Using Adaptation Plans to Control the Behavior of Models@Runtime

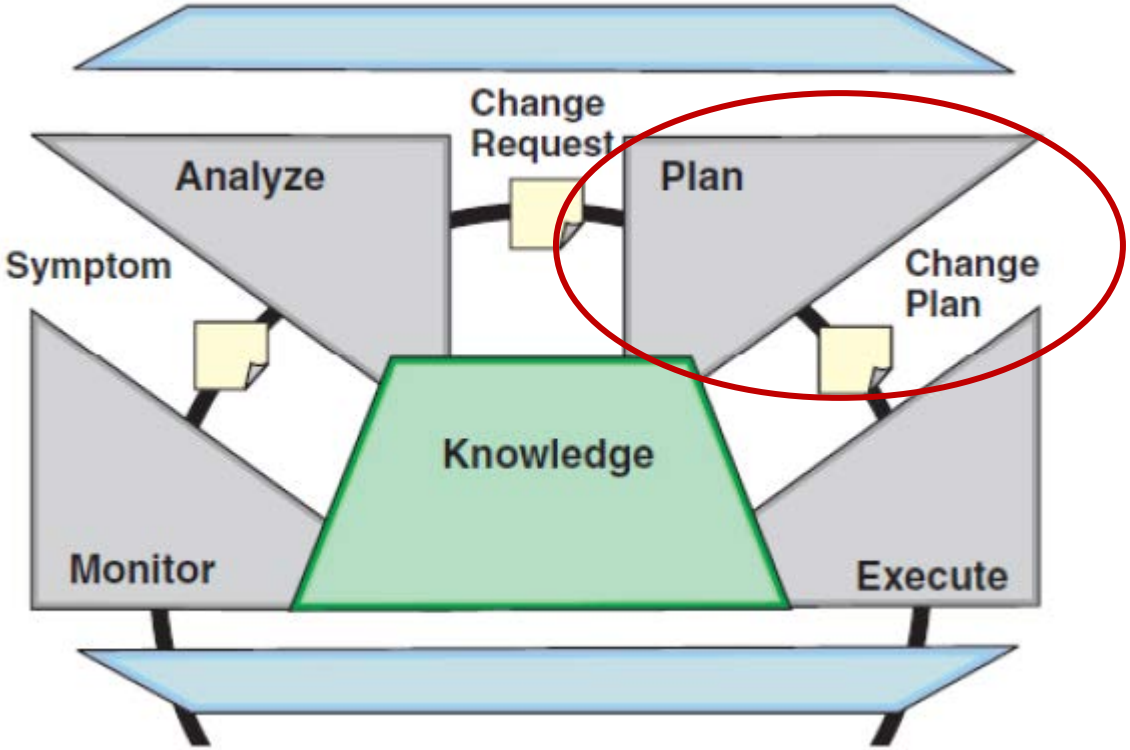
Maksym Lushpenko, Nicolas Ferry, Hui Song, Franck Chauvel, Arnor Solberg

