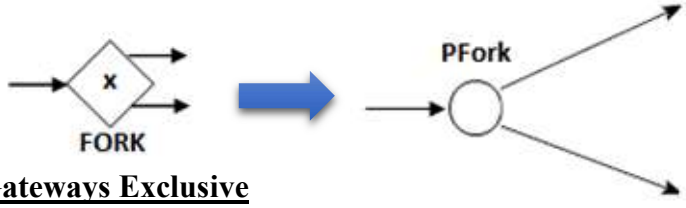
Transformation of timed BPMN busines processes and cloud resources into timed Petri-Nets

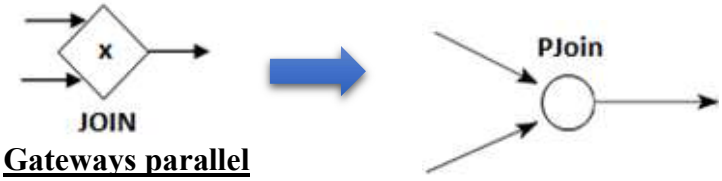
a) the mapping of the basic elements of BPMN in a temporal Petri net

Start event



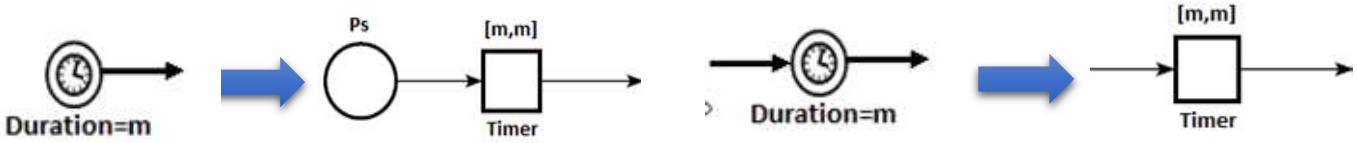
Gateways Exclusive

End event



Gateways parallel

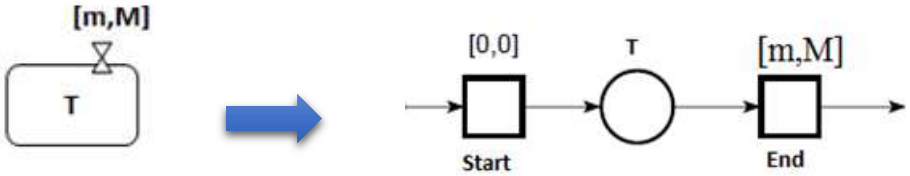
Task



Start timer event

b) The mapping of BPMN temporal constraints in a time Petri net.

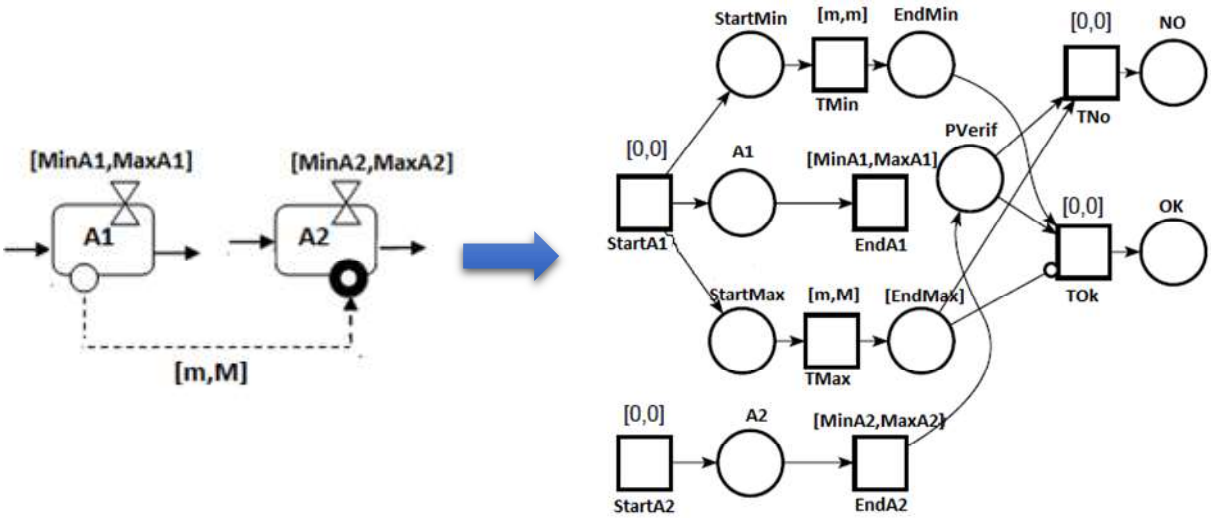
Temporal constraints intra activity :



