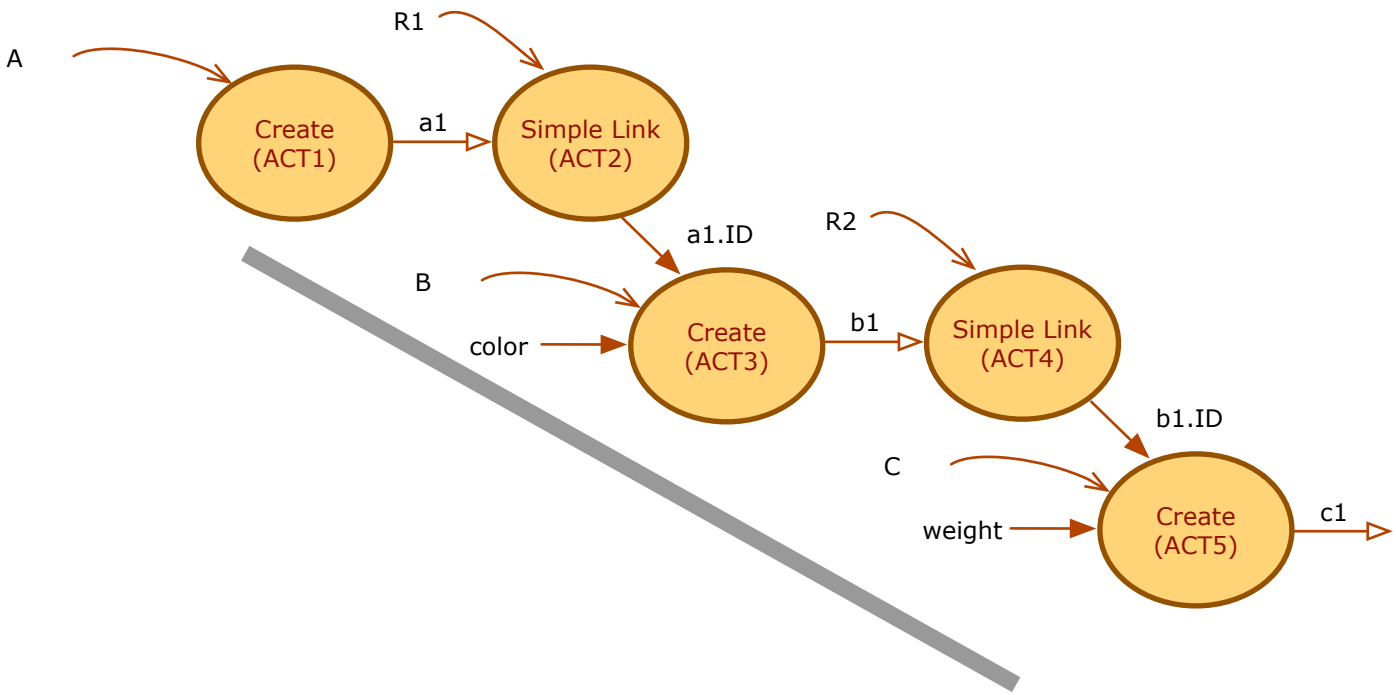
```
*C(weight) &R2 *B(color) &R1 *A
```

When creating an instance in a composition of generalization relationships, the highest superclass must be instantiated with one subclass instance at each level below



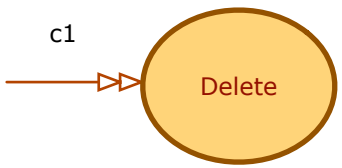
We'll assume that the parameter values and names match in the attribute initialization expressions

Regardless of ordering in the action language, we always build from the top down so that we have our referential attribute values as input to the downstream create action



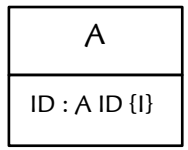
!*c1

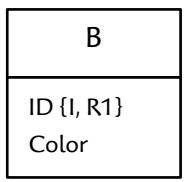
The action language will delete the instance of C and, since it is part of a generalization, remove all related superclasses as well

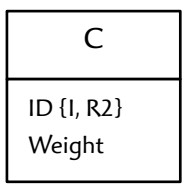


When deleting a subclass instance, the delete primitive will work its way up to all related superclasses (and up from any corresponding subclasses, if in a compound generalization)

Since the Delete Action does not output any instance flow, we can't chain them together to illustrate a separate delete on each generalization instance. Instead, we assume that all this goes on within the Delete Action.