SINTEF

Models@Runtime 2015

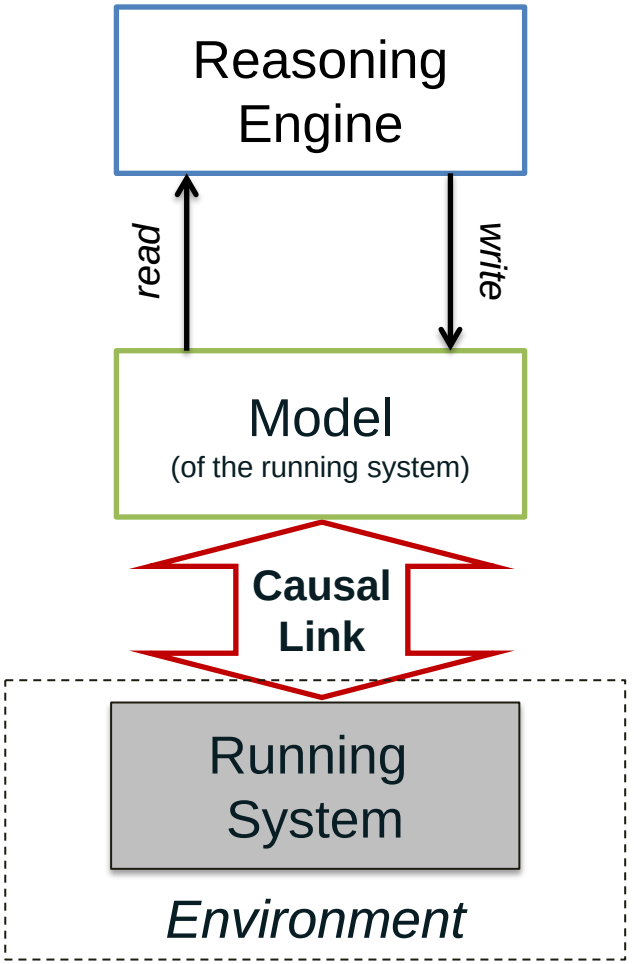
Related to future challenges from Betty

- Highler level adaptation



The models@runtime pattern

- Synchronization engine implicitly define an adaptation plan
  - Typically, this plan is derived from the analysis of the difference between the desired(new) and the current state of the system and a set of fixed rules (producing operations going from current to new)
- **Problem:** Need for customization of the adaptation plan.



Motivation and contribution

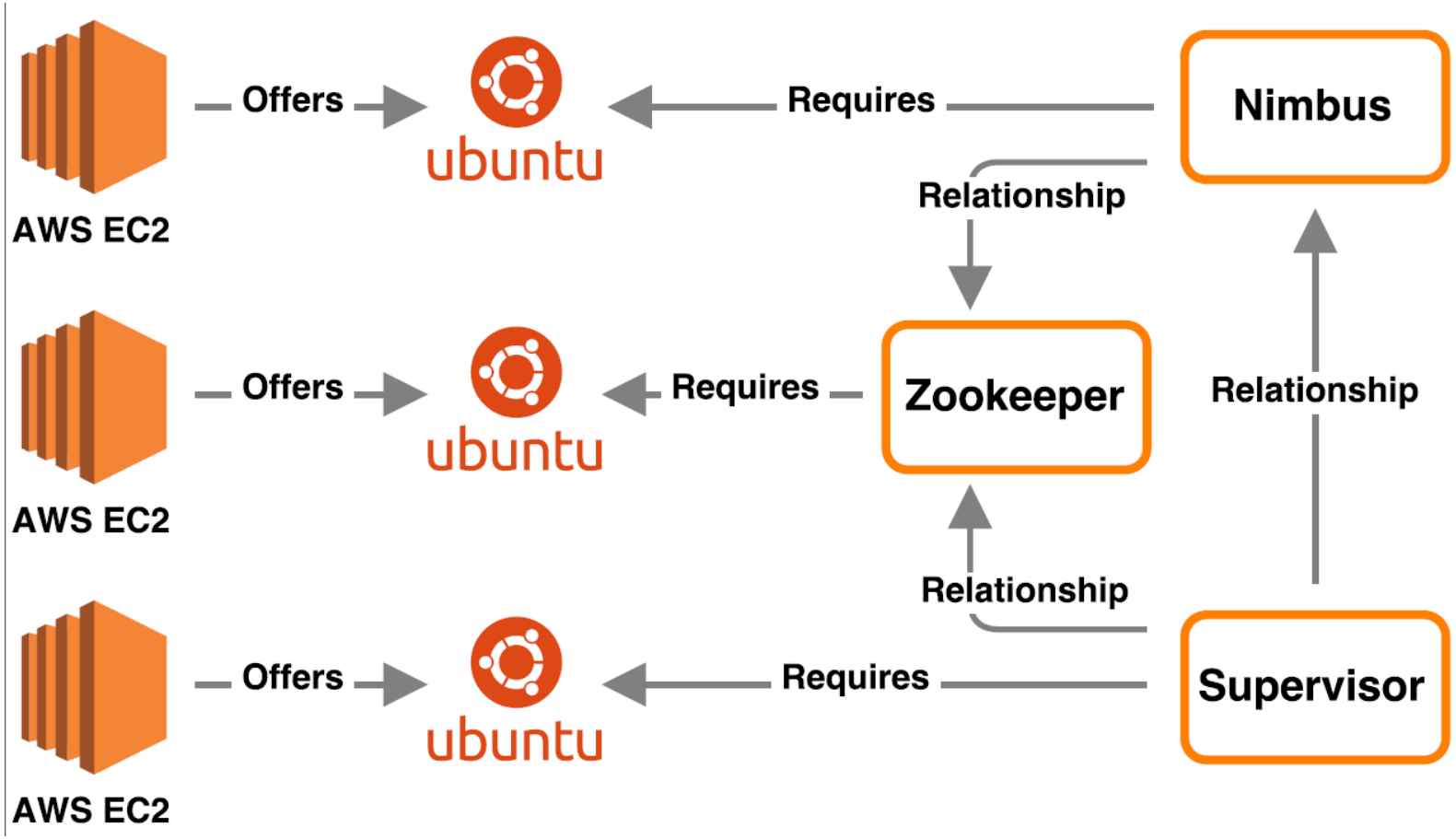
- There are often alternative ways to enact these adaptations
  - Can significantly affect the effectiveness performance and the quality of service.
  - To avoid adaptations that are not possible for specific platforms/applications

- Contribution
  - a domain specific modelling language for the specification of adaptation plans and,
  - a runtime environment to manage the enactment of such adaptation plans.