Activity duration

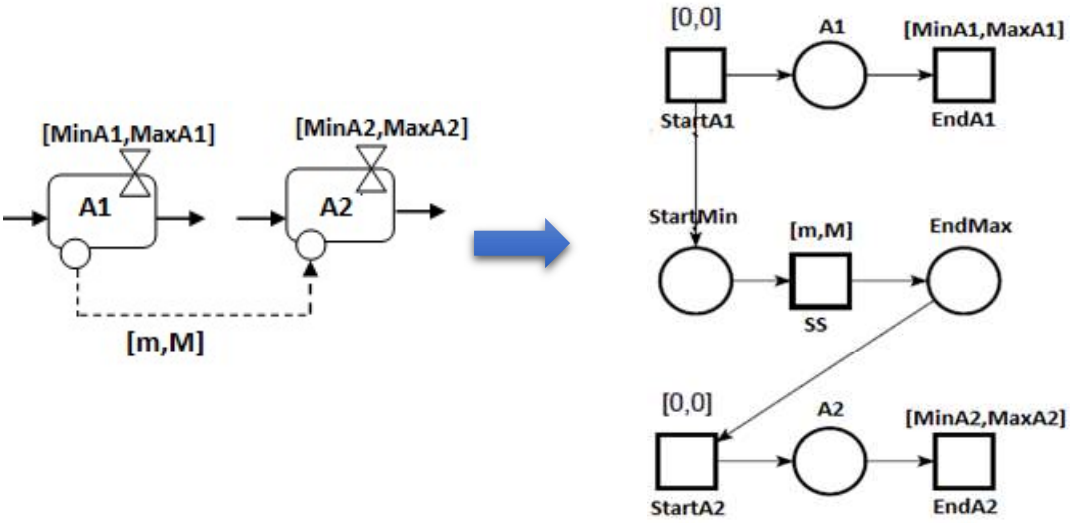
Temporal dependence :

SF: A2 can only finish after a time interval [m, M] that A1 has started



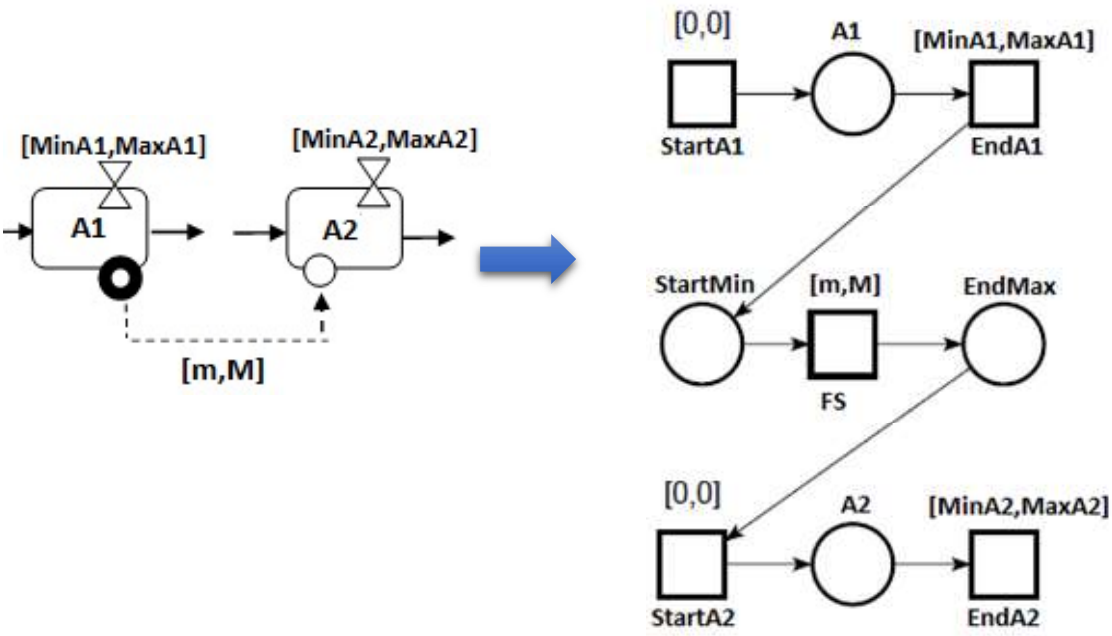
When crossing the startA1 transition, a token is added in StartMin and StartMax in order to control the evolution of the interval [m, M] and at the end when crossing the finA2 transition, a token is added in Pverif to check the constraint SF. If we have exceeded m (the existence of a token in the place EndMin) and we have not exceeded M (no existence of a token in EndMax) then constraint checked (ok), otherwise if we have exceeded M (existence of a token in EndMax) therefore unverified constraint (no)