Here we migrate a subclass instance

ATC
ID : Employee ID {I}

```
atcOn >> Off Duty Controller( Time logged off : Date.Now hms )
```

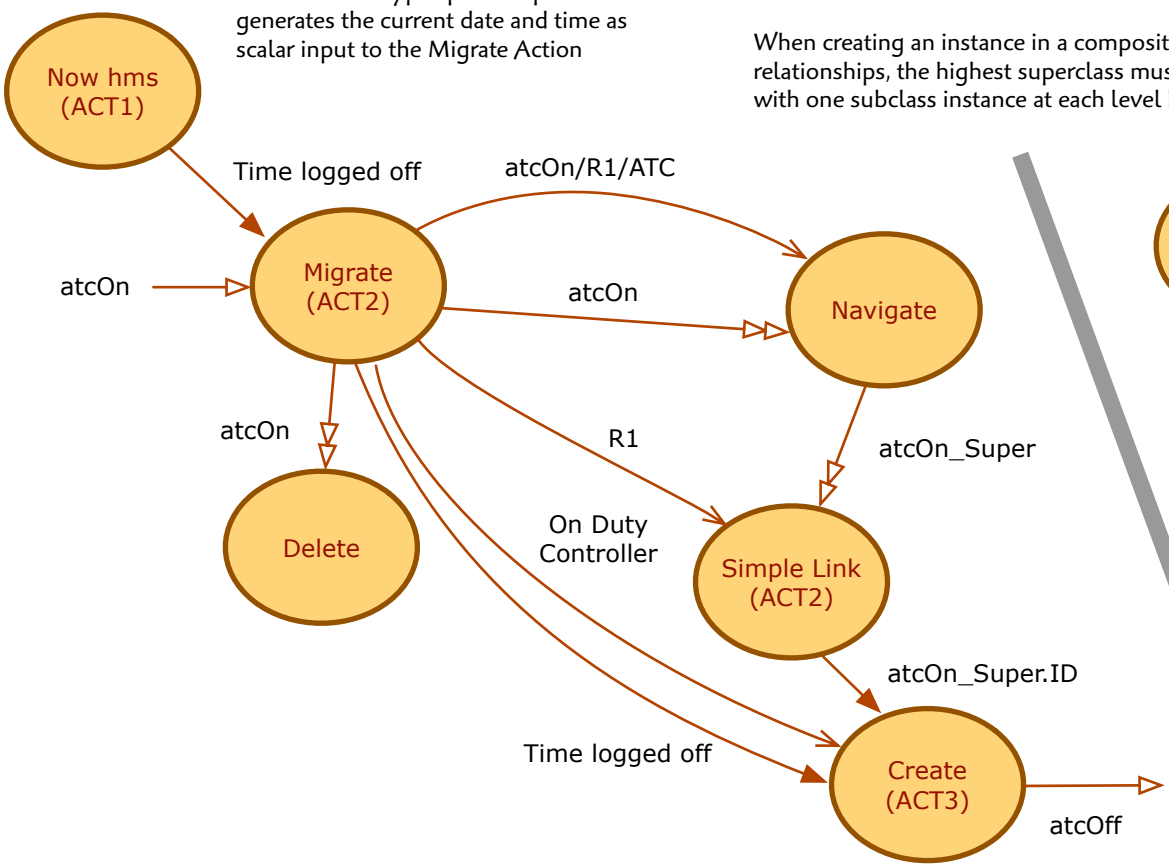
Here we delete the original subclass instance and create a new one initialized with the correct referential attribute and explicit attribute initialization.