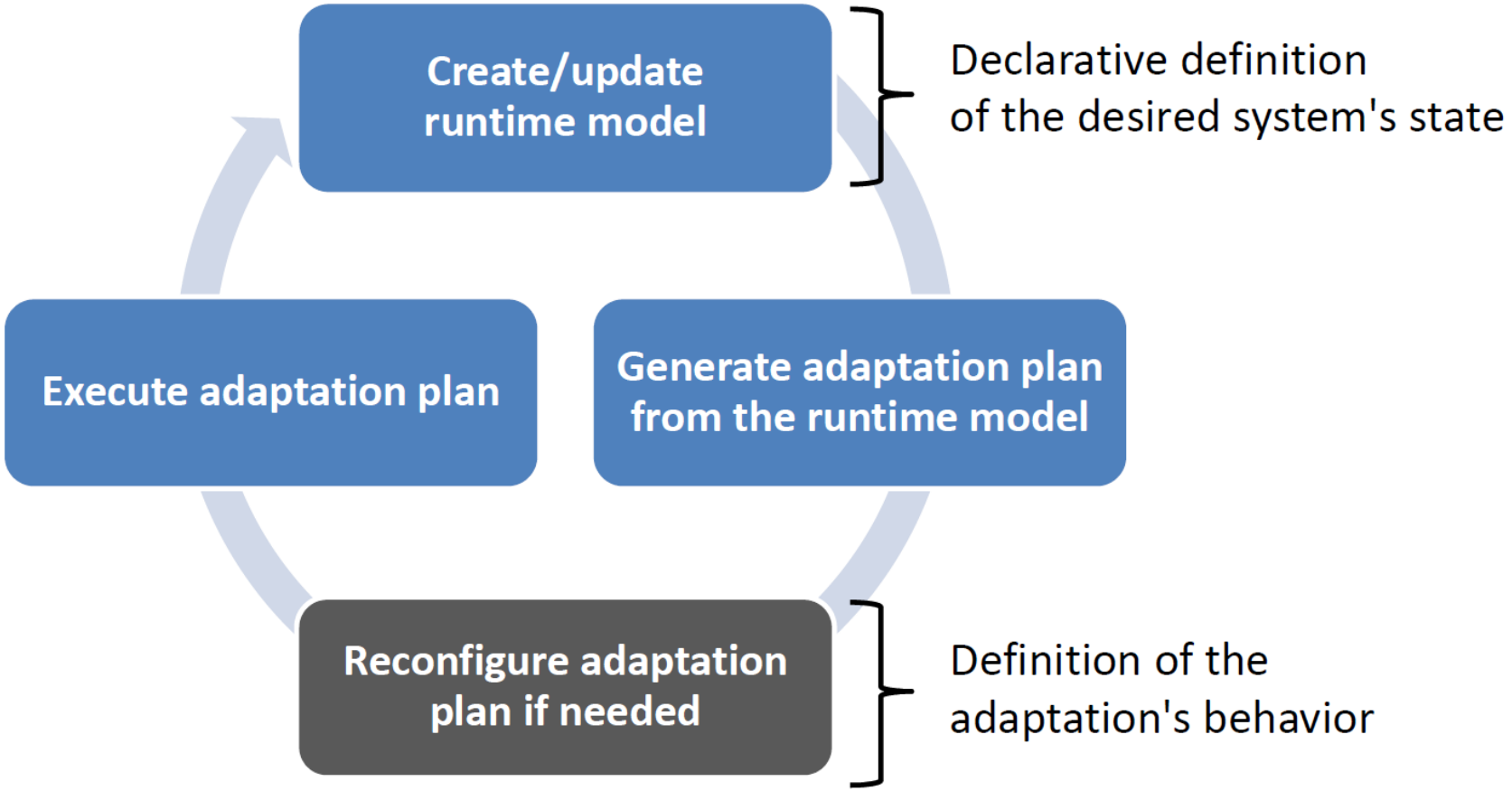
Example with CloudMF

- Two main components:
  - A **modelling environment** with a tool-supported domain-specific modelling language (**CloudML**) to model the provisioning and deployment of **multi-cloud** systems
  - A **models@run-time environment** for enacting the provisioning, deployment and adaptation of these systems.
  - Open source
    - www.cloudml.org