SS: A2 can only start after a time interval [m, M] that A1 has started



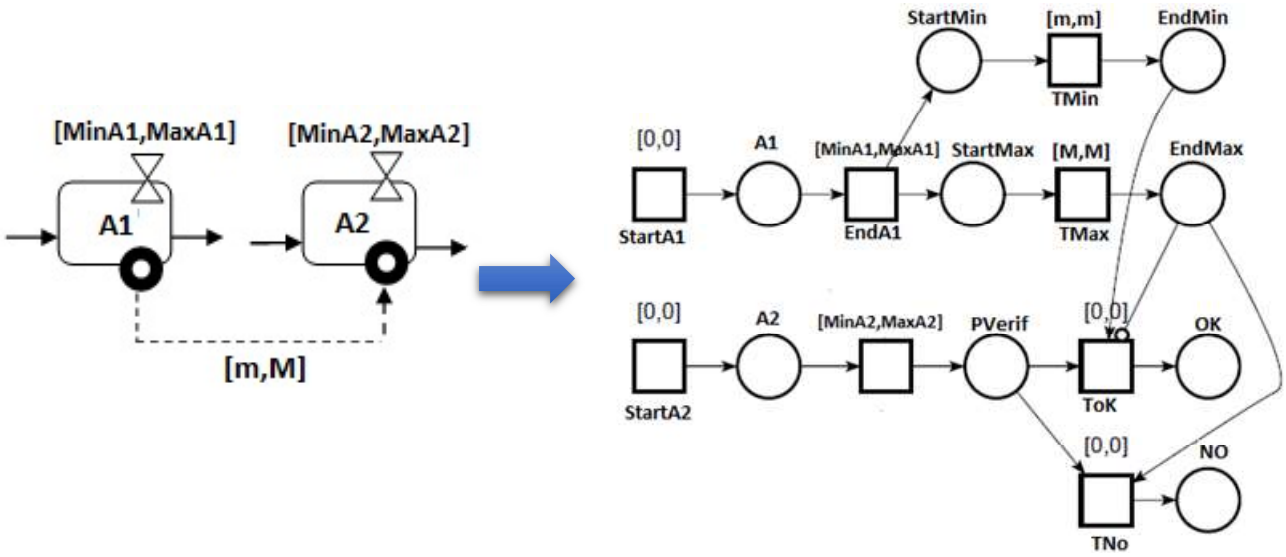
When crossing the start1 transition, a token is added in StartMin to control the evolution of the interval [m, M] to allow A2 to start when a token is added in EndMax.

FS: A2 can only start after a time interval [m, M] that A1 has finished



When crossing the finA1 transition, a token is added in PMin to control the evolution of the interval [m, M] to allow A2 to start when a token is added in PMax.

FF: A2 can only finish after a time interval [m, M] that A1 has finished

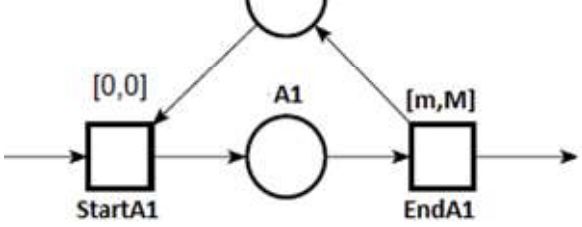


When crossing the finA1 transition, a token is added in StartMin and StartMax in order to control the evolution of the [m, M] interval and at the end when crossing the finA2 transition, a token is added in Pverif to check the constraint FF. If we have exceeded m (the existence of a token in the place EndMin) and we have not exceeded M (no existence of a token in EndMax) then constraint checked (ok), otherwise if we have exceeded M (existence of a token in EndMax) therefore unverified constraint (NO)

a) The mapping of BPMN cloud resources in a time Petri net.

On-demand strategy

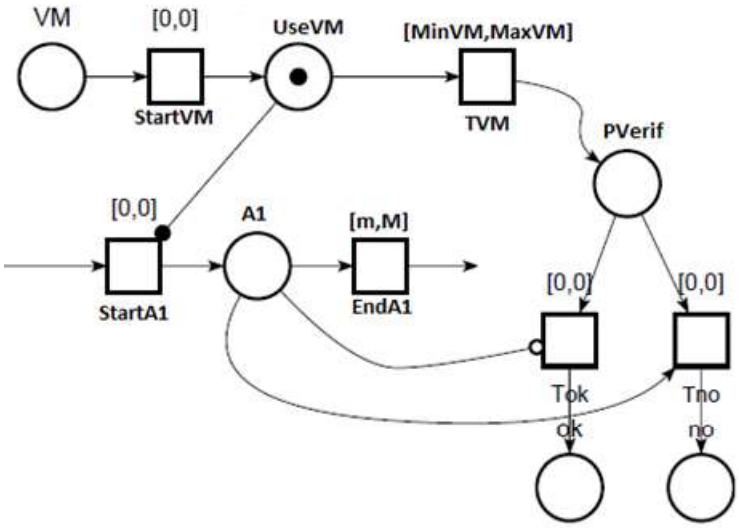
- Activity a1: [m, M]
- Cloud VM resource: on demand



When passing the StartA1 transition, a token is taken from the VM place that represents the Cloud resource and at the end we return the token to the VM place to allow other activities to use it.

Reserved strategy and spot predefined

- Activity a1: [m, M]
- VM1 spot resource cloud with predefined period: [min, max]



At the crossing of the transition debutA1, a token is taken from the VMencour place which represents the Cloud resource but without interruption of the interval [min, max]. At the end of the allocation time of the Cloud resource, a token is added in the Pverif place to check the allocation of the Cloud resource. If there is still a token in place A1 then the allocation of the Cloud resource is wrong, otherwise the allocation is correct.