On Duty Controller
ID {I, R1}

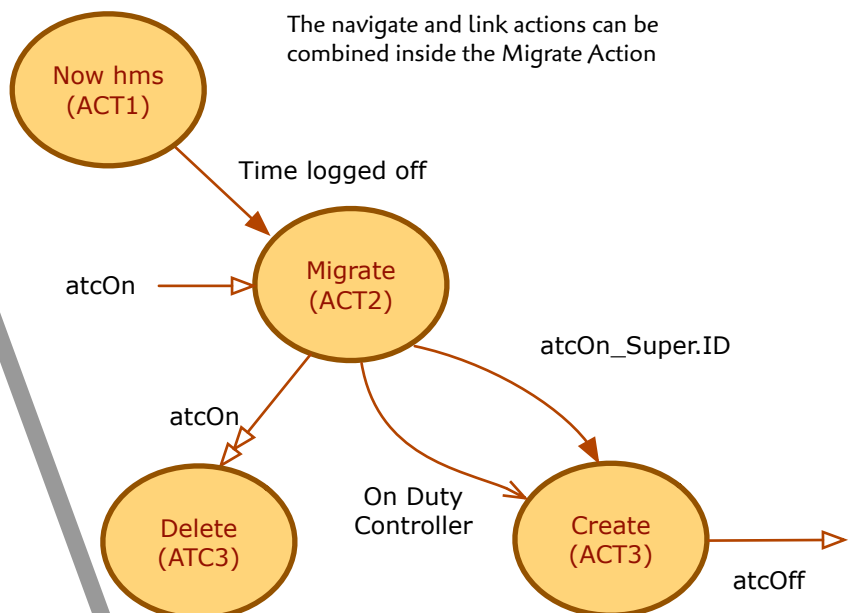
Off Duty Controller
ID {I, R1} Time logged off : Date

The Date data type specific operation generates the current date and time as scalar input to the Migrate Action

When creating an instance in a composition of generalization relationships, the highest superclass must be instantiated with one subclass instance at each level below



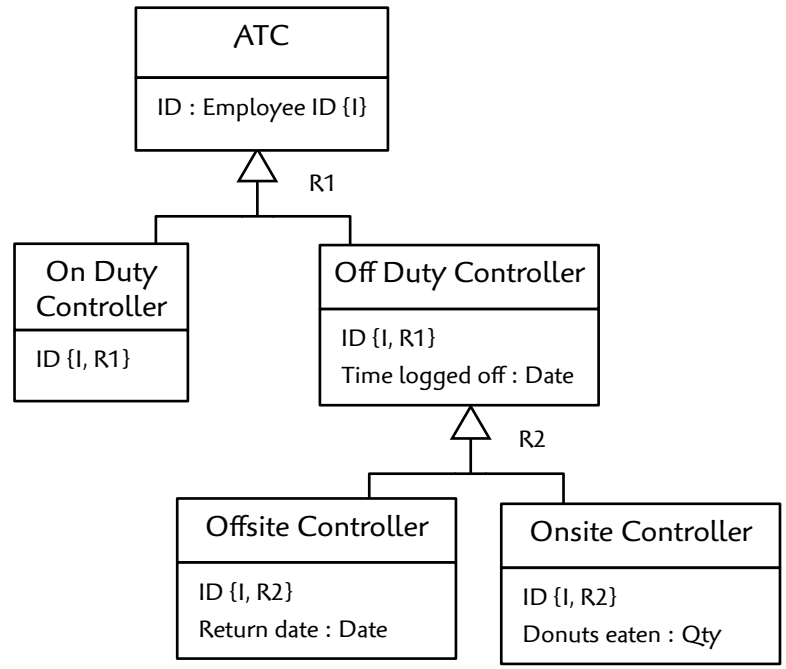
The navigate and link actions can be combined inside the Migrate Action