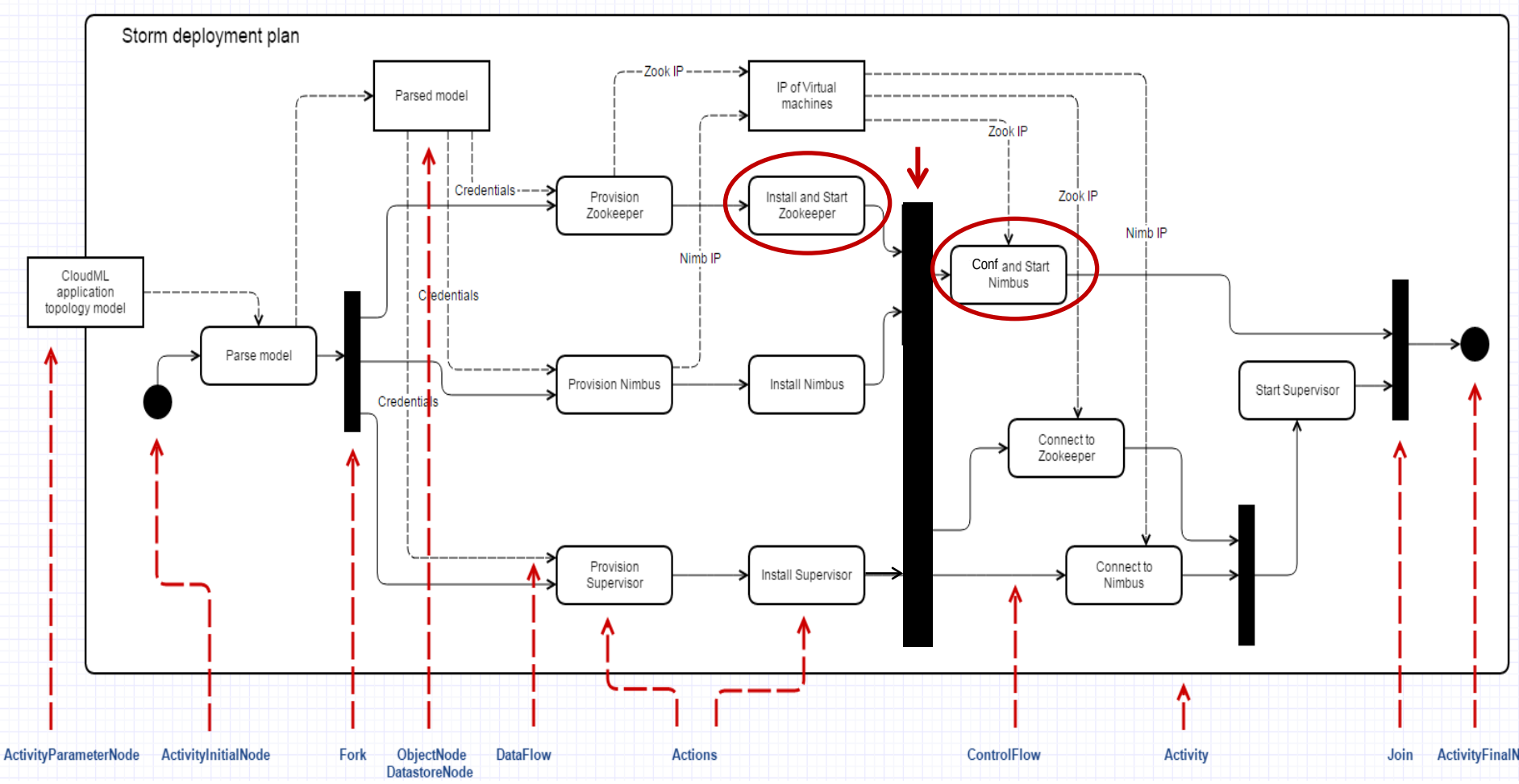
Example, Deploying Storm



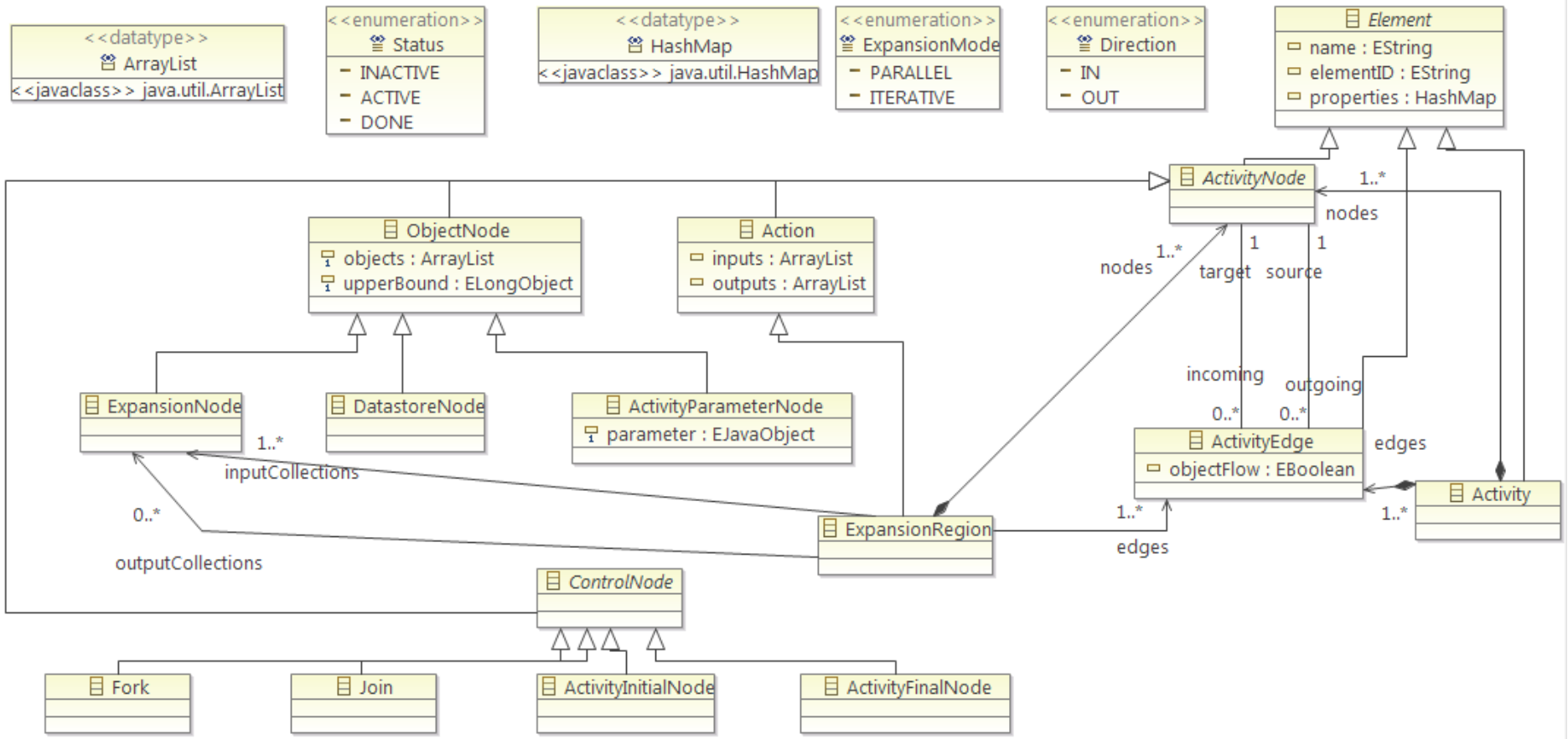
Proposed approach



Specifying Adaptation Plans



Adaptation plan DSL

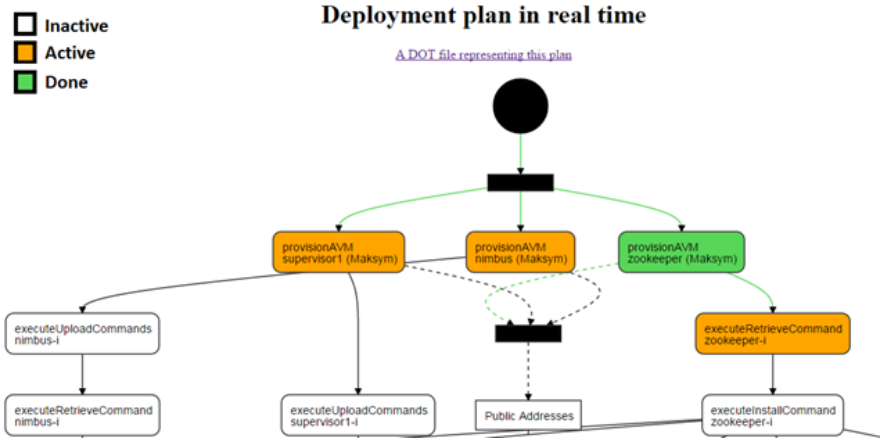