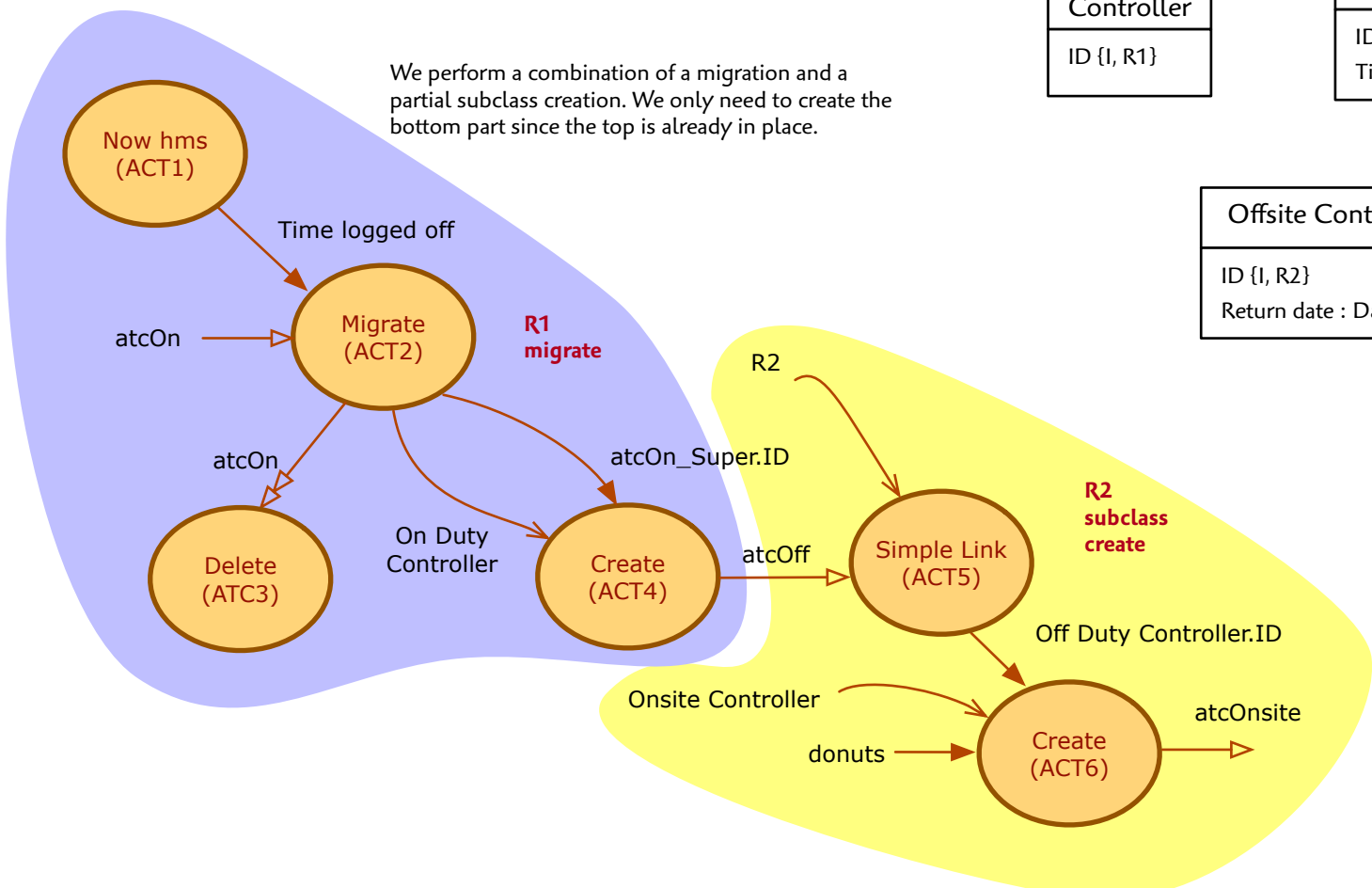
Here we migrate a subclass instance

```
atcOn >> Off Duty Controller( Time logged off : Date.Now hms )
>> Onsite Controller( Donuts eaten : donuts )
```

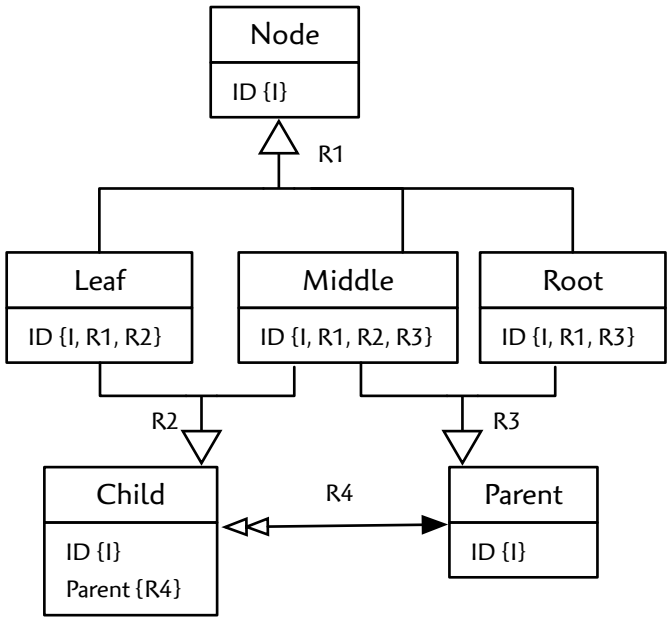
Here we migrate to a Composition Generalization and need to specify two subclasses for creation

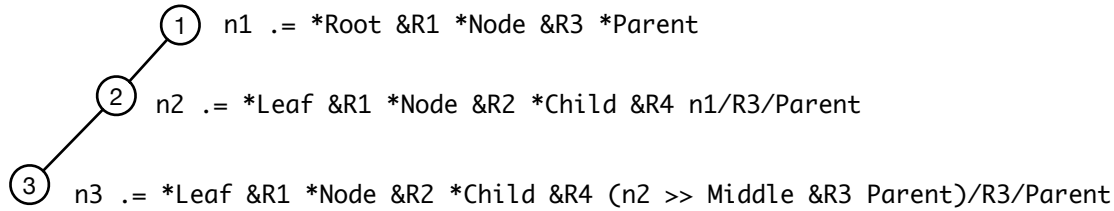


We perform a combination of a migration and a partial subclass creation. We only need to create the bottom part since the top is already in place.



Creating a subclass instance in a multiple generalization





n1 is created as a Root node instance as a Node instance on R1 and as a childless Parent instance on R4

n2 is created as a Leaf node instance as a Node instance on R1 and as a Child instance on R2 with the n1 Parent instance across R4

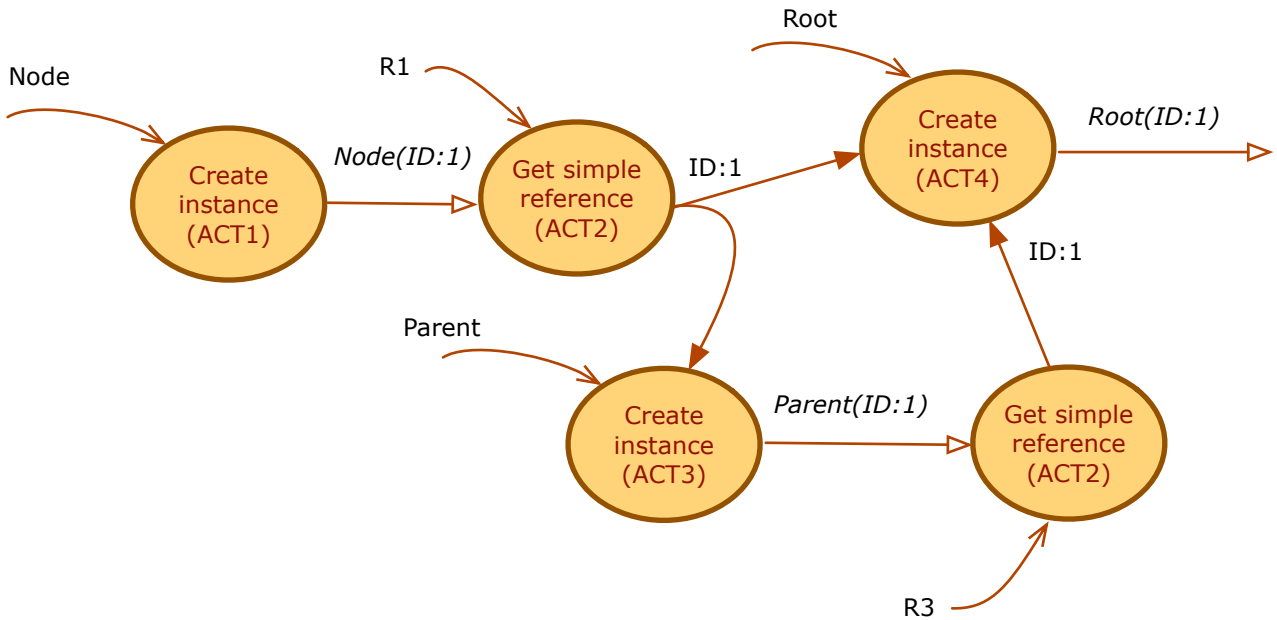
n3 is created as the new Leaf node instance as a Node instance on R1 and as a Child instance on R2 with the migrated n3 instance across R4 (note that n2 is now typed as a Middle instance)