Manipulating Adaptation Plans

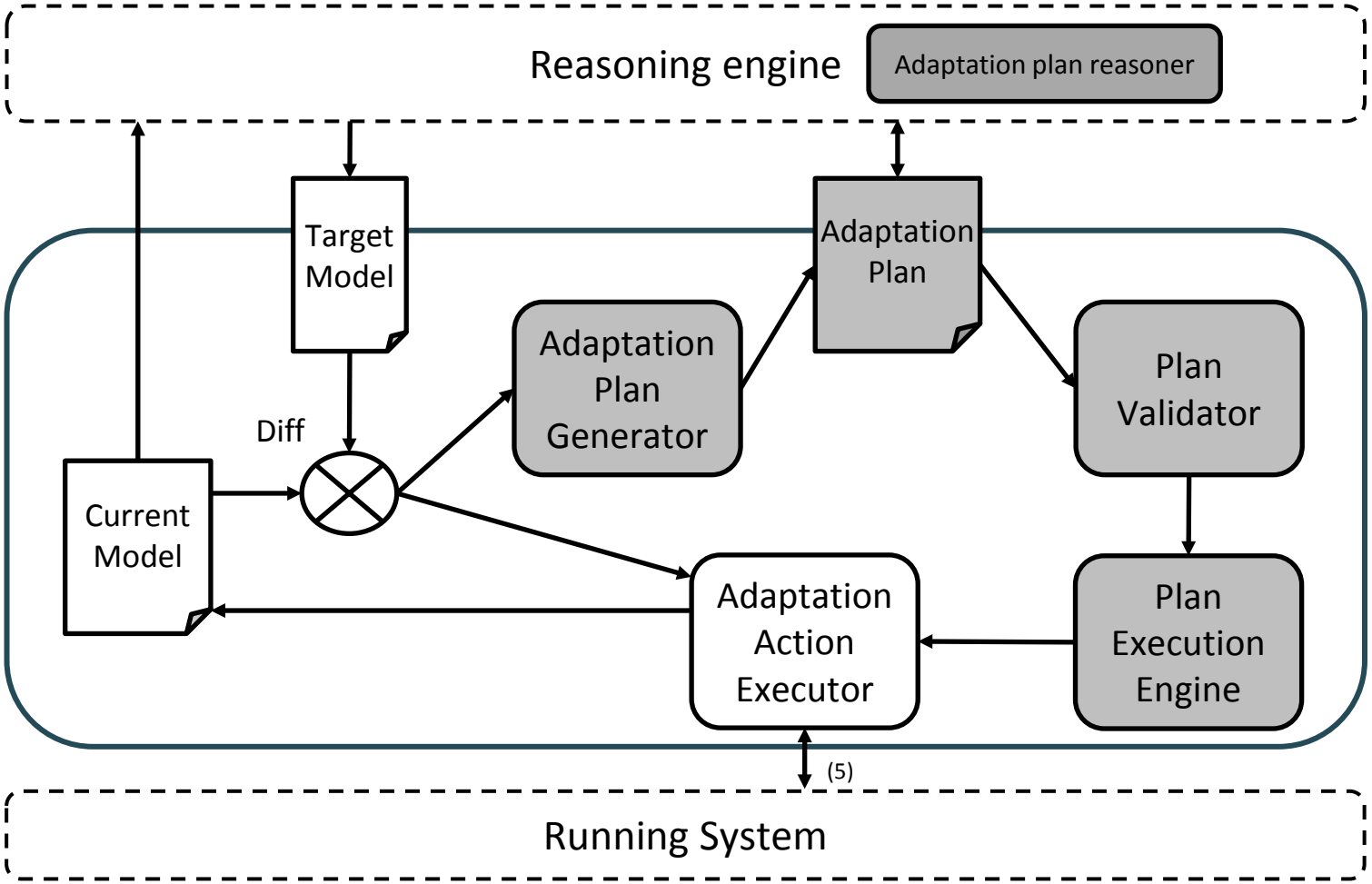
- Internal DSL

```
Activity deploymentPlan = ActivityBuilder.getActivity();
ActivityInitialNode start = ActivityBuilder.controlStart();
Action provision = ActivityBuilder.actionNode("Provision",VM);
ActivityFinalNode stop = ActivityBuilder.controlStop();
Fork fork = ActivityBuilder.forkNode(false);
ActivityBuilder.connect(fork, provision, true);
```