The modeler is responsible for writing action language that does not break the model constraints, such as ensuring that no orphaned Child is created.

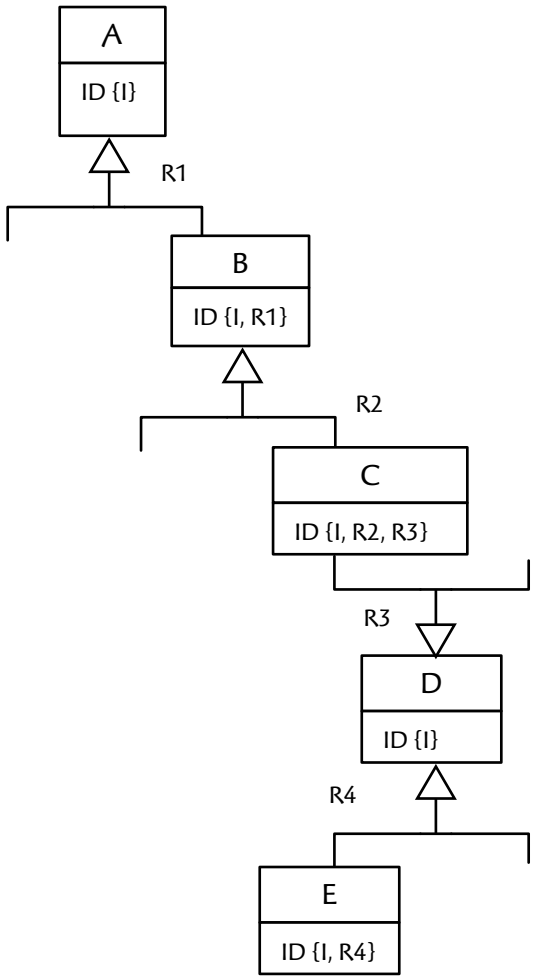
Creating any instance of Leaf requires two superclass instances, one on each generalization (R1, R2) and a new link to each.

Creating any instance of Middle requires three superclass instances, one on each generalization (R1, R2, R3) and a new link to each.

Creating any instance of Root requires two superclass instances, one on each generalization (R1, R3) and a new link to each.



Creating a subclass instance in a repeated, multiple and compound generalization




```
c1 .= (*C &R2 *B &R1 *A) &R3 *D &R4 *E
```

We need to work our way from the superclasses out.

So we radiate out to each superclass until there are no further generalizations. So we create instances A and D first. Then we work our way back from each of these superclasses until we reach the final leaf subclasses B, C and E.

The metamodel can ensure that each required create and link is in place so that incomplete action language is detected.

C participates in two generalizations as a subclass R2 and R3.

The superclass B in R2 participates as a subclass in one generalization R1.

The superclass A in R1 does not participate in any other generalization, so that is our end condition.

The superclass D in R3 participates in the R4 generalization as a superclass, so we descend to E.

E does not participate in any other generalization, so we are done.

A subclass creation consists of one creation for the subclass and a link to each related superclass, one per generalization on the starter subclass.

Then, for each of those generalizations we look for another generalization or specialization.

For a generalization, we need a create for the superclass and a link in the subclass.

For a specialization, we need a create for the superclass, a create in the specialized subclass and a link in that subclass.