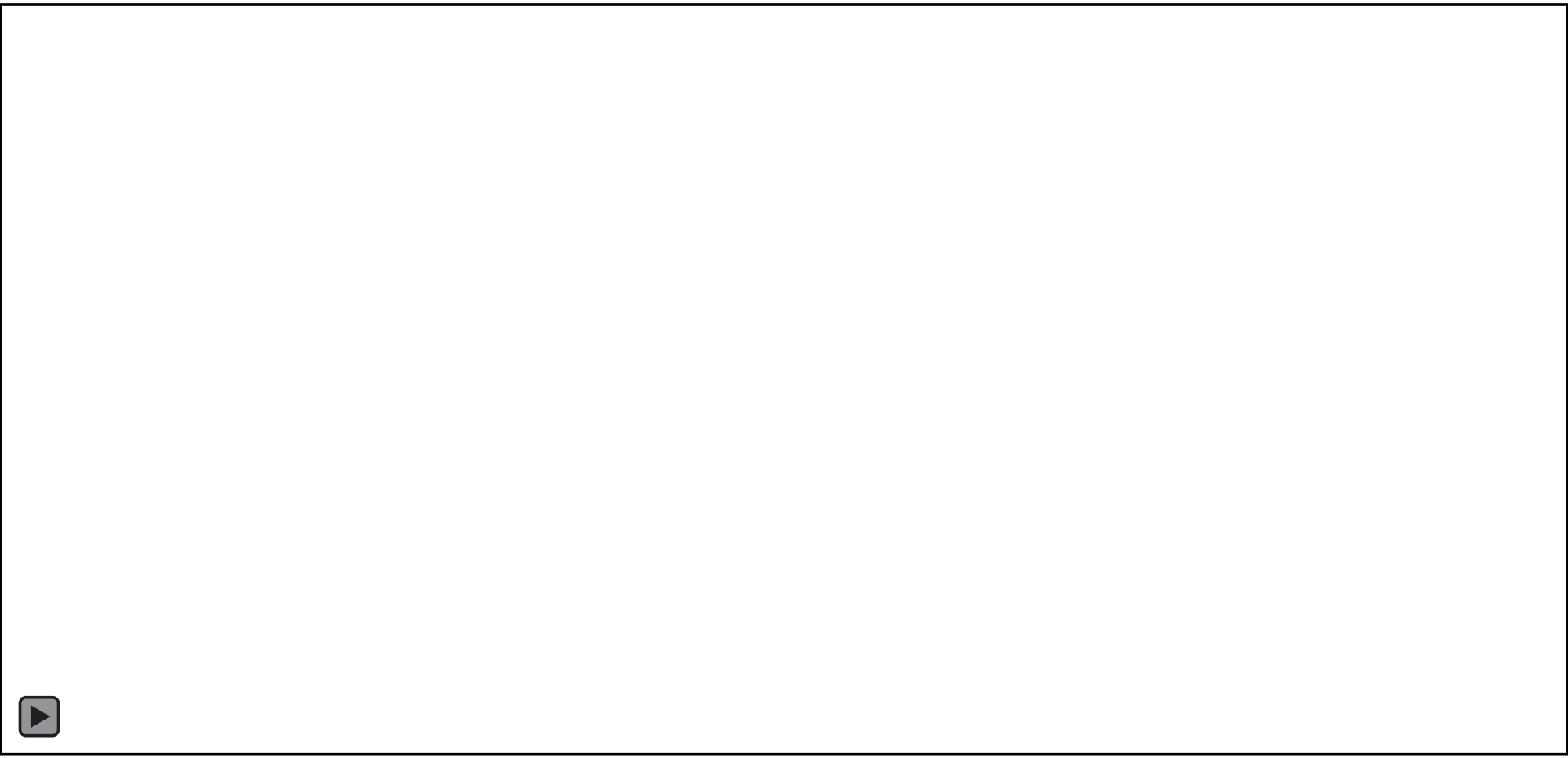
- Runtime Visualization



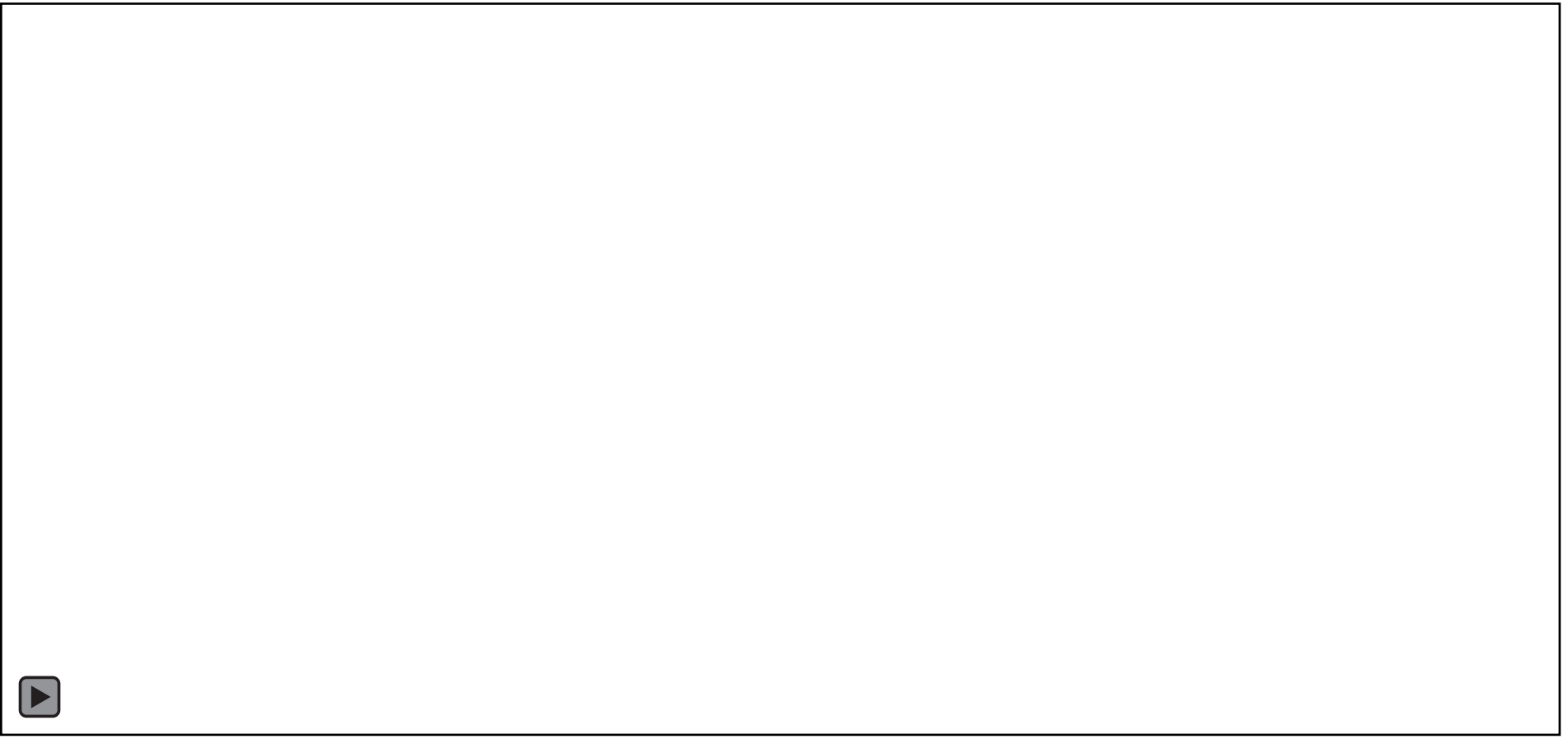
Runtime environment



Demo – run time view of initial deployment



Demo – run time view of Adaptation



Discussion

- Plan generator: Generate from the result of the diff an adaptation plan. ***For now, domain (CloudML) dependent, and plan reasoner is application specific (e.g., Storm specific)***
  - *At some point it needs to be, but probably room for generalisations/automation*
- Plan validator: Checks the correctness of the adaptation plan. *domain independent.*
- Execution engine: Workflow engine that navigates through the plan, exploits reflection of component states. Domain independent
  - *Dynamic intervention of running adaptation plans?*
    - *Can make sense in the cloud domain, where adaptations can last long (in some cases hours)*

Conclusion

- A language to build adaptation plans
- A runtime environment integrated within a models@runtime engine to enact such adaptation plans

- Future work
  - Generalizing and applying our approach to other domains
  - Apply similar approach to larger part of the MAPE-K loop, providing frameworks for higher level adaptations.

Thank you !

Contact:
Arnor.solberg@sintef.no
nicolas.ferry@sintef.no